

# AGRÁR- ÉS VIDÉKFEJLESZTÉSI SZEMLE

A SZEGEDI TUDOMÁNYTANEM MEZŐGAZDASÁGI KAR  
TUDOMÁNYOS FOLYÓIRATÁNAK  
KONFERENCIA CD MELLÉKLETE



Volume 6. (1)

Hódmezővásárhely

2011

Kiadó:

Szegedi Tudományegyetem  
Mezőgazdasági Kar  
6800 Hódmezővásárhely  
Andrássy út 15.

**Felelős kiadó:**  
**Responsible publisher:**

Dr. Bodnár Károly dékán/dean

**Főszerkesztő:**  
**Executive editor:**

Dr. Horváth József  
tudományos dékánhelyettes/vice dean

**A szerkesztőbizottság tagjai:**  
**The members of the editorial board:**

Dr. Bodnár Károly  
Prof. Dr. Gosa Vasile  
Dr. Majzinger István  
Dr. Monostori Tamás  
Dr. Pet Elena  
Prof. Szűcsné Dr. Péter Judit  
Prof. Dr. Tanács Lajos

**ISSN 1788-5345**

Készült: 300 példányban



**2011/1.**

## TARTALOM / CONTENT

	oldal/page
<b>PLENARY SESSION</b> .....	<b>11</b>
NAGY FRIGYES:.....	12
<i>The relation of common and national agricultural policy</i> .....	12
MORI, MARGHERITA: .....	18
<i>Financial innovation in agriculture</i> .....	18
KOCOSKI L., KALEVSKA T., TRAJKOVSKA B.:.....	26
<i>Influence of somatic cell count in raw milk on cheese production</i> .....	26
<b>SECTION 1: AGRICULTURAL ECONOMICS AND RURAL DEVELOPMENT</b> .....	<b>32</b>
BORBÉLY KATALIN, PATAKI LÁSZLÓ, VÁGYI FERENC RÓBERT: .....	38
<i>Examination of the financial position of Hungarian agricultural enterprises between 2002 and 2009</i> .....	38
GÁL, JÓZSEF – GÁLNÉ, HORVÁTH ILDIKÓ: .....	38
<i>Environmental protection as part of strategy in Central and East European agricultural enterprises.</i> .....	38
GÁL, JÓZSEF – TÓTH, ERIKA: .....	43
<i>Napkor – Possibilities of a settlement in periphery from the aspect of regional development</i> .....	43
OLÁH JUDIT - PAKURÁR MIKLÓS: .....	52
<i>Statistical Overview of employment by economic activity and professional status in EU</i> .....	52
MÉSZÁROS KORNÉLIA, TÖRÖNÉ-DUNAY ANNA, ILLÉS B. CSABA :.....	59
<i>The factors of competitiveness of Hungarian beef cattle sector</i> .....	59
KRIEVIŃA, AGNESE, MIGLAVS, ANDRIS: .....	66
<i>Cooperative strategy and efficiency analysis of milk production chains in different EU countries</i> .....	66
GALGÓCZI-DEUTSCH MÁRTA:.....	74
<i>The linguistic landscape of the center of Hódmezővásárhely</i> .....	74
UNGUREANU GEORGE, CHIRAN AUREL, CIUREA ION VALERIU, GÎNDU ELENA, BREZULEANU STRJAREL... ..	80
<i>Tourism, social and economic balance tool and culture in rural area of Romania</i> .....	80
MAGYAR VERONIKA: .....	88
<i>Connection of farming and landscape forming in the Benedictines</i> .....	88
GÁLNÉ, HORVÁTH ILDIKÓ:.....	93
<i>Role of inhabitants living outside of towns in rural areas</i> .....	93
BODNÁR GÁBOR: .....	98
<i>Implications of rural areas and demography in the Dél-Alföld region</i> .....	98



**SECTION 2: ANIMAL SCIENCES AND WILDLIFE MANAGEMENT ..... 105**

TÓTH BÁLINT, BLEIER NORBERT, LEHOCZKI RÓBERT, SCHALLY GERGELY, CSÁNYI SÁNDOR: .....	
<i>Habitat use of roe deer in a floodplain forest and the neighbouring agricultural Area.....</i>	<i>106</i>
BENK ÁKOS – VIDÁCS LAJOS: .....	
<i>The genetic preservation of Hungarian speckled hen and the Speckled Transylvanian naked neck hen in Hódmezővásárhely.....</i>	<i>112</i>
ÚJVÁRY DÓRA, SZEMETHY LÁSZLÓ: .....	
<i>Agressive and submassive behavioural elements of captive wild boars in feeding situation.....</i>	<i>118</i>
SCHALLY GERGELY, SZEMETHY LÁSZLÓ: .....	
<i>Comparison of Eurasian Woodcock (scolopax rusticola, L.) Monitoring Methods.....</i>	<i>124</i>
IVANC A., DEKIC R., CETKOVIC DANIJELA, MISCEVIC B., KÖNYVES T., VUKOSAV MARIJA, OBRADOVIC S., SUTUROVIC EDITA: .....	
<i>Evaluation of environmental conditions by fish hematology .....</i>	<i>130</i>
SZÜCS J. P. –MÉSZÁROS A., - SÜLI Á. –BODNÁR E.S. –AVASI Z:.....	
<i>Biological preservative in whole crop wheat ensilage.....</i>	<i>137</i>
HELTAI MIKLÓS, HORVÁTH ZSUZSANNA, KISS ÁGNES, NAGY ANNA, MARKOLT FERENC , SZENTKIRÁLYI PETRA, LANSZKI JÓZSEF: .....	
<i>Habitat Selection of the Eurasian Badger in Various Areas of Hungary .....</i>	<i>144</i>
ÖZKAN ELMAZ, ÜMIT CIRIT, ONUR KESER, CAN KUTAY:.....	
<i>Effect of different protein levels on, testicular parameters and semen quality in kivircik ram lambs during pubertal development.....</i>	<i>150</i>
AVASI ZOLTÁN –SÜLI AGNES–KUCSERA JUDIT: .....	
<i>Effect of the storage time and several silage inoculants on the aerobic stability of sorghum silages .</i>	<i>156</i>
SMAILOV ERKINBEK – NAZARKULOV KUBAT: .....	
<i>Breeding of „Aikol” strain sheep.....</i>	<i>162</i>
PINNYEY SZILÁRD: .....	
<i>Parameters of nasal botfly infestation of roe deer in plain locations.....</i>	<i>166</i>
BARTA TAMÁS – MAJZINGER ISTVÁN: .....	
<i>Examination of feeding and some population parameters of roe deer (Capreolus capreolus, L.) on the Great Hungarian Plain.....</i>	<i>169</i>

**SECTION 3: FOOD SCIENCES AND FOOD SAFETY..... 176**

BORLOVAN, IOAN - LIVIU SĂMBOTIN - ADRIAN COROIAN: .....	
<i>The food safety impact on food products merchantability .....</i>	<i>177</i>
SEREGI JÁNOS: .....	
<i>Organic animal breeding and production, quality assessment of raw materials and products.....</i>	<i>183</i>

HÄZNERS, JURIS - INGŪNA GULBE: .....	
<i>Evaluation of the existing and potential Latvian canned fish export markets.....</i>	189
KÖNYVES T., VUKOSAV M., IVANC A., BOŠKOVIĆ J., MIŠĆEVIĆ B: .....	
<i>Production and composition of milk from tsigai sheep breed in Vojvodina .....</i>	196
MAROSI TIBOR – GÁL ADRIENN: .....	
<i>Assesment of food safety by young people .....</i>	201
IVANC, A., DEKIĆ, R., LOLIĆ SVJETLANA, JANJIĆ NINA, ERIĆ, Ź., TRBIĆ, G., GNJATO, R., ĆETKOVIĆ DANJELA: .....	
<i>Drinking water quality in rural regions of different hydrographic areas.....</i>	208

**SECTION 4: INNOVATION AND SUSTAINABLE DEVELOPMENT..... 215**

BALOGH SÁNDOR, SNELCER BETTI: .....	
<i>Traditional and modern foods.....</i>	216
FEHER, ANDREA, VASILE GOŞA, TABITA HURMUZACHE, SORIN STANCIU: .....	
<i>The impact of European economic recovery plan (EERP) on romanian rural area.....</i>	218
FEHER ANDREA, VASILE GOŞA, SORIN STANCIU, TABITA HURMUZACHE, COSMINA TOADER: .....	
<i>Stage of implementation of the national rural development programme in Romania three years after the adhesion.....</i>	223
SZEKERESNÉ KÖTELES RITA: .....	
<i>Way to sustainable development: sustainable society.....</i>	229
VIDA ADRIENN - CSABA B. ILLES:.....	
<i>Analysis of Hungarian Biofuel Supply chain .....</i>	235
B. GÁLOSI-KOVÁCS-ZS. M. CSÁSZÁR- N. PAP- P. REMÉNYI-K. KŐMŰVES:.....	
<i>Human resource development as a possibility for developing the most underdeveloped micro-regions of Hungary.....</i>	242
DŪL NÁNDOR:.....	
<i>Local answers for labor market disproportions- an overview of an organization development project by an agricultural regional integrated vocational training.....</i>	251
FETAHU, ELVIRA, BEJTJA, ILIR: .....	
<i>Selective marketing for sustainable tourism based on environmentally unspoilt areas tourist demand considering the ecological footprint .....</i>	258

**SECTION 5: PLANT SCIENCES AND ENVIRONMENTAL MANAGEMENT..... 267**

BOSKOVIC JELENA, VESELINKA ZECEVIC, TAMARA GALONJA COGHILL, ALEKSANDAR IVANC, SLOBODAN MILENKOVIC, GORDANA DOZET, TIBOR KÖNYVES:.....	
<i>Sustainable agriculture and environmental protection.....</i>	268
SŪLI-ZAKAR TÍMEA: .....	
<i>Surface reaction and interaction of no +co on catalyst.....</i>	274

ISMET YILDRIM, METIN AYDIN: .....	
<i>Resistance of Venturia inaequalis to hexaconazole, trifloxistrobin and captan .....</i>	280
DRAGOȘ, MARCELA –PÎRȘAN PAUL: .....	
<i>The influence of some sowing technology parameters on winter wheat in banat plain .....</i>	285
<b>POSTER PRESENTATION.....</b>	<b>291</b>
VIDA ADRIENN: .....	
<i>Possibilities of qualitative risk analysis .....</i>	292
BARANCSI ÁGNES: .....	
<i>Quality characters of winter wheat – amaranth flour.....</i>	297
BLAGA DIANA, NICOLETA MATEOC-SÎRB, CAMELIA MĂNESCU, GAIȚĂ RUXANDRA, MIROSLAV RAICOV .....	
<i>The traditions and habits of Romanian people from Méhkerék, Hungary country).....</i>	302
BLAGA DIANA*, NICOLETA MATEOC-SÎRB*, CAMELIA MĂNESCU*, MORARIU LUCIAN*, GAIȚĂ RUXANDRA	
<i>Healthy food, living food.....</i>	309
NÉMETH CSABA, NÉMETH ZOLTÁN, DALMADI ISTVÁN FRIEDRICH LÁSZLÓ, SURÁNYI JÓZSEF,	
BALLA CSABA: .....	
<i>Destruction of Salmonella Enteritidis in liquid egg white as the fuction of treatment temperature and heating rate.....</i>	314
CS. VÁGVÖLGYI, V. NÉMETH, E. SAJBEN, B. ŠKRBIĆ, N. ĐURIŠIĆ-MLADENOVIĆ, J. KRISCH, MANCZINGER:	
<i>Isolation and characterization of carbendazim-degrading bacteria from agricultural soil samples. .</i>	320
CS. VÁGVÖLGYI, L. MANCZINGER, D. SUGÁR, E. SAJBEN, A. PALÁGYI, J. KRISCH, J. ŽIVANČEV, B. ŠKRBIĆ :	
<i>Isolation and characterization of ethylenethiourea-degrading bacteria from soil .....</i>	325
DRÁGHICI OLGA: .....	
<i>Study of several factors that influence thermal analysis for meat samples.....</i>	329
EÖRDÖGHNÉ MIKLÓS MÁRIA: .....	
<i>For our ancestors natural, for our descendants necessity – sustainable water usage.....</i>	335
BALÁZS GÁBOR, KAPPEL NOÉMI, FEKETE DÁVID: .....	
<i>The rootstock effect in watermelon production.....</i>	340
SLEZÁK KATALIN, TERBE ISTVÁN, KIS KRISZTIÁNNÉ: .....	
<i>Vegetable growing on expanded clay .....</i>	345
E. SAJBEN, L. MANCZINGER, CS. VÁGVÖLGYI: .....	
<i>Functional diversity investigation of bacterial communities in distinct soil types with RISA after preculturing (RISA-APC) method. ....</i>	351
SALA FLORIN, COSMIN BLIDARIU: .....	
<i>Characteristics of soil in relation to grapevine nutrition .....</i>	356
SALA FLORIN, DANIELA PÎSLEA .....	
<i>Agrochemical properties: soil fertility parameters in relation to plant nutrition .....</i>	361
MILISITS GÁBOR, SÜTŐ ZOLTÁN, DONKÓ TAMÁS, ORBÁN ATTILA, UJVÁRI JOLÁN, PÖCZE OLGA, REPA IMRE	
<i>Comparison of changes in the liveweight and body composition of a newly developed cock line and TETRA-H chicks during the rearing period.....</i>	365

MILISITS GÁBOR, ANDRÁS SZABÓ, TAMÁS DONKÓ, ZOLTÁN SÜTŐ, ATTILA ORBÁN, ESZTER SZENTIRMAI, OLGA PŐCZE, JOLÁN UJVÁRI, ANTONELLA DALLE ZOTTE MARCO CULLERE, IMRE REPA: .....	
<i>Effect of yolk ratio in hen's eggs on the hatching weight and on the heart and liver ratio in chicks at hatching</i> .....	370
BORLOVAN IOAN, LIVIU SÂMBOTIN, ADRIAN COROIAN: .....	
<i>Food security – Challenge of future generations</i> .....	376
PETER SZABO ISTVAN, SZABO GABOR: .....	
<i>Research of Solar Energy at the Faculty of Engineering University of Szeged</i> .....	382
JIVAN CLAUDIA, SALA FLORIN: .....	
<i>Soil as nutrition environment in relation to nutritional requirements in apple</i> .....	387
KRISCH JUDIT, BADAMKHAND DEMBEREL, TSERENDULAM DUGARSUREN, RENTSENKHAND TSERENNADMID, VÁGVÖLGYI CSABA: .....	
<i>Natural preservatives of plant origin – antimicrobial action against food spoilage microorganisms in vitro and in foodstuffs</i> .....	392
STEF LAVINA, CALIN JULEAN, DAN DRINCEANU, MARIA NICULA, DRAGOS FOTA, DUCU STEF, IOAN PET: .....	
<i>Effects of some feed additives on bioproductive and biochemical indices of blood serum in broilers</i> .....	398
MANCZINGER L., M. VÖRÖS, E. SAJBEN, A. PALÁGYI, CS. VÁGVÖLGYI: .....	
<i>Extracellular enzyme systems of antagonistic Bacillus strains isolated from tomato rhizosphere</i> .....	404
MANCZINGER L., B. BÓKA, M. VÖRÖS, E. SAJBEN, A. BERKI, S. KOCSUBÉ, CS. VÁGVÖLGYI: .....	
<i>Influence of culture conditions on the antibiotic production of antagonistic Bacillus strains isolated from tomato rhizosphere</i> .....	408
KREDICS LÁSZLÓ, LÁDAY MIKLÓS, KÖRMÖCZI PÉTER, MANCZINGER LÁSZLÓ, RÁKHELY GÁBOR, VÁGVÖLGYI CSABA AND SZEKERES ANDRÁS:.....	
<i>Trichoderma communities of the winter wheat rhizosphere</i> .....	413
ĆWIERTNIEWSKA, MARTA–KOTECKI, ANDRZEJ:.....	
<i>Productivity of triticale (Triticosecale) in aspect of intercropping with narrow-leaf lupine (Lupinus angustifolius)</i> .....	419
GALGÓCZI-DEUTSCH MÁRTA:.....	
<i>The linguistic landscape of the center of Santa Rosa, California</i> .....	425
PAKURÁR MIKLÓS–OLÁH JUDIT: .....	
<i>Statistical Overview of Birth, Death and Migration trends at EU level</i> .....	430
SZABÓ, P. B.:.....	436
<i>Dough rheological and kernel hardness investigation on different Hungarian winter wheat varieties</i> .....	
LENESCHI VALENTIN, LUMINIȚA COJOCARIU, TAMÁS MONOSTORI, DACIAN LALESCU.....	442
<i>Optimization of chemical fertilizers application at Alopecurus pratensis L., in Banatplain conditions</i> .....	
LENESCHI VALENTIN, LUMINIȚA COJOCARIU, TAMÁS MONOSTORI, DACIAN LALESCU, HORABLAGA MARINEL.....	
<i>The classification of genotypes on the quantitative characters at Alopecurus pratensis L., in Simișoara conditions</i> .....	449
VÉHA, A., SZABÓ, P. B., GYIMES, E.: .....	
<i>ReduceD Fusarium toxin by Peritec technology</i> .....	455

POPOVIC VERA, JELA IKANOVIĆ, DANICA MLADENOVIC, GORDANA DOZET, VOJIN ĐUKIĆ, SNEŽANA JAKŠIĆ, NADA GRAHOVAC: .....	460
<i>Influence of nickel in soil</i> .....	
UNGUREANU GEORGE, CHIRAN AUREL, GÎNDU ELENA, BREZULEANU STEJAREL, CIUREA ION VALERIU DUDAŞ ANCA: .....	464
<i>Opportunities for improvement of tourism and agri-business in romania (case study vârtoş arieşeni "apusei mountains)</i> .....	
MOS VICTORIA:.....	471
<i>Research on local varieties and biotypes of vine-growing in Buziaş-Silagiu area</i> .....	
ZEČEVIĆ VESELINKA, BOŠKOVIĆ JELENA, KNEŽEVIĆ DESIMIR: .....	476
<i>Effect of environment and genotype on rheological properties of flour and dough of winter wheat</i> ...	
FABULYA ZOLTÁN – HAMPEL GYÖRGY: .....	481
<i>Production programming in the canning</i> .....	
PAP ZOLTÁN, SLEZÁK KATALIN, SZABÓ ANNA, KRISZTIÁNNÉ KISS MARIANN: .....	487
<i>Effects of humic acid on green flesh pepper forcing</i> .....	
DRAGOŞ MARCELA, NIŢĂ SIMONA, NIŢĂ LUCIAN, PANAITESCU LILIANA, LUNGU MARIUS: .....	492
<i>Research on the behaviour of certain oilseed rape varieties in gâtaia area</i> .....	
NAGY KITTI, TIMÁR ZOLTÁN, SLEZÁK KATALIN: .....	496
<i>The effect of picking time on the yield of pepper</i> .....	
LENDVAI EDINA: .....	502
<i>Analysis of the cap by the basis of the Hungarian farmers</i> .....	
OCNEAN MONICA, LIVIU SAMBOTIN: .....	508
<i>Financial support mechanisms for romanian farmers beginning with 2007</i> .....	
MORARIU, LUCIAN, DIANA BLAGA RUXANDRA GAIŢĂ NICOLETA MATEOC-SÎRB: .....	513
<i>Avaluation of sustaineble development indicators for Ramonia and Hungary</i> .....	
MORARIU LUCIAN, DIANA BLAGA , CAMELIA MĂNESCU , CARMEN DUMITRESCU, NICOLETA MATEOC-SÎRB: .....	519
<i>Aspects regarding cross-border cooperation program Romania Hungary</i> .....	
<b>ABSTRACTS</b> .....	<b>525</b>
BODNÁR ÁKOS, ANDREA PRÁGAI, RÓBERT VEPRIK, ANDREA K. MOLNÁR: .....	526
<i>Feed preference and general behaviour of alpacas in Szeged Zoo</i> .....	
JUHÁSZ VERA, BLEIER NORBERT, CSÁNYI SÁNDOR: .....	527
<i>The characteristics of the roe deer's group formation in an agricultural habitat</i> .....	
HELTAI MIKLÓS, NAGY ANNA, SONKOLY KRISZTINA:.....	528
<i>Changes of the Red Fox Population in the Eastern Part of Hungary Between 1970 and 2009</i> .....	
GHERMAN REMUS; DUMITRESCU CARMEN; DINCU ANA MARIANA:.....	529
<i>Managerial techniques int he field of continuous training of human resources at microeconomic level</i>	

GHERMAN REMUS, DUMITRESCU CARMEN, DINCU ANA MARIANA:.....	
<i>Human resources development in tourism.....</i>	<i>530</i>
OCNEAN, MONICA – SAMBOTIN, LIVIU: .....	
<i>Role of capital and investments in agricultural development.....</i>	<i>531</i>
ALINA LAȚO, ISIDORA RADULOV, K. LAȚO, F. CRISTA, ADINA BERBECEA, L. NIȚĂ .....	532
<i>Sewage sludge – a possible fertilizing resource in agriculture.....</i>	<i>532</i>

A konferencia CD melléklet a X. Wellmann Tudományos Konferencia teljes anyagát tartalmazza.

The conference CD Issue contains the complete papers of the X. Wellmann International Scientific Conference.

***PLENARY SESSION***

## **THE RELATION OF COMMON AND NATIONAL AGRICULTURAL POLICY**

**DR. HABIL NAGY FRIGYES PHD**  
**fmr. minister of agriculture**

If we are speaking about the interdependence between common and national agricultural policy, we have to concern our moving possibilities in this particular branch. At the first sight we can reveal that narrow is the path to balance our actions. If one asks about proportions, it can be estimated that about 30-40 % of our agriculture is determened by the world market, an other 30-40 % by the common agricultural policy, and perhaps 20-30 % remains for us to enforce our wish and imaginations. Is it reasonable to pool our national sovereignty in this extent after joining the EU?

The Common Agriculturtal Policy has particularly high importance in agriculture and rural developement, because this is the area where comprehensive regulation for supports, and market relations exist. But because agricultural policy is created in Brussels, have we to do nothing else but to keep the common rules? No! Even we oblige to enforce our own particular interest in the legislation. The main question is: do we have any possibilities for national arrangements within the frame of Common Agricultural Policy, in wich area, and in what extent?

### **WHAT ABOUT SINGLE MARKET?**

First of all, one has to emphasize that the target of Common Agricultural Policy is to operate a succesfull single market first of all for the sake of consumers. Beside this it endeavours to ensure market stability for farmers to escape disturbances by influencing the output of goods by means of market instruments. Parallel by the operation of the single market, the long term sustainability of production plays more and more growing rule. From the point of view of the worldwide lack from energy, nowadays the attention is directed also to the fuel gained from agriculture. If we approach the theme one-sidedly, unbearable burden can stress the natural environment, wich has to be escaped.

We take part in the decision-making actions of the EU, so we have the chance to influence the legislation procedures, especially if we cooperate with other member states having similar interest. For example it had been carried through successfully in the course of the budgetary negotiations. It has to be underlined, that mutual agricultural policy can be realised above all through national approach. Beside the possible influence of common decisions, the areas, wich stood in national competence, have to be treated prominently. Taking these areas one by one we find out, that we are facing very relevant elements. The common and national agricultural policy has to be harmonised. This is the condition and garanttee to develop and sustaine our agriculture for long term. That needs continous cooperation with farmers, mostly in the frame of extension service. A well-organised advisory system, including well-accomplished experts can be pawn to close up successfully for earlier member states in agricultural producion.



Which are the most frequented branches of policy that remained in national authority? We have to regard one by one the most stressed areas, for example the cooperatives, land-policy, tax-mechanism, national support possibilities, tailoring agricultural structure, international relations, vocational teaching and training, scientific research work, just to mention the most distinguished topics. In each case we have to find out and elaborate how to organise proper consultative system, in which geographical distribution, by what type of experts. It is not an exaggeration to accentuate the importance of advisory management. That means new perspectives for the existing regional extension service centres, but those have to renew and rejuvenate themselves, according to the challenges of the continuously changing CAP reforms.

### **THE CONSUMER-MARKET OF THE NEW MEMBER STATES IN THE CENTRE OF INTEREST**

It is not correct to attribute to the accession an appearance, as if after historical storms our country finally arrived into a safe harbour, and this was our mean target. It has to be underlined, that the enlargement is fundamental interest for the EU, too. Our continent is constrained to launch into competition with the oversees powers, for the time being not with a lot of success. For that it is insufficient to start from the present situation, but strategical thinking is needed. Europe is not Europe without the integration of the twelve new, and the future members. If those would have been remained outside the EU, their closing up falls behind, so they would become a withdrawal power. In the lack of solvency they do not enlarge the market of the EU, and have less chance for tailoring themselves to the procedures of globalisation. Their closing up can be realised only by integration with the other EU countries. The fate of globe is determined by the big powers, and Europe cannot be a big power without Middle and East-Europe.

Consequently, the EU is in a position of necessity. Statistical datas reflect obviously its backwardness in the area of economic growth, and this seems to be a longterm phenomena. Accordingly, the enlargement for the EU is not a noble gesture, but basic interest, even historical liability from certain point of view. West-Europeans don't hear this pleasantly, but there is no reason for us to be modest, because we do not wait allowances, but fair treatment. The standpoint, that we were, who desired to join the EU, and a result of this our obligation is to adjust ourselves completely, can be accepted only by sustenance. Surely, we have to tailor ourselves, but not on the account of our agriculture. In this line we expect mutuality, with right. The Roman saying, that „if one intends to go to Rome, has to behave as a Roman”, but it is not a Bible.

Concerning that the industrial and food products of the most developed countries of Europe can stream unhinderedly to the market of the new member states, it is obvious, that the realised extra profit compensates abundantly the rich member states for the money, paid into the EU budget. This is approximately 1 % of their GDP, which appears to be symbolic, especially if we count it pro capita. An important part of our EU support derives from the Hungarian taxpayers' pocket, because we don't get much more payments from the EU, as much we pay into the EU budget. So only the surplus derives from the taxpayers of other member countries. From the above-mentioned follows some relevant issue. If the EU represents and enforces the interest of its taxpayers stone-hardly, so we can not be condemned, if we do the same. We are not allowed to underestimate our national

agricultural policy, even we have to attribute more importance to that. One commits failure if considers the agriculture neglectable, turning money only according to the proportion of the national economy. At the same time the EU has recognised already that the rural sphere is not only economical but at the same time sociological question, the importance of which cannot be always expressed in figures.

### **THE ROLE OF THE ECOLOGICAL BACKGROUND OF AGRICULTURAL REGULATION**

The EU has been founded by countries which have predominantly oceanic climate. Accordingly they lay high weight for the pasturing cultures and ruminants. They consider poultry and pig keeping almost as industrial activity, and comprehend it as „processed cereals”. That sounds attractive, but it is not true! They forget and neglect the genetical and multiplicative background of that particular branches. Perhaps we would convince them, that if they need the markets of ten countries having continental climate, the special interest of them can't to be neglected. We are not able to base our animal keeping on pastures, because the Hungarian pastures are not suitable for that. We tried that many times unsuccessfully. We have to utilise our cereals in the first place by pigs and poultry, otherwise because of absence of sea harbour, and the limited transport possibilities we lose our comparative advantages. The position of the crop-consumer animals have vital importance for us, therefore we must concentrate similarly, as the EU does for its own specialities. It is intolerable, that Hungary is forced to export its cereals uneffectively, because of the absence of direct payments for the pig and poultry branches. As a result of this, rural areas, small regions can go down, which is contradictory to the cohesion policy of the EU, targeting the closing up of the backward areas. We have to find solution for our neglected branches, not by protectionism, but through improving natural figures, and by stronger competitiveness. This is an important obligation of the national agricultural policy.

Do not misunderstand, we are ready to keep the directives of the Common Agricultural Policy, being basically interested in the uniformed, transparent roles, and honest behavior on markets. Simultaneously we have to enforce the possibilities, which promotes the position of the crop-consumers without going against the principles of the EU.

### **HAVE WE TO ACCEPT THE FREE STREAM OF CAPITAL AND COMMODITIES?**

Some people think that national agricultural policy is nothing else, but to refuse all, which is not home-made, and they step with particular intensity against the import of agricultural commodities, and against foreign investments into agriculture. Instead of a technical approach, for instance the food import led often into demonstrations, and the land market became political battlefield, the economical standpoint of which induces furious opposition in many people.

Hungary can be proud of being a netto food-exporter. If we want other countries to buy agricultural goods from us, we can't lock ourself to purchase things from abroad, despite injuring the interest of some producers. „Interest protectors” demand for example, not to

bring pork into the home market, but expect for other countries to buy their corn surpluses. The world market does not operate in this way. Who doesn't wish to keep the rules of the game, disqualifies itself from the international division of labour. It doesn't mean, that to protect our market is not allowed. The western countries do that, introducing very sophisticated technics to prevent their market from the import of goods, as we have experienced bitterly so often. However, we have to see that the import-limitation causes unfavorable consequence to our export. The lack of competitiveness cannot be compensated by administrative prohibitions.

We pay foreign working power in each imported goods. It can be equalised, if we let other countries pay more and more Hungarian working power. This system has been operated up to our accession. But after, in the last years, we could notice opposite tendencies. The proportion of the export-import decreased dramatically. This phenomenon must be turned back. It is fundamental interest that all the food, which can be manufactured in Hungary, possibly must be produced here, paying local working powers instead of foreigners. It happens then, if Hungarian farmers can close up on the area of competitiveness.

We have to consider that the basic element of market economy is to ensure the free streaming of capital. If it doesn't operate, we can't speak about market economy. Hungary undertook to ensure the preconditions for that. To invest capital into agriculture testifies mainly purchasing arable land, and this action as negative discrimination, can't be prohibited for companies and the citizens of other EU countries. This is one of the basic principle composed in the „aquis communautaire”, but the member countries are allowed to issue the national preconditions of land market liberalisation. This is also a part of the national agricultural policy. The big reformer Széchenyi in 1830 in his book „Credit” spoke about the lack of capital, caused by the limitation of land market. We are wrestling with this particular topic since those time. As after 2014 to buy land by companies and EU citizens will be legal, we have to find public agreement to prevent land turnover from speculation. The interest of agricultural investors has to be harmonised with the rightful demands of rural people.

One of the reason of declination of our animal husbandry is, that for our big companies dealing with livestock is not allowed to have land, wich would be necessary to produce green feed and to deposite manure. The land leasing system is not a reliable guarantee for that. The disappearance of livestock from numerous Hungarian farms can be disasterous also for crop producers because there is no livestock to feed. This topic has to be particularly emphasized in the national agricultural policy.

### **THE CORRECT MONETARY AND FISCAL POLICY AS NATIONAL OBLIGATION**

An important part of financial support and national resources can be found in the Hungarian budget. The experiences reflect that to reach these resources is not easier than to be able to get them at EU cash-desc. The forever floating, parking, postponing and pulling out payments and terms by the government causes losses and unsatisfaction in farming and decreases the reliability of public institutions. The sums and conditions owe to farmers „have to be graved into stones”, and fulfilled in time, instead of uncertain and foggy explanations. When required, political decision is needed. It is not lucky, that in the case of matters having vital importance for the society, administrative circles make decisions about

financial resources. It is not necessary to wait, that the decisions will be forced by demonstrators. Because the payments derive from public money, it would be a natural demand to publish the preferentiated persons or companies and the assigned sums. In a country, where the allocation and tax payment is not public, we hardly can speak about transparency. It would be also a part of national agricultural policy.

We can't disregard from the fact that among the twelve new member states Hungary is a net exporter of agricultural products. Therefore the government is somehow responsible to help preserving this heritage. The strong national currency took out many billions of forints from the pocket of food industry, ultimately from the pocket of farmers. We often forget to speak about losses and impacts caused by unfavorable monetary policy for the agriculture, however they are independent from the will of farmers, like drought or hailstorm, but can induce bigger troubles than those. Export-oriented, drawing branches went to floor, perhaps finally. The strong forint is unfavorable fore exporters. A responsible national agricultural policy would be able to concern about it.

### **NO CHANCE FOR US WITHOUT COOPERATION AND INTEGRATION**

The spreading supermarkets brought decisive change in food industry. The market is operated more and more by these multinational firms, reaching decisive share of the food market, and dictating all the objectives, mostly the prices for the food industry, despite it is mostly in the hand of multinational firms. On the other side thousands and thousands of small-scale farmers are fighting lonely, with lost hopes, without perspective. They have no chance to be equal partners for the supermarkets and money-world. Their societies are divided, often discuss with each other, instead of understanding and elaborating mutual strategic imaginations. Their main task would be to stop dividedness of agrarian-world.

In western countries the political and economical interest of producers are represented by cooperatives, in most cases successfully. In our case political mistake led to the present stage, the lack of cooperatives. Some politicians interpret the former Hungarian collective farms as kolkhozes; causing big damages in the heads, removing small-scale farmer's mentality from the chance of survive. Some years ago the Hungarian Parliament created a new "Cooperation Law". That can be a frame, but it has to be fulfilled with content by the farmers themselves.

### **NO RESULT WITHOUT TECHNICAL KNOWLEDGE**

The value of up to date knowledge is increasing everywhere. Consequently to restructure and re-tailor our educational system to the always changing requirements has vital importance. We need not old-fashioned farmers, but competitive, constructive, well accomplished managers. It isn't enough only to harmonize the educational scheme with the EU. One has to estimate the demand of the particular professions, and adjust the proportion and level to the practical demands. One has to shape the desirable share of teaching and research activities within the higher education, considering that we are operating in market economy. The vocational teaching and training is also a part of the national agricultural policy.

Hungary can appear in the single market with particular products having local characteristics to increase the choice. To realize that it's necessary to have plant and animal varieties, bred especially for our local ecological conditions. The research work has to be targeted into this particular direction instead of the present diversification. We have to mention, that regional extension management will be built up within short time. The practical knowledge has to be forwarded to farmers.

Though we repeat continuously that the best investment is education and research, unfortunately we neglect to enforce that particular principle in the practice. Our educational and research institutions are fighting with every-days financial disturbances. To support that area is not prohibited in the EU, so the national policy has the task to discover possibilities to improve the situation. The Bologna-process alone is not able to do that. We have to reorganize the system of vocational education, maybe on market-basis. We have to make clear for students that their future living standard and life-quality depend on their efforts and spiritual-economic investments. All that must encourage students and scholars alike for higher achievement. Remember that the educational policy remained in the competence of member states.

#### **THE INTEREST OF THE FOOD ECONOMY IS INDEPENDENT FROM DAILY POLICY**

We prepared ourselves more than ten years to be member of the EU. The chance to gain supports is given for every ruler of the production, but the illusions of easy money disappeared slowly. Only the possibility is given, the utilization needs a rank of new knowledge at home, and hard advance in the European Parliament. Two different types of agricultural policy can't be represented simultaneously. In the question of agriculture we would rise above the egoistic political interest, because we have only one agriculture, which is quite vulnerable, and because agriculture is the fate of rural areas. The discussions have to be placed to practical basis involving the touched people, and to create a situation near to consensus for the sake of the future of inhabitants in the countryside.

**As a matter of fact, well-articulated and strong agricultural and rural policy at national level is not only a chance, but also an obligation for us. That's what we have to serve!**

## FINANCIAL INNOVATION IN AGRICULTURE

**MORI, MARGHERITA**

University of L’Aquila, College of Economics  
Via Giovanni Falcone 25, 67100 L’Aquila, Italy  
[margherita.mori@univaq.it](mailto:margherita.mori@univaq.it)

### **ABSTRACT – Financial innovation in agriculture**

The process of financial innovation is a patchy phenomenon, far from exhausted, that has left some areas of the agribusiness almost unaffected. Looking at the financial arena as a huge laboratory, a set of new tools could be taken advantage of, in order to exploit the potential of finance and hence to speed up the flight to quality in agriculture, well beyond the scope of agricultural lending; these tools include weather derivatives, cat bonds, micro-finance, mutual guarantee institutions, and the JEREMIE (Joint European Resources for Micro to Medium Enterprises) initiative.

After identifying the strategic areas of the financial system that are likely to prove most beneficial to the agribusiness, the toughest task has to do with making all relevant information available to the small enterprises prevailing in agriculture, not to mention the micro ones. A success story has been developed by the Louisiana Business & Technology Center in Baton Rouge (LA, USA) after Hurricane Katrina: a *mobile classroom* was set up to reach the unserved parishes in rural Louisiana with counselling, encompassing managerial finance, and also to be utilized as a *business incubator on wheels*.

The use of this 30-seat converted semi-trailer entails an innovative way of delivering financial assistance and services: therefore, it can be taken for a meaningful change in the *place* factor of the marketing mix traditionally resorted to by banks and, as such, may fit into the concept of financial innovation. The ambitious results attained over there do not only give satisfaction for international interest, but also sound like an invitation to replicate them by adopting this case study as a contribution to foster long term, sustainable growth in agriculture.

**Keywords:** cat bonds, financial innovation, JEREMIE, micro-finance, weather derivatives

## INTRODUCTION

The empirical evidence justifies the statistical studies that describe the service industry as one of the three economic sectors and label it as the tertiary sector of the economy; the secondary sector is approximately the same as manufacturing whereas the primary sector consists of agriculture, forestry, fishing, and extraction such as mining. The activities performed in the service sector basically aim at improving productivity, performance, potential, and sustainability by using knowledge and time.

A substantial shift has been observed for the last thirty years from the primary and secondary sectors to the third one in industrialised countries; actually, economies tend to follow a pattern evolving from heavy reliance on agriculture and mining, toward the development of manufacturing (for instance: automobiles, textiles, shipbuilding, and steel), and finally toward a more service-based structure. As a result, the service industry is now the largest and fastest growing sector of the economy in the Western world.

Banking, insurance, and – in more general terms – financial services spearhead the market segments in this industry. However, the situation is not as clear-cut as it might seem: despite the categorizations set forth, there are links between the financial arena and

the primary sector that deserve much more attention than they have been paid so far; this is especially true of Italy, where agriculture has been characterized historically by a series of inequalities, both regional and social.

*A few remarks*

To make a long story short, the majority of agricultural workers struggled under harsh conditions as waged labourers or owned derisory plots of land, too small for self-sufficiency until the middle of the nineties. Afterwards, large tracts of land were redistributed to landless peasantry, which allowed to absorb greater amounts of labour and encouraged a more efficient land use; nevertheless, many farms are still undersized and, as such, not viable.

Additional drawbacks stem from being most of the firms in the primary sector owned and operated by families. No surprise that managerial criteria do not fully display their potential in agriculture: in particular, finance can be expected to speed up the flight to quality in this market segment, being money an essential input as well as a scarce resource worldwide; in turn, financial innovation is likely to upgrade the way in which the agribusiness is currently managed and hence to spur its long-term, sustainable growth, not only in Italy.

Based upon these thoughts, it must be recognized that both scholars and practitioners have tried to cope with emerging issues in managerial finance for a long time, thus generating a remarkable quantity of high quality information; however, much room remains for financial management to progress in the agribusiness and the unexploited opportunities cannot be overlooked under the troublesome conditions that continue to affect the economic scenario. Therefore, the main goal is to contribute to bridge the gap between theory and practice, as far as promoting a more massive recourse to the best practices that the financial side of the service industry can make available to the primary sector, with the local perspective to be properly combined with the global one, according to the *glocal* approach.

## **MATERIAL AND METHOD**

Toward this objective, the starting point can be identified with a critical overview of the empirical research and theoretical models developed in the field of financial innovation, so as to end up with a survey of the most innovative features of the financial system. The next step has to do with sorting out the strategic tools that are best suited to satisfy the financial needs of the small companies prevailing in agriculture, not to mention the micro ones: in a few words, it is a matter of realizing what's new in the financial arena that these firms might most take advantage of.

Giving priority to the real-world problems in the agribusiness, the most challenging issues deal with how to channel all relevant information to end-users, such as farmers scattered throughout the country, including micro enterprises located in areas where it would be hard to find a bank branch; this exercise could prove even tougher if it had to be carried out in a disaster management framework, which by the way agriculture should not feel unfamiliar with, being a weather sensible market segment. All in all, it is worth assessing how firms that belong to the primary industry can be made aware of the most innovative ways designed to improve their financial management, given their traditional profile, and can be

finally induced to rely on these financial tools, so as to benefit from them as much as possible.

In anticipation of the wide choice of encouraging results that this investigation is likely to produce, it should be extended to how to replicate them, which is another exacting task: by common opinion, experiments are reserved to applied sciences and thus excluded from the methodological set available to finance; yet, the practical outcome, consisting of a more massive recourse to financial innovation in agriculture, should be greatly appreciated. The positive effects that this ongoing process might possibly generate in the primary sector – as well as in any other industry – promises to make the required efforts rewarding, in sight of fostering sustainability and growth in the agribusiness over the long run.

#### *Highlights of the process of financial innovation*

For the last fifty years financial innovation has been deeply transforming the financial system as a whole and each of its pillars, namely financial services, financial institutions, and the market segments that the financial arena is made up of (FORESTIERI G., MOTTURA P., 2005). Assuming the broad perspective that the global competitive challenge imposes, any change in these elements can be classified as a sort of financial innovation, including new ways of delivering traditional financial services: it is not just a case that the spread of information technology has prompted *process innovation* in the financial industry since the eighties (CARANZA C., COTTARELLI C., 1986), to the benefit of both suppliers and consumers of financial services; further developments are on the cards, as implied for example by the advent of what has become known as *e-finance* (MISHKIN F. S., EAKINS S. G., 2009).

The financial crisis that began in the summer of 2007 caused – among other things – a big financial squeeze, that triggered a global brainstorming about the future of both traditional and alternative funding channels, caught between uncertainty and instability. Since the financial sphere of the economy is assumed to efficiently support the real one, the underlying question that has been gaining momentum is whether banks are enough: for sure, they keep on performing vital functions but non-banking institutions have increased their competitiveness by supplying even too creative products, in an effort to sustain company liabilities and to assist the same target market with risk management techniques.

At the same time, the issues concerning risk management have been increasingly dealt with, to the point that nowadays risk is perceived as a multifactor concept to be analysed from several perspectives. As a consequence, its theoretical roots have been explored in different fields, well beyond the original scope of the insurance industry and its own actuarial and statistical framework: for instance, the topics that have been most recently covered in corporate finance aim at studying risk within the value maximization context and at developing strategies for mitigating risks; by contrast, banking has been more and more concerned with risk capital and capital requirements, as the reform of the 1988 Basel Accord culminated in what bank supervisors refer to as Basel II (BANK FOR INTERNATIONAL SETTLEMENTS, 2004), and the call for Basel III should further enhance the role of risk assessment and measurement, thus compounding fears of credit rationing among borrowers.



### **Recent developments in the agribusiness**

Investigating boundaries and manifestations of such a blurred concept as financial innovation can provide an idea of just one side of the coin; on the other side, attention has to be focused on the financial needs that remain unsatisfied in agriculture or that are worth stimulating to attain a higher level of managerial finance standards. As a matter of fact, innovation has made both agriculture and finance extremely diversified sectors, as it can be argued by pointing at agricultural loans, though the process of financial innovation has left some areas almost unaffected in the agribusiness and its management skills need to be improved in a way that is *right for the times*, in general terms.

As if the options that have been crafted over time to populate the financial world were not enough, further strategic tools may be created for agriculture, provided that the process under investigation is far from being exhausted. A supporting argument leads to consider the potential for weather derivatives in our new, climate-changed world: they started to be traded in the United States at the end of the nineties, in an attempt at devising new ways to manage – and, in particular, to hedge – weather risks; direct exposure to them can involve as many as one million firms estimated in agriculture, forestry, and fishing in Italy (PACELLI V., 2008).

In these market segments hedging may also be pursued by making recourse to catastrophe (briefly, cat) bonds, since they allow to transfer the risk of being affected by natural disasters to investors, who may finally bear the resulting losses, if specific trigger conditions are met. No question that the introduction of these bond issues sounds reassuring, but their high degree of sophistication prevents most of the agribusiness from adopting them; anyhow, not even private equity and venture capital have been as widely accepted as it could be expected in agriculture, in spite of the efforts undertaken to promote these financial tools that are designed to provide financial support to innovative small enterprises showing promise of job creation, economic growth, and international competitiveness.

### **The role of micro-finance**

The unsatisfactory proportion of equity to debt financing should fuel feelings of pessimism, since indebted companies' vulnerability would rather persuade to strengthen their capital base and the same conclusion must be drawn by discussing the issues concerning their credit rating. Against this theoretical background, there are reasons to believe that benefits can be more easily reaped by resorting to micro-credit in the agribusiness, featuring a productive structure that is mostly built upon small firms, relatively closed to outside investment: while the recent financial crisis has led to the tightening of credit standards, above all by the largest banking groups (Bank of Italy, 2010), the recourse to financial institutions involved with micro-credit has been taken into increasing consideration as a part of the exit strategy; this trend is likely to continue and eventually become more marked, since the difficulties to access credit remain substantial compared to the years preceding the crisis.

In fact, micro-credit allows to borrow a smaller amount of money than the loan size usually offered by commercial banks, which may help companies to survive and hopefully grow, despite being denied access to traditional banking and related services, mainly due to the collateral aspect of loan requests. However, the advantages associated with micro-credit cannot be thoroughly grasped if its description is conditioned upon its smaller size than

traditional bank loans: new institutions specializing in this market segment have contributed to its success by developing innovative distribution channels and new ways of delivering loans can be included within the concept of financial innovation, regardless of their amount; of course, *product innovation* does not tell the whole story, because *product* is only one of the *four Ps* accounted for by conventional studies about the marketing mix (MCCARTHY E. J., 1981), the other variables being *promotion* and *price*, besides *place*.

Furthermore, micro-credit can be seen as a sub-set of micro-finance, encompassing micro-lease and micro-equity financing, as well as micro-insurance policies and even micro-deposits, to the benefit of the agribusiness as of any other productive sector. To make these financial services far more attractive, they perform a social role that adds to the functions historically attributed to the banking system and leads to evoke the concept of *ethical finance*: its distinctive trait has to do with social responsibility issues, so far away from the profit maximization goals that theorists have recommended and entrepreneurs have pursued for decades, thus postponing stakeholders' to stockholders' welfare; this point can be stressed by arguing that micro-finance calls for attention as an alternative to both traditional banking and illegal practices, such as usury.

### **Some strategic tools**

The role that micro-finance is likely to play may be unfortunately minimized if it is confined to the underdeveloped environment in which Nobel prize Muhammad Yunus made initially recourse to this financial tool, in order to bring livelihood opportunities to the doorsteps of poor people. Indeed, micro-finance has proven useful elsewhere and its specific features make it a strategic way out when it comes to recover after a natural disaster: if this is the case, severe though basic financial needs, requiring a huge amount of money overall, dramatically surface all together and all at a sudden in different market segments; among and across them, special consideration has to be devoted to family-owned small companies that abound in agriculture and represent a unique category of firms for mixing up the characteristics of enterprises and households (CUCULELLI M., MICUCCI G., 2008).

Similar comments, suggesting an unconditioned attitude, apply to institutional programmes based upon new financial engineering instruments, that can be usefully resorted to in agriculture, not necessarily in an underdeveloped environment or in an impacted area. The set of these instruments includes JEREMIE (Joint European Resources for Micro to Medium Enterprises), a joint initiative of the European Commission and the European Investment Fund with the European Investment Bank, aimed at improving access to finance for medium, small, and micro enterprises, in particular through the supply of micro-credit, venture capital, guarantees, and other forms of innovative financing; announced in 2005, this programme is designed to allow managing authorities to use some of their Structural Funds allocations to invest in revolving funds – rather than once-off grant financing – and so encourage recyclable forms of assistance, while discouraging an exclusive reliance on grants.

Public-private partnership innovative models, such as JEREMIE, pave the way for an even wider range of strategic tools that financial management in agriculture can usefully resort to. The underlying *join for change* philosophy may convey benefits that would be out of reach to firms on a case by case basis, since each of them alone could not take advantage of existing economies of scale to the same extent: for instance, the increasing role played by mutual guarantee institutions gives ground for optimism because of the widely felt

difficulty of gaining access to small business finance (COLUMBA F., GAMBACORTA L., MISTRULLI P. E., 2010); the opportunity to issue district bonds acts as a reinforcement, with agriculture standing in a prominent position, due to the growing number of agrifood and rural districts.

## RESULTS

Looking at the financial arena as a huge laboratory, with both physical and virtual features, there are many success stories that experimental studies have resulted in and some interesting case studies involve the primary sector; in an effort to choose the ones that most deserve consideration, it seems convenient to share the fruitful – though burdensome – experience made in the Abruzzo region, in Central Italy, in the aftermath of the earthquake that devastated L’Aquila and its environs on April 6, 2009 (EARTHQUAKE ENGINEERING RESEARCH INSTITUTE, 2009). Under the critical circumstances that can be easily imagined, a positive sentiment has been brought about by a couple of innovative solutions that fall within the concept of *ethical finance* and that may prove beneficial to the agribusiness in that area.

On one hand, micro-finance has been emphasized by a project known as *Microcredit for Abruzzo*, that was developed by Consorzio Etimos and presented on July 22, 2010. This programme has been arranged so as to draw upon donations managed by the Italian Department of Civil Protection and to profit by the cooperation offered by several partners; they include a number of local banks, mostly mutual banks representing a category of banking intermediaries that traditionally provide financial services for agriculture.

On the other hand, right after the earthquake, a generous contribution to the University of L’Aquila was announced by Parmalat S.p.A., a global player active in milk and dairy products and fruit-based beverages, with one third of the money donated by the company’s employees: the grant was intended to be used for a single project, tied to the donor’s multinational image and in fact allowed to create a micro-biological laboratory for both research and teaching purposes, tailored to the field of interest of the contributing firm; further activities could be eventually carried out in cooperation with local agricultural firms so as to support their recovery. Despite the difficulty of finding adequate premises, due to the pervasiveness of damage on campus, the *Parmalat Lab* was opened on July 15, 2010 and a scholarship was additionally offered to cover its operating expenses during the first year.

## CONCLUSIONS

Lessons learned encompass some conclusions about the relevant role that can be played by Universities, especially if they are located in an impacted area, and by their cooperative efforts, such as the ones jointly undertaken by the University of L’Aquila and Louisiana State University and Agricultural & Mechanical College (LSU) in Baton Rouge (LA, USA) on *redevelopment after a natural disaster*, a program sponsored by the US State Department. To make knowledge and expertise spread, as the academic mission implies, special attention can be drawn to the *mobile classroom* that has been set up by the

Louisiana Business & Technology Center, an integral part of the E. J. Ourso College of Business at LSU: it is a converted semi-trailer that can be utilized also as a 30-seat *business incubator on wheels* to reach the unserved communities in rural Louisiana and encourage to seek further assistance; thanks to this entrepreneurial program, intensive business counselling has been provided, first of all to farmers in some of the areas most severely impacted by Hurricane Katrina, which originated an extensive need to educate agricultural firms on various recovery programs, loans, grants, and tax incentives.

The evidence built up over there leaves no doubt that financial innovation can help to upgrade financial management and to eventually benefit from greater access to credit in agriculture, like in all other industries. In fact, money should fully display its potential as an input, as important as any other one, even in this most traditional market segment: useful insights can be gained by assessing the leverage factor, that is defined as the ratio of total debt to total assets or total value of the firm; leverage, if used successfully, increases the returns to the owner(s) of the firm whereas, if unsuccessful, can result in inability to pay fixed charge obligations and, ultimately, in difficulties leading to financial reorganization or bankruptcy.

Further issues that deserve consideration have to do with credit rating, provided that a well managed firm from the financial viewpoint could expect to be better rated and hence to pay a relatively lower cost of capital. To sum up, new strategic tools come into being daily in the financial arena that are likely to speed up the flight to quality in agriculture, though the hardest task is to make aware of them the multitude of small enterprises prevailing in this market segment: within this framework, even a change in the *place* factor of the marketing mix historically developed by banks can fit into the concept of financial innovation, as shown by the recourse to the *classroom on wheels*; the ambitious results achieved by its use do not only give satisfaction for international interest, in line with the more and more widely accepted *glocal* perspective, but also sound like an invitation to replicate them by adopting this case study as a contribution to foster long term, sustainable growth in agriculture.

## REFERENCES

- BANK FOR INTERNATIONAL SETTLEMENTS, BASEL COMMITTEE ON BANKING SUPERVISION (2004): “Basel II: International Convergence of Capital Measurement and Capital Standards: A Revised Framework”, Basel, Switzerland, June
- BANK OF ITALY (2010): “Annual Report – Ordinary Meeting of Shareholders – Abridged Report”, Rome, Italy, May 31, p. 126
- CARANZA C., COTTARELLI C. (1986): “Financial Innovation in Italy: a Lopsided Process”, Temi di discussione nr. 64, Banca d’Italia, Rome, Italy, p. 5
- COLUMBA F., GAMBACORTA L., MISTRULLI P. E. (2010): “Mutual Guarantee Institutions and Small Business Finance”, in “Business Models in Banking: Is There a Best Practice? – Proceedings of the 2009 Banking Conference”, Università Bocconi, Milan, Italy, p. 151
- CUCCULELLI M., MICUCCI G. (2008), “Family Succession and Firm Performance: Evidence from Italian Family Firms”, Temi di discussione nr. 680, Banca d’Italia, Rome, Italy, p. 3
- EARTHQUAKE ENGINEERING RESEARCH INSTITUTE (2009): “Learning from Earthquakes”, Special Earthquake Report, June, Oakland (CA), USA

FORESTIERI G., MOTTURA P. (2005): “Il sistema finanziario”, Egea, Milan, Italy, p. 2

MCCARTHY E. J. (1981): Basic Marketing, Irwin, Homewood (IL), USA, p. 42

MISHKIN F. S., EAKINS S. G. (2009): “Financial Markets and Institutions”, Pearson Prentice Hall, Boston (MA), USA, p. 9

PACELLI V. (2008): “Weather risk management: analisi della domanda e dell’offerta di strumenti finanziari”, in DELL’ATTI S. (ed.): “La finanza a servizio del comparto agroalimentare”, Edizioni Scientifiche Italiane, Naples, Italy, p. 172.

## **INFLUENCE OF SOMATIC CELL COUNT IN RAW MILK ON CHEESE PRODUCTION**

**KOCOSKI LJ<sup>1</sup>., KALEVSKA T<sup>2</sup>., TRAJKOVSKA B<sup>1</sup>.**

<sup>1</sup>University St. Kliment Ohridski, Faculty of Biotechnical Sciences – Bitola R. Macedonia

<sup>2</sup>Bistra Agro Holland, Dairy Industry – Kicevo, R. Macedonia

e-mail: ljupce.kocoski@uklo.edu.mk

### **ABSTRACT**

The purpose of this study is to determine the qualitative and quantitative changes of milk components due to the increased number of somatic cells and their influence on cheese production. During the study milk is categorized in three categories depending on the number of somatic cells.

The average number of somatic cells in milk from I category is 444.780/ml, II category 825.560/ml and in III category 1.242.220/ml.

The average contents of milk: fat, proteins, lactose, dry matter, casein and whey proteins in milk from I category is 4,2%, 3,3%, 4,7%, 12,1%, 2,9%, 0,9%, respectively. In II category 4,1%, 3,2%, 4,3%, 11,6%, 2,7%, 1,0%, respectively, and 4,0%, 3,1%, 4,0%, 11,1%, 2,4%, 1,2%, respectively in milk from III category. The pH value of milk in I, II and III category is 6,627, 6,799 and 6,897, respectively.

There is a positive correlation in all three milk categories between somatic cell count and the whey proteins, while negative correlating dependency was found between the other chemical parameters and somatic cell count.

**Key words:** quality, milk, chemical components, somatic cells, cheese.

### **INTRODUCTION**

The quality of milk intended for processing is determined by its physical-chemical and hygienic properties. A basic indicator of milk hygienic quality is the number of somatic cells, which are passing through the normal secretor process of the milk either from blood or from the epithelium, as normal biological structural elements.

Somatic cells increase when intramammary bacterial infection is present which causes change in milk secretion followed by qualitative and quantitative milk changes. These changes generally decrease the content of milk fat, lactose and casein and increase whey proteins.

The alterations in the physical and chemical properties of the milk are in correlation with the number of somatic cells (Katic and Stojanovic, 1998). According to (Srbinoska, 2007) the variation of the composition and the properties of raw milk affect certain technological operations in the processing of milk which affect the composition, properties, quality and yield of dairy products.

### **MATERIAL AND METHOD OF WORK**

The cow milk used for the purpose of the research was from farms from the region of Kicevo. Analysis of the physical and chemical composition and somatic cell count was carried out on the samples of the bulk milk.

The analysis of the chemical composition of the milk means determining milk fat content, proteins, lactose and dry matter using an infrared analyzer Milcoscan in accordance with

the IDF 141C:2000 standard, while the determining of the casein content in percentage and the whey proteins is done by using the Kjeldahl method in accordance with the AOAS, 1995 standard.

The pH value was measured with a pH meter- Mettler Toledo.

The cell count was determined with Fossomatic 5000 and milk-enumeration of somatic cells was done according to ISO 13366/2:2006 standard. The working principle of Fossomatic 5000 consists of staining and electronic counting of somatic cells. According to SCC milk is categorized in three categories:

1. I Category milk with up to 600.000/ml somatic cells,
2. II Category milk from 600.000 to 100.000/ml somatic cells,
3. III Category milk with more than 100.000/ml somatic cells.

### RESULTS AND DISCUSSION

The results in Table 1 show that the average somatic cell count in the first category milk is 444.780 (min. 339.000 up to max. 586.000), in the second category 825.560 (min. 690.000 up to max. 972.000) and in the third category 1.242.220 (max. 1.172.000 up to max. 1.306.000).

**Table 1. Average number of somatic cells in category I, II, III**

<b>Indicators</b>	<b>n</b>	$\bar{x}$	<b>S<sub>d</sub></b>	<b>min</b>	<b>max</b>	<b>Cv (%)</b>
I category milk	9	444.780	84,735	339.000	586.000	19,051
II category milk	9	825.560	89,208	690.000	972.000	10,806
III category milk	9	1.242.220	47,232	1.172.000	1.306.000	3,802

**Table 2. Average value of the chemical composition of the milk from I, II, III category**

<b>Milk category</b>	<b>n</b>	<b>Fat</b>	<b>Protein</b>	<b>Casein</b>	<b>Whey proteins</b>	<b>Lactose</b>	<b>Dry matter</b>
<b>I</b>	9	4,206	3,268	2,910	0,8610	4,723	12,197
<b>II</b>	9	4,106	3,192	2,665	0,9680	4,349	11,647
<b>III</b>	9	3,989	3,139	2,386	1,1820	3,964	11,092

The results in Table 2 indicate certain variations in the chemical composition among the three categories of milk, which are in correlation with the number of somatic cells. The average content of milk fat in I category milk is 4,206%, in the II category 4,106% and in the third category 3,989%. It can be noticed that certain decrease of the content of milk fat occurs with the increase of the number of somatic cells of the milk.

The average content of protein in the first category milk is 3,268%, in the second 3,192% and in the third 3,139%. The results show no significant variations. The increase of SCC in milk does not significantly affect the total protein content (Katić et al., 1994).

The results in Table 2 indicate significant decrease of the content of the casein- the main milk protein. In the 1<sup>st</sup> category milk it is 2,910%, in the 2<sup>nd</sup> 2,665% and the decrease of

the content of the casein is significantly evident in the 3<sup>rd</sup> where SCC is the highest 2,386%. The difference in the percentage of casein among the three categories are significant at the level of ( $p < 0, 01$ ). The decrease is a result of the reduction of the synthesis and secretion of the protolithic protein called plasmin.

The value of the whey proteins increases in all three categories. In the 1<sup>st</sup> category it is 0,8610%, in the 2<sup>nd</sup> 0,9680% and the value of the whey proteins in the 3<sup>rd</sup> category is 1, 1820%. Significant differences in the content of the whey proteins was observed among the three categories of milk ( $p < 0, 01$ ). The increase of the whey proteins as a result of the change of the vascular permeability decreases the thermo stability of the milk (Jones and Bailey, 1998).

The obtained results show great variation of the content of the lactose among the three categories of milk. The average content of lactose is decreased as the SCC in milk is increased. In 1<sup>st</sup> category of milk it is 4,723%, in 2<sup>nd</sup> 4,349% and in the third category the average content of lactose is 3,964%. Highly significant differences were observed in the content of lactose ( $p < 0, 01$ ). According to Rupic and Havranek (2003), the physiological minimum is 4,55% and any decrease of it refers to increase of somatic cell count in the milk.

The obtained results show a decrease of the content of dry matter in all three categories of milk, which is in accordance with the decrease of the content of the milk components. The average content of dry matter in the 1<sup>st</sup> category milk is 12,197%, in the 2<sup>nd</sup> 11,647% and the least content of dry matter in the third category is 11,092% (min.10, 91% up to max.11, 25%).

**Table 3. Yield of the cheeses from I, II, III category**

Weighing of the cheese	I category			II category			III category		
	$\bar{x}$	S <sub>d</sub>	Cv (%)	$\bar{x}$	S <sub>d</sub>	Cv (%)	$\bar{x}$	S <sub>d</sub>	Cv (%)
1st day	20,350 <sup>a</sup>	0,356	0,175	19,486	0,270	1,388	18,790	0,115	0,613
15th day	19,123 <sup>b</sup>	0,095	0,495	17,976	0,437	2,432	17,096	0,257	1,506
30th day	17,643 <sup>c</sup>	0,201	1,138	15,893	0,028	0,180	14,787	0,119	0,805

\* The differences of the values with different superscript letters are significant at the level:  
 a:b statistical significance at the level of ( $p < 0, 01$ )  
 b:c statistical significance at the level of ( $p < 0, 01$ )  
 a:c statistical significance at the level of ( $p < 0, 05$ )

Table 3 shows the yield of the three categories of cheeses. The measuring of the yield of the cheese was carried out three times during ripening period as follows: d 1 immediately after cutting it, d 15 and d 30 of the ripening of the cheese. The results obtained lead to the conclusion that the yield of first category milk the first day of ripening is 20,350 kg, of the second category 19,486 kg and of the third category 18,790 kg. The coefficient of variation in the cheese from the first category is (Cv=0,175), the second (Cv=1,388) and the third (Cv=0,613).

On the fifteenth day of ripening the yield of the 1st category is 19,123 kg, the second category 17,976 kg and the third category 17,096 kg. The standard deviation in the first category is (Sd=0,095), in the second category (Sd=0,437) and in the third category (Sd=0,257). The coefficient of variation of the cheese from the first category is (Cv=0,495), from the second category (Cv=2,432) and from the third category (Cv=1,506).



On the thirtieth day of ripening the rendement of the cheese from the first category is 17,643 kg, from the second 15,893 kg and from the third 14,787 kg. The standard deviation in the cheese from the first category is (Sd=0,201), from the second category (Sd=0,028) and from the third (Sd=0,119). The coefficient of variation of the cheese from the first category is (Cv=1,138), from the second category (Cv=0,180) and from the third category (Cv=0,805).

The rendement difference in the three categories of cheese according to statistical data indicates significant change on the level of (p<0,05).

The rendement and the abatement are a key element for an economical cheese production. According to Kapac- Parkaceva (1988) several factors affect the rendement of cheese such as the quality and chemical composition of the milk, especially the fat and casein concentration, the technological process and the way the cheese is stored.

**Table 4. Total abatement ( $\bar{x}$ ) of the cheese during ripening**

Category	Total abatement	
	kg	%
<b>I category</b>	2,707 <sup>a</sup>	13,30
<b>II category</b>	3,593 <sup>b</sup>	18,44
<b>III category</b>	4,003 <sup>c</sup>	21,30

\* The differences of the values with different superscript letters are significant at the level:

a:b statistical significance at the level of (p<0,01)

b:c statistical significance at the level of (p<0,01)

a:c statistical significance at the level of (p<0,05)

As can be seen from the data in Table 4 of our study the cheese from the three categories after thirty days of ripening has different rendement which is lower in the categories with higher somatic cell count. According to the results the rendement of the cheese of the first category after ripening was 17,643 kg, the rendement of the second category 15,893 kg and the rendement of the cheese from the third category was 14,787 kg. The difference of the rendement among the three categories of cheese are significant at a level of (p<0,05).

Taking in consideration that the cheese from the three categories is produced under the same technological conditions (same quantity of milk, same pasteurization and coagulation temperature of the milk, curd processing, pressing, salting/brining and ripening of the cheese), it can be said that the difference in the rendement of cheese is due to the change of the milk composition (change of the quality of the milk) which ultimately affects the end goal - the rendement of cheese.

Mihailov (2005), examined the influence of somatic cells on the rendement of white soft cheese and his findings were as follows: the rendement of cheese from milk with 100.000 somatic cells is 18,20 kg, the rendement of cheese from milk with 800.000 ml somatic cells is 17,77 kg, and the rendement of cheese from milk with 1.300.000 somatic cells is 17,48 kg. Bruhn (1983) researched the influence of the somatic cells on the rendement of Cheddar cheese and came to the following findings: he rendement of cheese obtained from 100 liters of milk with 240.000 somatic cell count was 9,748 kg, the rendement of cheese obtained from milk with 496.000 somatic cell count was 9,686 kg, and the rendement of cheese obtained from milk with 640.000 somatic cell count was 9,430 kg. The results shows that the cheese made of milk with higher SCC have a lower rendement. The research carried out at the Cornell University for the purpose of establishing the quantitative ratio between the increase of the somatic cells and the rendement of cheddar

cheese concluded that the increase of somatic cells of 100.000/ml dramatically reduces the rendement by 1%, and the increase of somatic cells of 100.000-1.300.000 lowers the rendement by another 1-2% (Dairy center News, 1991).

One of the aims of our research was determining the abatement in the ripening process. The results obtained show that the total abatement after the ripening period of 30 days in the cheese from the first category is 2,707 kg or (13,30%), in the second category the wastage rate is 3.593 kg or (18.44%). The abatement in the third category cheese is the highest at 4,003 kg or (21,30%). The differences in the total abatement in the three categories are significant at a level of ( $p < 0,01$ ).

The abatement was determined even in the phases of the ripening of the cheese, i.e. the abatement that appears in 1-15 day and the abatement of the cheese that appears in 15-30 day. The difference in the abatement between 1-15 day and 15-30 day in the first cheese category is at the significant level of ( $p < 0,05$ ), and in the second and third category the abatement between 1-15 day and 15-30 day is significant at a level of ( $p < 0,01$ ).

Many authors, in the available literature, conclude from the data that the number of somatic cells affects the rendement of cheese, but only few are with precise indicators. The infection of the mammary gland results in both a decrease of milk production in the cells of the secretory epithelium and quantitative and qualitative changes in the composition of the milk followed by a decrease in the content of the casein, lactose, milk fat and an increase of the composition of the whey proteins and enzymes. According to Auld et al. (1996), the change in the composition of the milk with increased somatic cells has a negative effect on its suitability for cheese processing, and is the result of the influence of the enzymes on the proteins and fat. The negative effect of higher levels of somatic cells in the milk intended for cheese making means decreased hardness of the coagulum and a loss of a substantial amount of casein and fat in the whey, whereas the increase of the content of the whey proteins results in a decrease of the thermostability of the milk. The change in the ratio of the casein fractions occurring in the milk with higher somatic cell count results in a decrease of the rendement, altered sensory properties, decreased shelf life due to higher water retention and low profitability during the processing of the milk into cheese. According to Mazal (2007), the cheese made of milk with high levels of SCC contains more water, and during the ripening process there is higher proteolytic activity endangering the typical sensory quality of the cheese.

## CONCLUSION

The results of this trial indicate that there are significant differences in the physico-chemical content of the three categories of milk, i.e. the increase of SCC in the milk alters certain milk components, especially decreasing the percentage of lactose and the main milk protein-casein and increasing the content of the whey proteins. The alterations in the chemical content are more noticeable in the second category milk and they are significant in the third category milk where the average SCC is 1.242.220. In this milk category the content of lactose is pretty low 3,964%, the casein 2,386%, whereas the whey proteins have the highest value 1,1820%. The alteration of the chemical content and properties of the milk due to high SCC, during its processing leads to lower dairy quality and rendement, and thus brings out economic losses in the dairy industry.

The rendement of cheese in the three categories after the ripening of 30 days is as follows: cheese from I category milk 17,643kg, cheese from II category milk 15,893, and the

rendement from III category 14,787kg. Although the cheese was manufactured using the same technological processes the rendement in cheese from II and III category decreases. We can conclude that nevertheless the cheese is made under the same technological conditions the rendement is lower in the cheese made from the milk from category II and III along with the proliferation of somatic cells and their impact to change in milk components.

The total abatement (mass loss) that occurs in all three categories during the ripening period from 1 to 30 days is: cheese obtained from category I milk 13,30%, cheese from category II milk 18,44%. The abatement in the cheese produced from category III milk is the highest at 21,30 %.

The differences occurring in the total abatement among all three categories are significant at level ( $p < 0,01$ ).

### REFERENCE

- AULDIST, M. J., COATS S., SUTHERLAND B J., MAYES J. J., MCDOWELL G. H. AND ROGERS G. L. (1996). Effects of somatic cell count and stage of lactation on raw milk composition and the yield and quality of cheddar cheese. *J. of Dairy Res.* 63: 269.
- HARMON, R.J. (1994). Physiology of mastitis and factors affecting somatic cell count. *Journal of dairy science* 77.
- JONES, G.M, AND J.R. BAILEY. (1998). Mastitis Control in Heifers and First Lactation. Virginia Cooperative Extension, Publication Number: 404/281.
- KAPAC PARKACEVA N. (1988). Tehnologija na prerabotkite od mleko, Agricultural Faculty, Skopje
- KATIĆ V., TAYEB EL HUDA, BABIĆ, LJ., POPOVIĆ, J. (1994). Uticaj mastitisa na kvalitet mleka. *Veterinarski glasnik*, 271-276.
- KATIĆ V., STOJANOVIĆ L.: (1998) : Uticaj mastitisa na higijensku ispravnost mleka. Jugoslovenski mlekarski simpozijum „Kvalitet mleka i fermentisanih proizvoda”, Zlatibor. 5-9.
- MAZAL, G., P. C. B. VIANNA, M. V. SANTOS, AND M. L. GIGANTE. (2007). Effect of somatic cell count on Prato cheese composition. *J. Dairy Sci.* 90:630–636.
- RUPIĆ, V., HAVRANEK, J.: (2003): Mlijeko od farme do mljekare. Hrvatska mljekarska udruga. Zagreb.
- SRBINOVSKA S.: (2007): Higijena i kvalitet mleka u Republici Makedoniji u saglasnosti legislativom Savremena Poljoprivreda vol.56, 5 str.61-68, Novi Sad.
- SKEIE, S. (2007) Characteristics in milk influencing the cheese yield and cheese quality. *Journal of Animal and Feed Sciences* 16, suppl 1. 130-142

***SECTION I: AGRICULTURAL ECONOMICS AND RURAL  
DEVELOPMENT***

**Moderátorok/Moderators:**

Prof. Dr. Nagy Frigyes

Prof. Dr. Ioan Csoz

**Secretary:**

Galgóczi-Deutsch Márta

## **EXAMINATION OF THE FINANCIAL POSITION OF HUNGARIAN AGRICULTURAL ENTERPRISES BETWEEN 2002 AND 2009**

**BORBÉLY KATALIN, PATAKI LÁSZLÓ, VÁGYI FERENC RÓBERT**

University of West Hungary, Faculty of Economics  
9400 Sopron, Erzsébet u. 9.  
borbely.katalin@gmail.com

### **ABSTRACT – Examination of the financial position of Hungarian agricultural enterprises between 2002 and 2009**

The emerging and strengthening unfavourable processes in the Hungarian agro-industry after the change of regime influenced the financial position and its ratios significantly. Their indebtedness and parallel to it their financing risk grew. Their profitability sank and the figures of efficiency became minor.

There were great expectations in the branch prior accession to the EU that these unfavourable processes would stop and positive developments would begin. In our survey we found these expectations materialized only partly. The profitability grew owing to increasing subsidies consequently the indebtedness showed some decreasing. In the same time the real value of the agro-industry's output decreased further leading to continued reduction in the efficiency of this activity. The majority of positive impacts ceased after 2006 excluding the higher level of profitability.

**Keywords:** structure of capital, financial position, profitability, efficiency, conservative financing strategy

### **INTRODUCTION**

In the change of regime's period the Hungarian agro-industry was shocked seriously. The causes were the privatisation, the cutting the lands into little farms, the sector's decreasing role in the GDP and the employment. The fixed assets became more and more depreciated and the line –of mostly unfavourable– changes could be continued. The agricultural activity has always had high risk, low returns and in the same time claim to high value of total asset, so the funding of it has not been solvable by the growth of the equity. Consequently there emerged a demand for involving liabilities that boosted the financing risk. Unfavourable tendencies started in the agricultural enterprises' profitability, efficiency and financial position.

In our paper we have tried to answer the question if the above tendencies of the nineties whether or not would remain beyond the millennium or rather if the accession to the EU has changed (and if so to what extend) the position of farming enterprises in this sector?

### **MATERIAL AND METHOD**

The analyses are based on the tax authority's corporation tax returns between 2002 and 2009 and the credit statistics of the Hungarian National Bank and other financial institutions. We have used the reports on the most important industries. The aggregate data hide inevitably the differences among the enterprises.

We have considered agro-industry's enterprises those including agriculture, fishing and forestry. The companies have double entry bookkeeping and have to prepare corporation

tax return yearly. We have used ratios, average, dispersion to prove our statements. The examined period is from 2002 till 2009.

## **RESULTS**

The total sum of equity of all the examined enterprises increased by 65 percent in these years and in 2009 it exceeded the 1000 billion HUF (1053 billion HUF). The long-term liabilities grew by 89 % and the current liabilities 48 % in this period. While the equity's rate of growth was steady that of the liabilities not.

The current liabilities went up continuously. Since 2004 the increase has been continuous but slowing down and the year 2009 showed some recession. Consequently the rate of equity regressed from 53 per cent of 2002 to 47 per cent of 2004-2005. Then it increased moderately and in 2009 came close to 54 per cent. The dispersion of the above mentioned rate is relative low: 0.1553.

The structure of the capital was changed by the growth of the equity's proportion prosperously. The favourable process was owing to the narrowing down of the borrowing's possibilities, but not a conscious decision-making. (KÁROLYNÉ et al., 2009)

The rate of current liabilities showed fluctuation between 28.10 (in 2003) and 32.66 (in 2007) per cent by a low dispersion coefficient (0.1311). The proportion of the long term liabilities and equity to the current liabilities was two thirds to one third.

Within the credit portfolio the long-term liabilities exceeded the current liabilities permanently in the examined years with exception of 2002. Mostly due to the favourable interest rate and state-subsidized long-term credits the proportion of long-term liabilities moved about 70 per cent between 2003 and 2006 exceeding this value in 2004.

One of the reasons for this downsizing of the short-term credits was our accession to the EU because after it was no more allowed for the state to subsidize short-term interest rates. After 2006 we experience that the biggest part of all credit's yearly growth was short term so the rate of the long-term credits slipped to around 50 per cent.

The weight of the issued capital became more and more insignificant. The proportion of the issued capital to the shareholders' equity was 46 per cent (45.87) in the beginning of the examined period and at the end of it decreased to about 26 per cent (25.99). Both the proportions of the issued capital and the nominal value were reduced.

The specific indicator of issued capital showed a big decline from 2003 to 2004 when the average sum of it diminished by 5230 thousand HUF while the number of the enterprises (with accrual based bookkeeping) was rising by 1833 what meant about 20 per cent. It is characteristic of this time that enterprises began their activity with less issued capital than earlier probably because of expectations regarding our EU accession.

The proportion of the capital-reserve to equity was on average 22.61 per cent in the examined term. The capital-reserve increased by nearly nominal 74 billion HUF in the period. It meant a growth of 50 per cent. This fact was influenced by a measure that allowed the enterprises to state the received subsidies without repayment for developing as capital reserve at the same time with the cash in flow. (The most part of the subsidies was accounted as other revenues.) (HERCZEG, 2009)

The role of the aggregate profit reserve –as for its tendency– grew considerably bigger. The growth in the above mentioned period was on average 20 per cent which meant till 2006 below 20 per cent, but after this year it showed a considerable growth parallel with

the changing of the profitability for the better. The growth was 28.83 per cent in 2009, nominally 3.7 times as large as earlier in the period.

Among the parts of equity the net results of the years were positive excluding 2003 that was a year of drought.

There was no considerable reorganisation in the structure of the examined agricultural enterprises' assets. The rate of the fixed assets to the total assets moved between 51 and 53 per cent by a low dispersion (0.1247). There were two exceptions: The years 2004 and 2009 when the value of the mentioned rate was 54.21 and (unexpectedly high) 56.15 per cent.

The value of the long-term liabilities increased significantly in these years which meant that the source of the growth of the fixed assets were long-term debts.

The increasing investment activity and the following growth of fixed assets were motivated by the renewing offer of credit, state subsidies and the tax allowance according to the investments.

In spite of the high depreciation (61 per cent) of the fixed assets in the examined term the growth of fixed assets was significant so increased the proportion of the high value and quickly depreciable fixed assets.

The inventories and the receivables were the most important factors in the current assets. The proportion of the receivable to the current assets exceeded the average of the debtors' proportion of the Hungarian economy in all these years.

The current ratio (the total current assets divided by the current liabilities) showed some growth between 2002 and 2004 and it had the highest value in 2004 (162.67 per cent) than was reduced. The ratio moved below 150 percent between 2006 and 2009.

The current ratio exceeded the acid test ratio significantly. The difference of the ratios meant the high proportion of the inventories. The above-mentioned facts (high value of the receivable and inventories) relates to an illusory liquidity.

The downfall of the liquidity with a low profitability and high indebtedness could bring the diminishing of the borrowing's possibility.

The aggregate value of equity, excluding of 2002 was not covered by the value of fixed assets in the examined years, so the fixed assets were funded not only by equity. The average coverage of the period was 96.21 per cent.

The capitalization (equity and long term liabilities) exceeded on average the value of the fixed assets by 25.25 per cent showing growth between 2002 and 2004 and after that came a step-by-step decrease. Consequently the 25 per cent of the current assets were funded by capitalization. The net working capital was positive in the examined years. The financing strategy of the above mentioned enterprises was conservative in the examined time.

The rate of growth of the agricultural enterprises' output was behind the total asset value. The revenues on current price increased steadily, but only by 23 per cent. This fact lagged far behind the aggregate value of inflation in this time. During this period the value of total assets increased by 62 per cent.

The efficiency ratios (total asset turnover, tangible asset turnover and the value added to total asset) were reduced between 2002 and 2004. The decrease stopped after 2004 however the ratios did not show a change for better. There was a remarkable regression owing to the crises in 2009.

Before 2000 the rate of total asset value and equity lagged behind the aggregate value of inflation i.e. the process of capital's loss having begun in the eighties continued and even boosted. (PATAKI, 2003 b) The growth of output was behind the growth of the total asset value.

**Table 1: Efficiency ratios in the examined period**

	2002	2003	2004	2005	2006	2007	2008	2009
„A”	86,17%	80,64%	74,25%	72,46%	73,76%	73,20%	75,09%	65,66%
„B”	180,07%	160,47%	157,17%	152,62%	152,01%	153,46%	155,65%	126,27%

„A”: Sales/ Total asset „B”: Sales/ Tangible asset

Source: own calculation based on the corporation tax returns of tax authority

After 2000 the capital's loss stopped, but the diminishing of the asset turnovers went on. (PATAKI, 2003 a) The conclusion can be drawn that the agricultural enterprises' total asset value is too high for their output. The loss of capital in nineties is comprehensible as conformity to the not expected level of the output. Without capital's loss the decrease of the asset turnovers could have been faster. (BORSZÉKI, 2000) Instead of notion capital's loss capital's diminishing would be more exact.

The position of the enterprises according to the asset turnovers becomes insecure. The enterprises should have new markets, increase their revenue and use all the opportunities for the sale.

The decrease of the capital's efficiency was counterbalanced by growth of the labour productivity. The second fact is owing to the diminishing of the staff number.

The examination of the enterprises' profitability showed that the profit before tax sank till 2004 but after 2004 it started to grow significantly. In 2003 the result before tax was negative due to the extraordinary drought.

The net income from operation showed similar characteristics. The net income of 2008 exceeded the value of 2004 by 146 per cent. The results of financial and extraordinary transactions influenced the net income from operation negatively. The result of the financial transaction was negative in all of the examined years and it diminished the net profit before tax by 43 per cent on average. The difference of the extraordinary income and expenses was positive in every year.

The retained profit of the year was rising noticeably and there were especially high in 2005 and 2008. Parallel the profitability ratios (ROE, ROA and ROS) increased after 2004, too.

**Table 2: Profitability ratios in the examined period**

	2002	2003	2004	2005	2006	2007	2008	2009
ROE	6,98%	-1,24%	2,36%	0,56%	7,91%	6,78%	8,18%	2,81%
ROA	0,77%	0,49%	0,56%	0,53%	1,33%	0,66%	0,24%	0,23%
ROS	4,29%	-0,79%	1,50%	0,37%	5,50%	4,66%	5,70%	2,31%

Source: own calculation based on the corporation tax returns of tax authority

The growth of profitability increased the agriculture enterprises' self-financing's ability however the depreciation ran to two thirds of the cash flow i.e. it did not arise from profit. The effect of the self-financing's ability developed the ratio of equity to the total asset influencing the liabilities favourably.

However, there is a fact mentioned above which influences the conclusions. The accounting of the subsidies as other revenues exceeded the net income from operation and did not show the realized result. The value of the subsidies exceeded the realized result of operation in every year. In the examined period the average value of the net income from operation was about 67 billion HUF and the average value per year of the subsidies



without repayment was over 113.5 billion HUF. The net income from operation without subsidies would have been negative, a yearly average 50 billion HUF. (BORSZÉKI, 2008)

The fact that the whole or major part of the income from operation originates from subsidies is not a Hungarian characteristic, but it is important information to the profitability of the examined enterprises. So the growth of the net income from operation after 2004 was owing to the increased volume of subsidies which fact was the consequence of the accession to the EU.

## CONCLUSIONS

In our opinion the earlier process of the capital' loss has stopped in this sector. The total asset and the equity of the enterprises grew in the period significantly (62 and 65 per cent). The rate of growth of the revenue and added value was lower which means problems of return on asset and equity.

The further capitalization is limited mostly by the returns. The most part of the investments would be realisable from the profit after tax and depreciation. The interest rate subsidies give reason for borrowing. The growth of the asset value is limited by the opportunities for sale.

The expectations regarding accession to the EU were significant, but these effects influenced the ratios of the agricultural enterprises only for short time favourably. The number of the businesses grew although they had been established with low issued capital. The retained profit of the years increased, especially in 2005 owing to favourable agricultural output prices. The reserves of the equity were rising. The rate of the long-term liabilities got larger than the short-term liabilities. The conservative financing strategy seemed continuous. Part of the effects was only temporary and their influence was eliminated after 2006.

## REFERENCES

- BORSZÉKI É (2000): „Az intézményrendszer helyzete és fejlesztése az agrárgazdaságban az EU csatlakozás tükrében. VISION II. konferencia kiadványa. Gödöllő, p.165-175
- BORSZÉKI É (2008): A jövedelmezőség és a tőkeszerkezet összefüggései a vállalkozásoknál. Bulletin of the Szent István University. Special Issue Part I.
- HERCZEG A (2009): Társas mezőgazdasági vállalkozások forrás- és tőkeszerkezetének elemzése 2002 -2006 között. DE AMTC PhD értekezés p.150
- KÁROLYNÉ, ZDENKÓ I. – Illés B. Cs. – Pataki L. – Kozma T. (2009): The effect of the foreign capital and European subventions on the competitiveness of the Hungarian agribusiness enterprises in the last 15 years. Proceedings of the 113<sup>th</sup> EAEE Seminar, A resilient European food industry and food chain in a challenging world. MAICh, Chania, Crete, Greece, CD, full paper, p. 14
- PATAKI L. (2003 a): The examination of the status and structure of capital in the case of a model of co-operating agricultural enterprises in Heves county. Studies in Agricultural Economics No. 99. 99-112. p.
- PATAKI L. (2003 b): A heves megyei gazdasági társaságok és szövetkezetek tőkehelyzetének és –szerkezetének vizsgálata. Gazdálkodás 7. számú külökiadás. 60-67. p.

## **ENVIRONMENTAL PROTECTION AS PART OF STRATEGY IN CENTRAL AND EAST EUROPEAN AGRICULTURAL ENTERPRISES**

**GAL, JOZSEF<sup>1</sup> – GALNE, HORVATH ILDIKO<sup>2</sup>**

<sup>1</sup>Szegedi Tudományegyetem, Mernöki Kar  
6724 Szeged, Mars ter 7.  
[galj@mk.u-szeged.hu](mailto:galj@mk.u-szeged.hu)

<sup>2</sup>Nemeth Laszlo Gimnázium és Általános Iskola  
6800 Hódmezővásárhely, Ormos E. u. 18.  
[horvi967@freemail.hu](mailto:horvi967@freemail.hu)

### **ABSTRACT**

The demands and influences of the environmental movement change our life. We can find the local interests win often, therefore processes not organized because of this and investments appear beside each other. In agro-food business the reasons are attributable to lack of information and the weakness of the supplying systems. This situation offers different ways; therefore you have to find the best way to save it for the future. The problem is to know, how we can build into the strategy of the enterprise. Is it a demand or a duty? Can it be in the focus and possible to take marketing-mix around it? Environmental market is been developing in Central- and Eastern Europe, therefore its terminology has not been fixed yet. Against this situation it is possible to develop alternatives, in which marketing is very important part. Demands of customers pull the environment friend products and services. The inclination of the bad acceptance of the higher price is connected to this. On these bases how we can understand and require manifesting environmentally based marketing strategy? The security political aspect of the environmental protection has got stronger particularly under the influence of the change of the political system in Central and Eastern Europe. This way the participation in international environmental cooperation is more than the question of the protection of the environment. We would like to write about scope, measure, manage of it. It is not a duty for companies; it must be a type of motivation based everyday activity. We mention the regional special element of it.

**Keywords:** environmental protection, infrastructure, mentality, environmental market, strategy

### **INTRODUCTION**

After political and economical transformation there is a new situation and future in front of small and medium enterprises. Having reorganized bigger part of socialist state owned companies new Hungarian and multinational companies started to work. It started in the industry and service sector and at the end in agriculture. The social-economical processes accelerated in the last decade in the Central and Eastern European countries. The process brought numerous contradictions, difficulties. New problems to the surface and their solution need multi-dimensional way of thinking by the membership of European Union. We could ascertain that the change could not be realized in a day or two. The issue of the environmental protection appeared in this category as a significant field. Thinking, mentality and activity must be different. Environmental protection is not duty only for big companies, small and medium size enterprises also must do their bests. It is not just cost it is the way for sustainable development.

## **MATERIALS AND METHODS**

A lot of open questions we have to answer about agricultural enterprises and environmental protection. Traditions are very hard so it is difficult to change mentality and develop motivation. Without education and people's want it is impossible. Sustainable development is not only a wish; it is the way of the future. Inhabitants often think they cannot do anything because they are very small. It is false. Everybody can do his bests and not only during work time and workplace. We try to understand background and mentality about it in Central and Eastern Europe. Companies try to save their costs but they must follow the rules of duties and social requirements. They must find balance between economy, law and society.

## **RESULTS AND DISCUSSION**

How can environmental protection becomes part of market leded agricultural enterprises? Environmental pollution does not know state borders; therefore we must speak about regions and flows. In this structure local enterprises and inhabitants work together for common goals. We know profit oriented companies and population in social and economical crisis do not keep first position for environmental protection. Governments must accelerate and press enterprises and inhabitants to change their mentality and keep responsibility for longer time not only profit is in focus. In the agriculture it is much more difficult. You can see when somebody is owner of ground and somebody else rent it to use for a year or more. This case whose responsibility and activity to duty environmental protection? Historical background is different. For geographical reasons I should count Austria among the Central European countries which is the most influential country of the region with its outstanding environmental accomplishment. For the sake of comparison I will occasionally refer to the events, results achieved there. I regard the Czech Republic, Slovakia, Hungary, Slovenia, Croatia, Poland and the Baltic countries as the part of Central Europe. In these countries significant changes took place and they achieved certain results in the field of environment. I count Romania, Serbia and Montenegro, Bosnia-Herzegovina, Macedonia, Ukraine, Moldavia, Bulgaria, Albania, Byelorussia and Russia (mainly the region around St. Petersburg) among the Eastern European countries. In these countries a lot of economical and social changes took place but the speed and the success of these changes lag behind the Central European countries. The question is: what is the relationship between these facts and the responsiveness or indifference in connection with the state of the environment? The problem is to know, how we can build into the strategy of the enterprise. Can it be in the focus and possible to take marketing-mix around it? Environmental market is been developing in Central- and Eastern Europe, therefore its terminology has not been fixed.

It is worth studying as it comes up from both the scientific and everyday experience that whether the spread of mass production can be responsible for the deterioration of the environmental quality and of the living conditions? Provided we accept this responsibility we have to work a new production conception out and also we have to reckon with its social consequences. In the fight for distribution the capital and the work have to give up a part of their claims in the interest of legality of nature.

Nowadays number one goal of companies is cost reduction and increasing efficiency. In the course of putting the international division of labor and the expenses of

transportation into some onto the redesign of the logistic processes there is need. Installing the processing industry close to agricultural producers turns into a feature again or buy food companies close to fields.

Production may be more economical in the big item, but the role of the marketing becomes increasingly more important, since on the manufacturer's neighborhood realization, processing has a favorable effect on the environment according to his claims helping lose weight.

The environmental protection – as one of the assessing viewpoints of the technological progress in agriculture – is accompanied with professional debates even today. There is a seemingly unsolvable contradiction between the speed of the technological progress and the environmental loading. In contrast with it is the most desirable to harmonize our environment with our qualitative future the most important scene of which can be the environmental market. We produce many products in the industry and agriculture, but only few can be told environment friend ones. We cannot say all the products must be bio products, but we have to take in focus the less row material and energy using and waste. Information and marketing must help this strategy and process. (Menon and Menon, 1997)

The opinion is changing in the regard that the conflicts between the short-term interests of economy and the long-term interests of environment can be stimulated. (Szlavik, 2005, Bartha Szabo, 2002)

This hypothesis is supported and proved in our research. This chain of thoughts must be examined in Central and Eastern Europe in the aspects that are typical of this region, as the development of the advanced countries experienced a different social-economical change after the World War 2. The starting thesis in the macro economical assessment of the environmental market is that this sphere of national and international market contains externalities. But, at the same time, it does not aim to satisfy, ease or stop the demand of the main economical processes. In the contrary, it intends to correct their consequences. This problem has so many elements that we can easily meet the erroneous view suggesting us that the international economy has found the solutions of all its problems in the environment protection. The reality is that the environmental market can only either strengthen or weaken the effects of the power (economical, social, political etc.) that moves the market but it cannot replace them even in a long run.

Population living outside of towns and villages, if we look back on the last half a century we can get some explanations on today's conditions. For the farm re-structure of agriculture meant a tragic shock. In collectivization the farm could only have a plot of 800-1600 m<sup>2</sup> around it. As a result, farms without their economic basis were sentenced to death. The picture changed completely, the lines of farms became few and far between. Ridges of the individual plots, the entries, the farm roads got thinned, ceased to exist or were formed somewhere else. Trees around the farms were dug out, the sweeps disappeared. Instead of them forest belts to protect the fields were planted. It is not the aim of this essay to analyze the life forms of large-scale production since I am intending to describe today's situation illustrated by an example. (Uhlig, 2008)

At the period of the political transformation it seemed that there is a claim on the part of the society to build more farms and that there will be a certain rebirth. After privatization and compensation people who really aimed to live on the land could hardly buy plots around their farmhouses so not even the minimal condition were created for the establishment of an efficient form of farming. Some of them had no other choice than to become an entrepreneur, or they escaped from the town to the outskirts because of the high

communal expenses or the bank loans, or the antecedents of today's economic crisis could be felt somehow.

Nowadays, much less farms can be found than at the end of the 19<sup>th</sup> century. In spite of this fact it is remarkable the great number of farms and people living there. The situation is the same in different Central and Eastern European countries. One is the most important question is how to develop enterprises to grown from crisis up with keeping environmental protection in focus as well.

Around the clock activity can be the solution to keep our livable world. We have good and bad examples and practices as well. Nowadays a lot of agricultural enterprises have economical problems because of the recession. It transforms strategy of enterprises and often try to save money by reducing their environmental activities.

## CONCLUSIONS

During the changes the short-term local interests often prevailed, and the regional and even global problems were articulated on the level of theory only. It is worth mentioning if the short-term interest of the economy and the long-term interests of the environment can be stimulated. One of the most important parts of it is agro-food business. It has long production, growing cycles therefore impacts to nature and economical processes takes long time as well. The public opinion regards farms as appealing, romantic places which are condemned to death. After the political transformation glimmered the hope for a short while that they would regain their earlier, almost futuristic function. It is known that it is impossible because of the lack of both the suitable infrastructure and services. If these two factors are not improved, it is beyond question that the farms cannot survive.

While in the Western part of Europe the population migrate from the towns to the country, in Central and Eastern Europe it is not ensured to provide the existing values, farms with good economic and touristic conditions even the most fundamental provisions.

It is a complex task to solve these problems and politicians, settlement researchers, the farm-college have summarized the most important tasks. Thus, besides development of the infrastructure and basic provisions, it should be discussed how to improve the public security of agricultural sector. It is necessary to create the conditions of sustainability taking the different natural-economic conditions of the regions with farms into consideration. Flexibility of agriculture and directly joined food industry is very limited. Planning and organizing life cycles are complicated and risky. We know there are many duties for agricultural enterprises to solve nowadays. They must fix priorities and environmental protection has not the highest. The solution is finding balance and accept expectation of society, economics environment and give the best answers for duties comes from the law.

## BIBLIOGRAPHY

- BARTHA SZABO J. (2002): Nemzeti feladat – lenne – a tanyak es tanyas tersegek megorzese, fejlesztese! <http://www.gondola.hu/cikkek/65265>, 2009.07.29.
- HUTCHINSON C. (1996): integrating environment policy with business strategy, long range planing, vol. 29, no 1, pp.11 to 23. Great Britain

- MENON A. AND MENON A. (1997): Enviropreneurial marketing strategy: the emergence of corporate environmentalism as market strategy, *Journal of Marketing*, vol. 61, January, pp. 51 to 67.
- SZLÁVIK J. (2005): *Környezetgazdaságtan, Környezetmenedzsment*, Muegyetemi Kiado, Budapest, pp. 25 to 43.
- UHLIG R. (2008): Magyar Tanya. VKSZI Magyar Tanyakert Programiroda hirlevele,

## **NAPKOR – POSSIBILITIES OF A SETTLEMENT IN PERIPHERY FROM THE ASPECT OF REGIONAL DEVELOPMENT**

**GÁL, JÓZSEF – TÓTH, ERIKA**

University of Szeged, Faculty of Engineering  
6724 Szeged, Mars tér 7.  
[galj@mk.u-szeged.hu](mailto:galj@mk.u-szeged.hu)

### **ABSTRACT**

Napkor is a small village close to Ukrainian and Romanian border. Geopolitical situation causes many disadvantages, but local people have many plans to develop their environment. It is a typical place for carrying out rural development programs and their impacts may be the basis of economic and social future. In our paper we try to introduce situation and survey some developable ideas presented in SWOT-analysis. We highlight the possibilities of the LEADER program relating to Napkor and how local people can take part in development.

**Keywords:** rural development, LEADER Program, Napkor, SWOT

### **INTRODUCTION**

By the turn of the millennium regional development has become the second pillar of the Common Agrarian Policy for the member states of the European Union which aims to transform the agrarian structure and to improve the regional conditions.

The primary aim is to find people and communities who are not only able to but also want to perform changes, something new and development. Processes of renewal start only when the individuals find prospective in life, if they can participate in development with their own vital processes. The question is how much the hope for changes, the fear from changes the intention to participate in them are possessed by certain layers of the local society.

Our examination was motivated by the wish to get to know more about the given region: the small village of Napkor. It is a big challenge since this settlement has never been examined thoroughly. It is a new area and we are aiming to analyze its regional development and village tourism.

### **METHODOLOGICAL THEORETICAL APPROACH**

It is a determinant factor for each settlement how it can obtain sources. The settlements which can utilize the possibilities of different financial applications can expect spectacular development while the others can fall behind. Today settlements, mainly the smaller ones are rather in a vegetative level so they are not up to innovation, that is why we are carrying out elaborate studies and striving to reveal more about the generally hidden reserves of the past, recent past and present of the society in order to be able plan for a reasonable time.

It is advisable to concentrate on relations between past and present, on their elements which carry renewal. There is a real reason for social renewal if we can examine the real

relations between people. People very often define themselves according to the village, town or region they were born or live in. Besides individual conscious, we have to pay attention to the settlement-regional awareness level, too. It is more expedient to examine development based on organic traditions. Openness, locking, traditions or the settlement's past, besides all similarities, form the local societies different. That is why in this present examination, we are aiming to reveal conditions, state of supply, new and old functions, recent past tendencies of the region chosen by us in details. Also, its self-organization which makes it possible for us to observe the regional differences, which are to say, what barriers, and obstacles have been conserved. How much are future, long view integrated into people's thoughts? In addition, it is a question to be answered how many the institutions of contacts, the activity of interest integration, directions, proportions and sources of thoughts carry and communicate renewal. What cooperation has been formed in the region? How much is the link to the region presented? Is it 'in the air' of the local society? What relations do the élite of the local society have? What effect do they have on the local decisions? How much do they help or support the activities of social groups? (Szoboszlai Zs. 1993)

### **DESCRIPTION OF THE SMALL SETTLEMENT CALLED NAPKOR**

Napkor (Picture 1) is located in Szabolcs-Szatmár-Bereg county, in the heart of Nyírség, about 15 km from the county seat, Nyíregyháza, by the main road 41. (Tóth E. 2009) Here emerges the highest hill of the central area of Szabolcs, called mount Golyóbis at the top of which there is a meteorological station. It can be easily reached on roads from the directions of Nyíregyháza, Nagykálló and Baktalórántháza, and it is possible to drive up to the motorway about 3 km from Napkor. The railway line Nyíregyháza-Vásárosnamény crosses the settlement where passenger trains and 'Inter Pici' trains run. The territory of the settlement is 6515ha out of which 3749 ha is the inner-city area. The settlement with population of 3838 people belongs to the Region of the Northern Plain, or more exactly to the small region of Central Nyírség (Közép-Nyírség) where the employment problems of the region can be considerably experienced. (Tóth E. 2009) The unemployment rate attains 18% in the settlement; the proportion of people belonging to the Roma ethnic group is high within the active but not employed population.



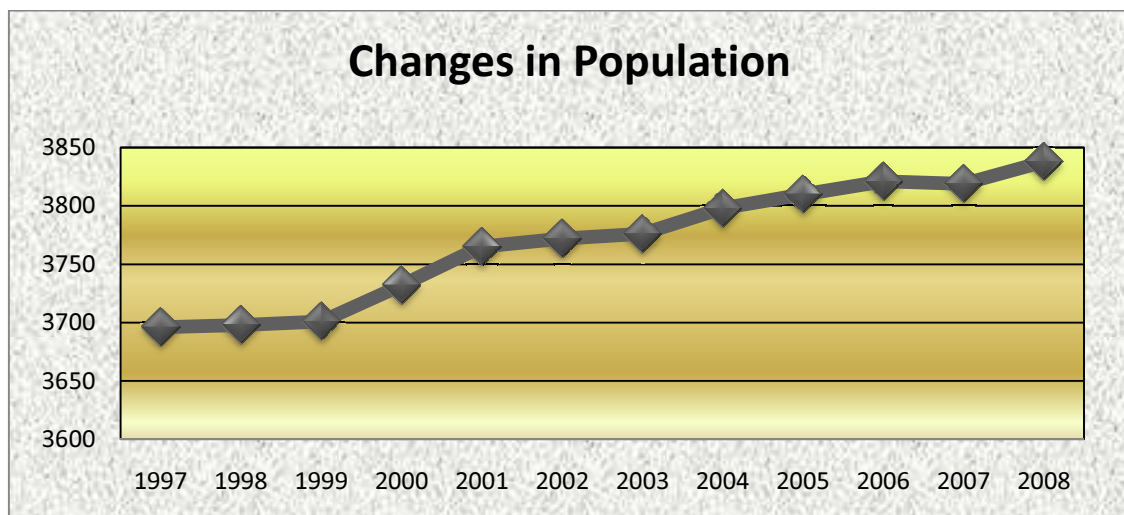
**Picture 1** *Napkor on the map*  
Source: [www.napkor.hu](http://www.napkor.hu) 2011



Although unemployment is lightened by the seasonal work coming from the agricultural characteristic of the settlement, it, of course, does not motivate the youngsters to stay in the settlement as they lack the conditions of employment because of the structure of the agricultural production. Cultivation includes, besides corn and cereals, production of intensive vegetables, tobacco and potato, and nursing the traditional apple, sour cherry and peach plantations. Also, there are acacia and pine forests in the surroundings.

By today the former, separated parts of the village have met thus forming the typical, stretched structure of settlement.

The hills are area-forming, geographical factors. The soil was formed by the sand carried and then deposited by the wind and it declines to the direction of S-N. Its flora and fauna are characterized by the generally spread species. There are many foxes, hares, roaders, boars and pheasants. According to geo-botany, it belongs to the Pannonia Flora Territory Plain Flora District Great Hungarian Plain Flora.



**Diagram 1:** *Changes in population*  
 Source: Napkor Mayor's Office, 2009

In the last 10 years the rate of birth decreased to 40-45 children a year, however, the death rate is much higher, the growth in population is due to the immigration (Figure 1). Thus, the natural increase and loss, and the immigration difference is still of positive value. The majority of population is Hungarian but there are people in small number who belong to the Romanian and Ukrainian minority groups, too (Table 1).

Ethnicity	Hungarian	90.81%
	Romanian	0.2%
	Ukrainian	0.2%
	Gipsy	6.09%
	Did not answer	2.7%

**Table 1:** *Ethnic groups*  
 Source: Napkor Mayor's Office, 200

A settlement's economy is considerably influenced by the qualifications of people living there. In Napkor, 6,8% of the population do not have any qualifications. 16,2% finished primary school (8 grades). The proportion of those who have passed the school-leaving examination is small: 15,2%. 7% of the population has a degree which hardly differs from the county average. However, illiteracy is very rare in the older generation. The others learn trades in training centers.

The economy of Napkor is under development. According to the data from 2009, 28 economic companies and 176 private ventures carry out activities based on agriculture. The number of primary producers is 1128. 256 people are employed locally, and 1513 people commute to other settlements, mainly to the county capital to work. The employment is shown in the following table (Table 2):

<b>Employment</b>	Employed (person)	1769
Employment (in case of people of working age)	Registered unemployed	282
	Out of which: long-term unemployed	70
	Number of active employees	1180
	People who regularly live on social benefits	63
	People who get annuity from the local government	98
	Total number of people of working age	2267

**Table 2:** Employment on the basis of data from January, 2009  
 Source: Local Government of Napkor, the social administrator

There are 1320 houses in the settlement which is a relatively high number regarding the population.

As we have mentioned earlier, Napkor is connected to the main road 41. The motorway M3 is close to the village. The settlement has a railway station, too.

There are 32 streets in the village. Most of them are covered with asphalt. The length of road network is about 25 km the half of which is built up. The length of roads in the outskirts is 15 km out of which 1 km is built up. The number of streets can be considered appropriate but there is something to be sad against their quality.

By entering the European Union the region has been slightly revaluated from economical viewpoint, mainly from the logistic aspect. Although these effects cannot be experienced in the settlement, with development of transportation and communication infrastructure, there is a hope for economic development of both the region and the settlement in the future.

The settlement is improved with every public utility, with the exception of sewerage the construction of which is an important task for the forthcoming years. The possibility for selective waste management is under process. Drinking water supply is suitable. The length of water-mains is 25 km, 99% of the houses are connected to the system. Construction of gas-mains is relatively completed which is important from the viewpoint of air pollution. The length of electricity network is 25 km.

Possibilities for communication in the village (Table 3)

Possibility	Yes	In progress
Tele-house	x	
Cable TV		x
Internet access	x	
<b>Type of Internet access</b>		
By phone	x	
Cable network		x
Microwave-connection	x	

**Table 3:** Communication possibilities in the village  
 Source: Data from the Mayor's Office

In the village there are two GP surgeries, and also a district nurse service. The hospital is in the county seat.

Approximately 400 students learn at Josika Miklos Primary School. There are 24 classrooms in the school. 27 qualified teachers work here.

In 1992 the Association of Forest Owners in Napkor opened a new prospective in the village life establishing the basis of private forest owners and hunting. The Association established the Forest School of Harangod which aims to let its visitors get to know the people living here, the forest and its flora and fauna. Besides the educative function, it has a role of public welfare since it works as a hunting lodge, and it intends to serve as an example for the sustainable regional development. The forest school expects classes from primary and secondary schools with colorful spring, autumn and winter programs. The purpose of these programs is the active acquisition of knowledge; children can learn the norms and rules of behavior in natural environment.

The Culture House, Library and Village House are being modernized according to the expectations of our times by the local government by means of financial applications.

It is indispensable to analyze the position of the village to be able to aim at the possibilities of rural tourism, concentrating on the new elements which determine the future.

### **A STEP TOWARDS FUTURE: THE REGIONAL DEVELOPMENT OF THE VILLAGE AND CHANGES IN TOURISM**

Among the basic principles of LEADER regional development modernity, novelty and innovation have an important position. They can open new bounds in regional development in which the local participants can create strategies, generate projects which have been ignored so far by the attention of central decision makers. The village Napkor joined the program in 2008. It is important to emphasize that it is not the technical innovation which is a determinant factor in connection with LEADER. They do not expect completely new technologies, scientific results due to the position of countryside and its conditions (low density of population, the quality of human capacity, lack of knowledge centers), though they are not really excluded. In case of regional development novelty can be manifested in a new subject, a new relation or cooperation, as well. With it, it is possible to find solutions for programs important, primarily, for the local population.

However, they can be determinant not only in the given small region but they can expand to wider territorial units, too. For example, building a refuse dump together, implementation of sewage disposal or investments, developments, creative ideas realized by means of applications, tenders. They all have contributed to improve the level of programs so far. It can be closely related to the tourism in Napkor.

In case of village truism the LEADER Program is exclusively limited to large-scale programs, events. Being a middle-sized village, earlier only 8 thousand people were interested in the slaughterers' competition, today the number of visitors is over 40 thousand. From year to year the participating teams are organized by friends, colleagues from different companies and settlements.

The Napkor Trophy Cup is a novelty in the line of events. That is why both the number of participants and visitors is high. Perhaps, it is due to the fact that youngsters are getting more and more quad maniac. With the improvement of life standards this sport has become accessible.

In Festivals of Military Engineering Technology means of military engineering technology of the past and present are on display. It was primarily preferred by fathers with sons.

Competition of Camp Patrols serves to establish friendly relations with those who love sports.

Days of Acacia Blooming, of Nyírség Flavors and Honey attract more and more visitors from year to year. Every year several settlements of Szabolcs participate in it where typical local dishes and honey produced by the local bee-keepers are offered to taste and buy.

Every year the villagers organize the hunters' and kindergarten balls of May, Day of Elisabeth and Day of Catherine. The earliest one is the ball of the Foundation of Elementary School.

It is the eighth time that they organize the tradition-preserving wine competition. This year 37 farmers from Napkor with 50 wine samples entered the competition.

In 1992 the Association of Forest Owners in Napkor was established with 86 members aiming to unite the forests owned by the members and thus to manage them more professionally and more efficiently.

In 1997 the Hunting Co-operative obtained the right to hunt around the settlements Napkor, Apagy, Nagykálló, Semlyén, Sényő and Nyírtura. The growing stock of game preserves attracts hunters from the USA, from the Arabian countries, France, Spain, Germany and Austria. Once even, the Spanish king was welcome here. The hunter tourism is a big attracting force for the village.

Application at present and under progress can be seen in Table 4.

Number	Object of public procurement	Type	Estimated value
1.	Renovation of the Old People Home	Building investment	27991000HUF
2.	Enlargement, renovation of the school building, attachment of an assembly hall to it	Building investment	12420000HUF
3.	Park, play ground	Building investment	17215000HUF
4.	Renovation of the Village House	Building investment	48000000HUF
5.	Building, improvement of roads, draining off the rainwater	Building investment	17000000HUF

Table 4. Applications under progress 2009  
 Source: <http://www.napkor.hu/hirdetotabla/palyazatok>

By means of SWOT-analysis (Figure 2) it is possible to formulate easily the priorities which are in the real interest of the village. They pay attention to avoid threats the most efficiently; their actions are directed to neutralize the weaknesses, to utilize the strengths and possibilities in the most efficient way. Their importance lies in that they initiate a chain reaction in the field of development, so they can generate newer and newer elements of development and can start more positive processes. In case of initiated or operating elements it is necessary to think them over and over again, to check and analyze them. It is indispensable to actualize the purposes and programs of development. (Napkor Község Fejlesztési Archívuma, 2010)

The settlement needs considerable resources in order to perform its duties, realize its aims. Most of the local governments cannot execute them from their own sources, their budget restricts them to realize their aims. Different opportunities for applications put up by Hungary or the Union serve the goal that lack of sources cannot hinder development. Regarding EU-applications, partnerships are of great importance in performing duties. They serve the aim that the given projects can be accepted in a wider community, so they can be based on a bigger layer of society. A good example for this is the Sewage Disposal Program in County Szabolcs-Szatmár-Bereg in which a greater emphasis is put on the drainage of the settlement. They can increase their chances in application with it. These common projects are useful not only because of the available resources but also the partners can get to know each other's viewpoints while preparing and discussing them. In an ideal case they can agree on setting the aims which serve the interests of a wider or narrower community and thus they can elaborate a common program of action.

The developed regions of the country have a good infrastructure while in case of peripheral regions which are far from Budapest it is the serious factor which hinders development. A special problem is that it is difficult to get to places by coach where there is a possibility of work (in bigger cities). Development of the road network implies such big expenses that cannot be provided in the settlements involved without central subsidies.

<b>Strengths</b> Internal and positive conditions, circumstances		<b>Weaknesses</b> Internal and negative conditions, circumstances		<b>Possibilities</b> External and positive conditions and circumstances		<b>Threats</b> External and negative conditions and circumstances				
<b>Politics, geographical position</b>	- favorable geographical position, close to the county seat, Nyíregyháza (three borders are close, too)		- there is not enough capital to build bicycle roads - there is less need to study because of the lack of workplaces		- regarding the wider environs of the settlement, the motorway and the highway 41, as axis of development, can have a developing effect, since they are very close and they also imply the possibility of transit traffic - to keep connections with the First Development Society of Nyírség		- because of the vicinity of Nyíregyháza, there is a possibility to become a sleeping settlement - the village is connected to the neighboring towns by bicycle roads			
	<b>Population, human resources</b>	- in the last few years the immigration balance became positive, immigration increased - living communication between ventures, the school and the job centre		- the young professionals leave the settlement - the immigration gain covers the fact that the older generation return back to the village. It increases the aging process. - low qualification of labor force - different living standards between the ethnic groups		- to strengthen the identity of the youngsters - positive difference in immigration: the number of people who move into the settlement is growing - the possibility to study at higher education is ensured in the region - cheap labor force: a great number of public workers and day-laborers		- they did not manage to stop migration of young professionals - they did not manage to retrain the labor force supply in a modern structure - unemployed career-starters		
		<b>Infrastructure</b>	- suitable infrastructure of public utilities. Building of the sewage system is under progress. - suitable transport possibilities, the vicinity of the highway 41, railway, public transport possibilities - vicinity of the motorway M3 and the bypass road of Nyíregyháza		- the road network of the settlement is old, in certain smaller streets it is incomplete - the pavements are aged, lack of bicycle roads, bicycle lanes - low number of public parks - the complete sewage is unsolved, placement of the communal waste is disturbing		- there are potential areas in the inner-village area in order to form parks or office buildings - the accessibility of the village can be improved by building the planned bicycle roads - vicinity of the county seat		- the economic areas are still not utilized – there is no sewage system built - use of broadband Internet has not been expanded completely	
			<b>Economy, economic</b>	- manufacture of products of good quality - positive touristic conditions: vicinity of 'sights' in county Szabolcs-Szatmár-Bereg, hunting possibilities, accommodation - programs of country or county level to improve village tourism		- the capital attractive force of the settlement is small - the sector of entertainment and services is less developed - immigration of well-qualified young generation is significant - industrial branches of innovation and development do not represent themselves in the village		- Formation of village tourism: tradition-preserving programs, events, festivals - keeping the more qualified young generation at place can have a pulling effect on regional development		- emigration of young professionals, specialists - improvement of the ability to attract capital has not been successful so far - the economy is narrowing down

**Figure 2: SWOT-analysis**  
 Source: data from the Mayor's Office

Development towards information society is going on in conditions where the social-economic processes exceed the framework of states and force the states to integrate both in continental and global level. In our region it is the European integration which determines the possibilities and speed of going on the way of development. With this present essay we aimed to show the position of Napkor in the way of globalization which forces the

companies, institutions, towns, settlements, regions to cooperate. Reliance on local factors, among the priorities of territorial policy, will appear with a bigger emphasis in Hungary, too.

## **CONCLUSIONS**

The village of Napkor has favorable conditions from several viewpoints. The settlement is developing from the aspects of economy, society and infrastructure. This village is an excellent example for realization of regional development and village tourism. However, it can be seen from the example of the settlement that there are application sources to perform most of the duties of local government provided the projects are planned professionally, based on real needs and the necessary financial resources are available.

As investments and developments, creative executions from application resources have contributed to increase the standards of programs, they are in close connection with the village tourism, as well. The people involved strive to give information about the possibilities for a wider public. The emphasized fields will be development of infrastructure, transport and green economy which is a step towards future. (Új Széchenyi Terv célja..., 2011)

## **BIBLIOGRAPHY**

- SZOBOSZLAI ZSOLT (1993): Javaslatok a Társadalmi innováció és a Közép-Tisza vidékén című kutatáshoz, kézirat, Szolnok
- TÓTH ERIKA (2009): Napkor község vidékfejlesztési és falusi turizmusának alakulása, kézirat, Szeged
- SZ.N. Folyamatban lévő pályázatok (2009), <http://www.napkor.hu/hirdetotabla/palyzatok> hirdetőtábla, pályázatok
- SZ.N. Új Széchenyi Terv célja, hogy talpra állítsa a magyar gazdaságot, beindítsa a növekedést, Délvilág, 2011.01.15. p.2
- SZ.N. Napkor Község Fejlesztési Archívuma (2010), kéziratok, Napkor

## **STATISTICAL OVERVIEW OF EMPLOYMENT BY ECONOMIC ACTIVITY AND PROFESSIONAL STATUS IN EU**

**OLÁH JUDIT - PAKURÁR MIKLÓS**

University of Debrecen Centre for Agricultural and Applied Economic Sciences  
Faculty of Applied Economics and Rural Development  
Institute of Management and Organisation  
4032 Debrecen, Böszörményi Street 138.  
[olahjudit@agr.unideb.hu](mailto:olahjudit@agr.unideb.hu)-[pakurar@agr.unideb.hu](mailto:pakurar@agr.unideb.hu)

### **ABSTRACT – Statistical overview of employment activity and professional status in EU 27**

RuralJobs is a collaborative research project partly funded under the European Commission Research and Development 7<sup>th</sup> Framework Program (FP7). It involves partner institutions from eight Member States. University of Debrecen is the coordinator. RuralJobs quantifies labour market, demographic and economic trends, and the impact of employment creation measures and policies in six, representative “reference areas” across the EU, and uses the information to demonstrate how rural development measures can be better targeted and how rural development policies should evolve. The Eurostat database was chosen as the main source of information for statistical analysis. Taking into account rurality the regions were divided into three groups: predominantly urban regions (PU), intermediate regions (IR) and predominantly rural regions (PR). Knowing the employment characteristics in EU regions contribute to common understanding of the processes on the labour market that is the basis of the formulation of new, efficient strategies of employment. Tendencies of employment by economic activity and profession features are analysed to initiate suggestions of employment development.

**Keywords: employment, self-employment, family worker, age group, sector**

## **INTRODUCTION**

There are many preconditions of employment development. Labour market mobility was greatly related to institutional developments in Great Britain for two decades previous to 2002 nevertheless employment had been increasingly tied to economic development (HILLMERT, 2002). Studying the regions of the EU to compare the employment of economically advanced and underdeveloped areas similar conclusion can be drawn since prosperous regions have higher employment status than economically stranded areas.

FALZONE (2000) states part time employment as a transition between non-employment and full-time employment or as an alternative to full employment. Part time employment can be a viable solution for married women with young children to build a carrier and to be a devoted family member.

Women’s employment is becoming growingly important the reason is not only to reach the desirable equal work – equal payment idea but there are many practical issues as well that force females to be employed. HOLST AND SCHUPP (2001) found that employment of women in Germany has become more important recently because of more single-person households and high divorce rates. Even in married-couple households women’s earning is a significant part of the family budget in many German families. It was difficult for women



to get a job in the well developed Western regions but the situation was “persistently precarious” for women of economically less developed Eastern regions.

Part time employment can be a necessity for many groups of people who can not undertake full employment. In the USA APPELBAUM (2003) diagnosed the following reasons to have a part time job: to create balance between work and personal life, young couples can not leave on one income, baby-boomers responsibility for young children and ageing parents, and increased investment for retirement. According to the study increasing number of American people wants work in good-quality part-time jobs. Appelbaum criticises the lack of public policies that back up high-quality, part-time employment and the existing situation where part time employees depend on the goodwill of the employer and in reality part time employees are in a much worse position than their full time associates.

Many research results have established that employment pattern is changing through age groups and gender. Employment rates of youth and elderly are lower than the employment rate of prime-aged people. Employment rate of prime-aged women is generally lower than employment rate of prime-aged men. Examining labour market institutions and demographic employment patterns using data from 17 OECD countries BERTOLA ET AL. (2007) found that the above mentioned labour market pattern was affected by unionization. They stated that unionization increased the differences in employment ratios amongst the age groups and between men and women.

In many European countries subsidised employment is a mean to increase the number of working population however exact researches to investigate the results of this kind of programmes are rare. In the Netherlands subsidised employment programmes were highly promoted by the policy in the decade of pre-2003. According to the research of JONGEN ET AL. (2003) employment subsidies made a little positive effect on the employment in the private sector and a more positive effect on the employment in the public sector increasing the employment in both sectors. However because the big number of regular employment leavers, overall employment decreased. The research team remarked that the effect of employment subsidies on aggregate and individual level can be quite different and the fast growing expenditures on employment subsidies necessitate the promotion of empirical researches of this area.

A specific type of employment is the Australian causal employment where the employee receives a significantly higher income than a permanent full time employee but causal workers lack the benefits. This type of employment is often a transition stage between unemployment and permanent full-time employment and it is a flexible form of employment. Despite the advantages various sources of insecurities are involved in the causal employment system that should be reduced (BURGESS ET AL. 2008).

In rural areas small businesses may be a plausible solution of employment growth. Taking samples of more than 2000 counties in the USA SHAFFER (2006) established that the smaller the average size of a business the faster the growth rate of sectoral employment. Because of the significance of small businesses on the economy understanding the way how small businesses affect labour market in a region can be an important step toward job creation.

MASI ET AL. (2003) conducted a research in a low income community searching the efficiency of Internet training educating people to acquire health information via home internet. They proved that group members receiving Internet training changed their attitudes toward the Internet technology and their affinity to used Internet increased significantly. The research suggests that short course courses are good tools to increase interest in IT in people who have not used Internet.

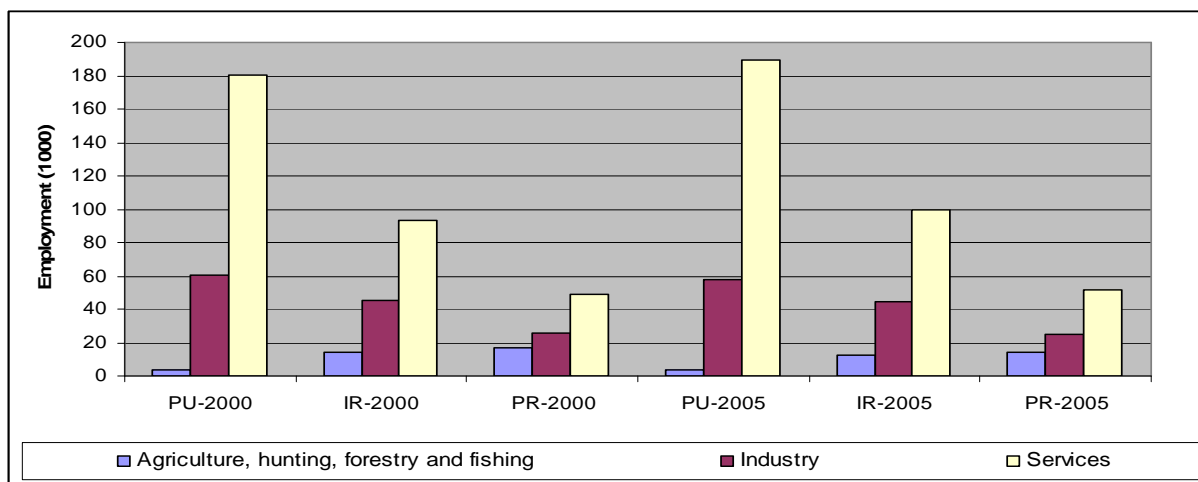
## METHODOLOGY

The Eurostat database was chosen as the main source of information for statistical analysis. When the data base was selected the following considerations were important: availability of data for all the EU 27 countries on national and regional (NUTS2 and NUTS3) level. The examined time period was from 2000 to 2006, the end was determined by the availability of data on the Eurostat database. Tendencies were evaluated by comparing the data of the first year and the last year of the examined period. Taking into account rurality the regions were divided into three groups: predominantly urban regions (PU), intermediate regions (IR) and predominantly rural regions (PR). The categorisation of rurality based on the methodology of the Organisation for Economic Co-operation and Development which method uses population density as the criteria of rurality.

## RESULTS

The aim of the EU is to employ each EU citizen who would like to participate in the labour market and to reach the 70% percent employment rate by 2010. Knowing the employment characteristics in EU regions contribute to common understanding of the processes on the work market that is the basis of the formulation of new, efficient strategies of employment.

**Table 1 Total Employment, EU 27, at NUTS levels 3, average of PU, IR and PR regions**

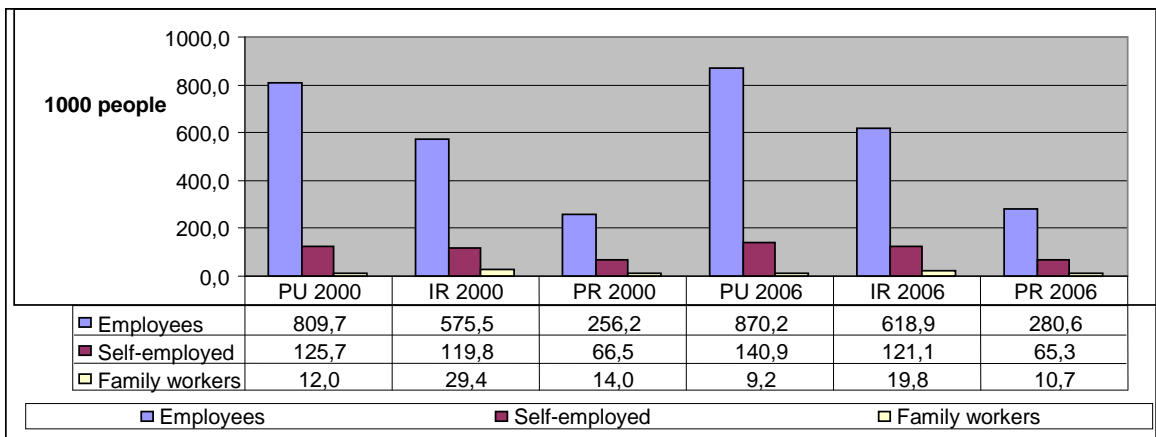


Source: Eurostat General and regional statistics, 2000, 2005

Employment in agriculture, hunting, forestry and fishing was the lowest in PU regions, more people was employed in IR regions and the higher number of inhabitants was employed in PR regions in the EU (Table 1). Employment in the industry and services showed an opposite tendency than employment in agriculture, hunting, forestry and fishing since the most people were employed in PU regions and the smallest number of employees worked in PR regions. The structure of economic activity was different in an average PU, IR and PR region. Comparing the ratio of employment in services, in agriculture, hunting,

forestry and fishing and in industry it was found that the ratio of people employed in services PU or IR regions was significantly higher than it was in PR regions. This huge difference in employment in services suggests that rural people’s access to various services is very limited in comparison with the possibilities of inhabitants in PU and IR areas which is an important disadvantage of the rural life. Enhanced service activities may directly increase the employment and may provide a more attractive situation in rural regions  
 In the Eurostat general and regional database, in the section of employment by professional status, the employment is equal with the sum of employees, self-employed and family workers.

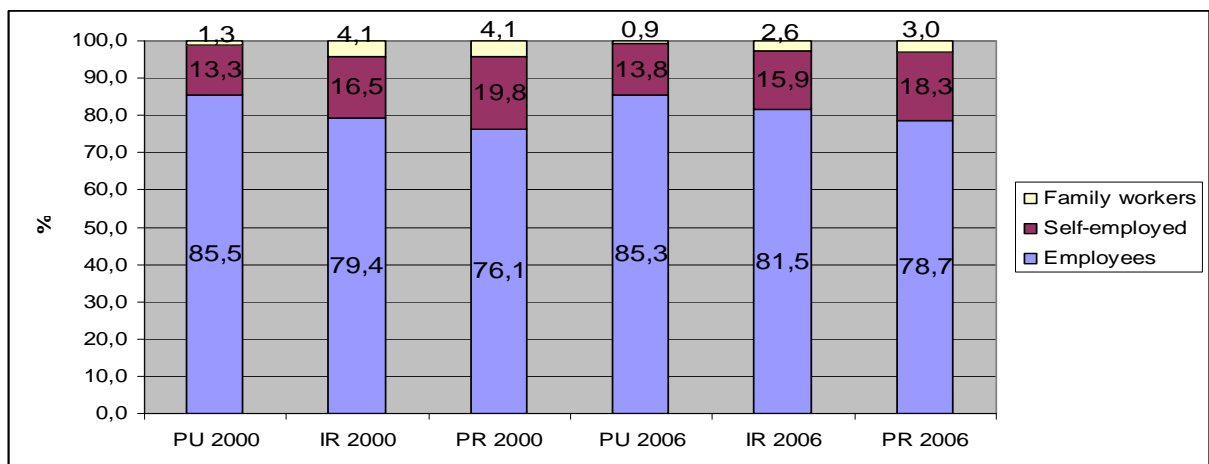
**Table 2 Employment by professional status NUTS 2 (1000)**



Source: Eurostat General and regional statistics, 2000, 2006

Analysing the employment by professional status it can be seen that the decisive part of people worked as employees and far more people were self-employed and the number of family members was significantly the lowest (*Table 2*).

**Table 3 Employment by professional status NUTS 2, 2006**



Source: Eurostat General and regional statistics, 2000, 2006

The structure of employment was different in urban and rural areas of the EU (*Table 3*). The ratio of employees was the highest in PU regions (85.29%) and the lowest in PR regions (78.70%) in 2006. The ratio of self-employed people and family workers showed an opposite tendency with low ratios in urban and higher ratios in rural areas. The rate of family workers was about three times more in IR and PR regions than in PU regions.

**Table 4 Employment by professional status NUTS 2 (%), 2000-2006**

Professional status	2000-2006		
	%		
	PU	IR	PR
<b>Employees</b>	7.47	7.55	9.49
<b>Self-employed</b>	12.05	1.08	-1.84
<b>Family workers</b>	-23.64	-32.59	-23.66

Source: Eurostat General and regional statistics, 2000, 2006

The number of employees increased notably in PU (7.47%), IR (7.55%) and in PR (9.49%) regions from 2000 to 2006 (*Table 4*). The development of self-employment was intensive in PU regions (12.05%) however small changes were experienced in IR (1.08%) and in PR (-1.84%). The low number of family workers diminished greatly in each region type (23.64%-32.59%).

**Table 5 Employment by highest level of education attained NUTS2 (1000) between 25 and 64 years, 2000-2006**

Between 25 and 64 years	PU	IR	PR
<b>Pre-primary, primary and lower secondary level</b>	8,17	0,77	-9,81
<b>Upper secondary and post-secondary non-tertiary education - level</b>	9,51	10,68	11,22
<b>Tertiary education level</b>	25,54	27,16	32,55

Source: Eurostat General and regional statistics, 2000, 2006

The level of education increased generally from 2000 to 2006 since the ratio of employees with tertiary education grew most intensively in PU, IR, and PR regions by 25.54-32.55%, the ratio of employees with upper secondary and post-secondary non-tertiary education improved less intensively by 9.51-11.22%, and the ratio of employees with Pre-primary, primary and lower secondary education increased by 8.17%, in PU regions, by 0.77% in IR regions and decreased by 9.81% in PR regions (*Table 5*). The most significant improvement in the level of education was found in predominantly rural areas which indicates that the demand increased for the people with higher education in rural regions.

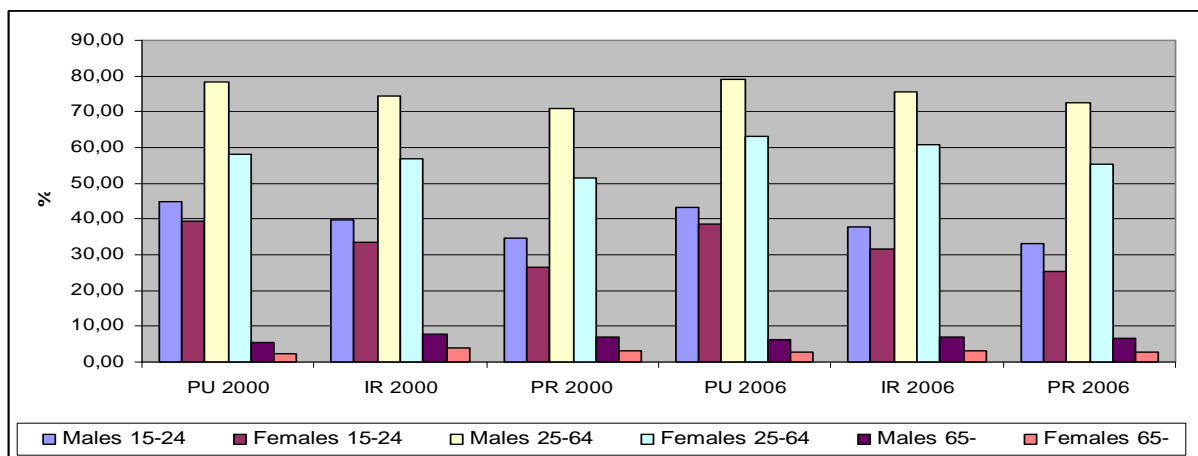
**Table 6 Employment rates by age, at NUTS 2 (%)**

Age groups	PU	IR	PR
	%		
Between 15 and 24 years	-2,69	-5,48	-3,54
25 - 64	4,21	3,67	4,67
65 years and over	20,92	-14,21	-7,25

Source: Eurostat General and regional statistics, 2000, 2006

The employment rates of age group of 25-64 increased in all region types from 3.67% (IR) to 4.67% (PR) (Table 6). The employment rate of the age group of 15-24 was lower than the employment rate of the age group of 25-64 in 2000 the gap between the two groups increased during the examined time period. The employment rates of the oldest age group decreased also in IR (14.21%) and PR (7.25%) regions but it increased notably by 20.92% in PU regions.

**Table 7 Employment rates by sex and age NUTS 2 (%)**



Source: Eurostat General and regional statistics, 2000, 2006

The order of employment rates by age groups was similar in both genders (Table 7). The lowest employment rates were in the age group of 65 and over and the highest employment rates were in age group of 25-64. The employment rates of both genders were higher in urban areas than rural areas in the decisive age groups of 15-24 and 25-64. Employment pattern is changing through age groups and gender. Employment rates of youth and elderly are lower than the employment rate of prime-aged people.

## CONCLUSIONS

Economic development affects the employment level in many ways. In geographically less favourable areas parents invests less in the education of their children that results in a less educated population of these regions that increases the gap between developed and

underdeveloped areas. The most significant improvement in the level of education was found in predominantly rural areas which indicate that the demand increased for the people with higher education in rural regions. Employment needs of the working age population differ greatly depending on the status of the person. European regions face the consequences of rapid and unequal development of the service sector. Further decrease of employment in agriculture changes rapidly the structure of employment in rural areas. Employment in agriculture, hunting, forestry and fishing decreased greatly in PU, IR and PR regions of the EU the most significant decline happened in PR regions.

## REFERENCES

- APPELBAUM, E. (2003): Company Practices: A Barrier to Good-quality Part-time Employment in the U.S. *Economic Bulletin*, Volume 40, Number 10 / October, p. 333-340
- BERTOLA, G., BLAU, F. D. AND KAHN, L. M. (2007): Labor market institutions and demographic employment patterns *Journal of Population Economics*, Volume 20, Number 4 / October, p. 833-867
- BURGESS, J., CAMPBELL, I. AND MAY, R. (2008): Pathways from Casual Employment to Economic Security: the Australian Experience *Social Indicators Research*, Volume 88, Number 1 / August, p. 161-178
- FALZONE, J. S. (2000): Labor market decisions of married women: With emphasis on part-time employment *International Advances in Economic Research*, Volume 6, Number 4 / November, p. 662-671
- HOLST, E. AND SCHUPP, J. (2001): Employment Behavior Among Women in Germany: Differences between East and West Persist *Economic Bulletin*, Volume 38, Number 11 / November, p. 377-384
- Hillmert, S. (2002): Deregulation of the labor market and chances of employment in Great Britain , *International Advances in Economic Research*, Volume 8, Number 1 / February, p.1-9
- JONGEN E.L.W., VAN GAMEREN, E. AND GRAAFLAND, J. J. (2003): Exploring the Macroeconomic Impact of Subsidized Employment *De Economist*, Volume 151, Number 1 / March, p. 81-118
- MASI, C. M., SUAREZ-BALCAZAR, Y., CASSEY, M. Z., KINNEY, L. AND PIOTROWSKI, Z. H. (2003): Internet access and empowerment , A community-based health initiative *Journal of General Internal Medicine*, Volume 18, Number 7 / July, p. 525-530
- SHAFFER, S. (2006): Establishment Size and Local Employment Growth *Small Business Economics*, Volume 26, Number 5 / June, p. 439-454

## **THE FACTORS OF COMPETITIVENESS OF HUNGARIAN BEEF CATTLE SECTOR**

**MÉSZÁROS KORNÉLIA, TÖRÓNÉ-DUNAY ANNA, ILLÉS B. CSABA PHD.**

Szent István University  
H-2100 Gödöllő Páter K. u 1., Hungary  
meszaros.kornelia@gtk.szie.hu, dunay.anna@gtk.szie.hu, illes.b.csaba@gtk.szie.hu

### **Abstract- The factors of competitiveness of Hungarian beef cattle sector**

This paper analyses the position of the Hungarian beef cattle sector by using secondary data and determines the factors, which may influence profitability. The analysis includes the impacts of the recent and the present market processes, as well. The paper examines the beef cattle sector in economic and ecological aspects of sustainability, as these factors play an increasingly important role in the market.

The beef cattle sector was analysed in the following three aspects:

- role in food production,
- profitability, and
- sustainability in economic and environmental aspects.

**Key words:** beef cattle sector, income production, sustainability

## **THE ROLE OF THE BEEF CATTLE SECTOR IN FOOD PRODUCTION**

Animal husbandry plays an important role in food production. After the political and economic changes in the beginning of the 1990ies, a significant decrease occurred in the Hungarian animal husbandry sector (Table 1), which was generated by the loss of the former eastern markets and the reduction of the effective demand.

**Table 1: Changes of the number of animals in 1000 heads (1985-2009)**

	<b>1985</b>	<b>1990</b>	<b>1995</b>	<b>2000</b>	<b>2005</b>	<b>2009</b>
<b>Cattle</b>	1766	1571	928	805	708	700
<b>Pig</b>	8280	8000	5032	4834	3853	3247
<b>Poultry</b>	38 376	31 121	27 549	19 422	22 968	18 907

Source: KSH, 2010

The quantity of the domestic meat consumption – similar to the number of animals – shows also a decreasing tendency (Table 2.). The beef consumption has been decreased to the one third, while the pork consumption to half quantity compared to the beginning of the examined period. The poultry consumption has been increased until 2000, and since then it has been reduced. Total meat consumption shows also a declining tendency in the examined period, except for the peak in 2000, which was followed by a significant decrease, below the former minimum level of consumption.

**Table 2: Meat consumption in Hungary (kg/person) (1985-2009)**

	<b>1985</b>	<b>1990</b>	<b>1995</b>	<b>2000</b>	<b>2005</b>	<b>2009</b>
<b>Beef</b>	8,7	6,5	6,8	4,3	3,1	2,6
<b>Pig meat</b>	43,1	38,8	27,1	28,0	26,7	27,2
<b>Poultry meat</b>	20,8	22,8	24,0	33,7	29,7	27,9
<b>Total meat consumption</b>	76,9	73,1	62,5	70,2	63,5	61,9

Source: KSH, 2010

The capacity of the eastern markets has been ceased by the political changes, but new EU markets have been opened. As a result of the BSE epidemic in 1996, the number of beef cattle was reduced by 1,9 million heads in the EU-15 member states, which made a 5% decrease of beef production. Forecasts say an additional 5% decrease of beef output up to 2014 (Table 3), therefore the internal consumption of the EU should be covered by increasing level of meat import (TÓTH, 2007).

**Table 3: The beef consumption in the EU**

	2005	2007	2010	2014
<b>Total consumption</b> (1000 t)	8445	8424	8310	8232
<b>Consumption</b> (kg/person)	17,3	17,1	16,8	16,6

Source: Tóth, 2007

Nearly 60% of the EU beef production is originated from the dairy sector as secondary product. In Hungary, this proportion is higher, that can be one of the reasons of the low domestic beef consumption. Due to the high beef prices and the low beef consumption habits the market of domestic consumers will probably not increase in the near future (POPP-POTORI, 2009; BUZÁS-SZABÓ, 2009).

The number of beef cattle in Hungary – similar to the EU – shows a declining tendency. The domestic beef consumption is very low; therefore a high proportion of the Hungarian beef production is to be exported. The export of live animals is the most significant proportion of beef export (Table 4), which produces less income, than the export of processed meat products. The most important destinations of beef cattle export was Greece and Austria in 2008. The export prices have been raised by 8% while domestic prices by only 4%; thus, the export of live cattle has grown further. The destinations of frozen beef are Italy, Romania and Denmark. (POPP-POTORI, 2009)

**Table 4: Hungarian beef export (2003-2008)**

Product	Export (net weight in 1000 kg)					
	2003	2004	2005	2006	2007	2008
<b>Live cattle</b>	15 169,5	18 789,0	22 210,2	27 029,0	31 350,1	32 936,2
<b>Fresh or iced beef</b>	7 526,5	9 959,3	8 959,3	8 507,8	10 056,6	12 770,2
<b>Frozen beef</b>	2 644,1	2 653,0	1 517,0	1 042,5	1 484,3	2 997,0
<b>Total beef export</b>	40 509,7	50 190,3	54 440,0	62 135,4	73 082,9	80 359,5

Source: KSH, 2010

Since the healthy nutrition methods have become more popular, the importance of food products from ecological farming systems has grown all over the world. The ecological animal husbandry is connected to extensive farming methods. As a result of the use of ecological farming methods, the importance of the old traditional Hungarian breeds has grown. Only 10% of the domestic beef cattle stock was certified as bio product in 2001 and nearly the total of the ecological production was exported (BODA, 2001). The need for ecological beef cattle products shows an increasing tendency (MÁRAI, 2008).



## PROFITABILITY OF THE BEEF CATTLE SECTOR

Enterprises of the beef cattle sector are generally operated with low profitability. The main revenues of the sector are derived from the production value of slaughtered animals. The price of slaughtered animals has increased between 2004 and 2006 (Table 5); the cost of production of live weight has also increased, while the gross margin – in contrast with the 2003 data – was positive in this period.

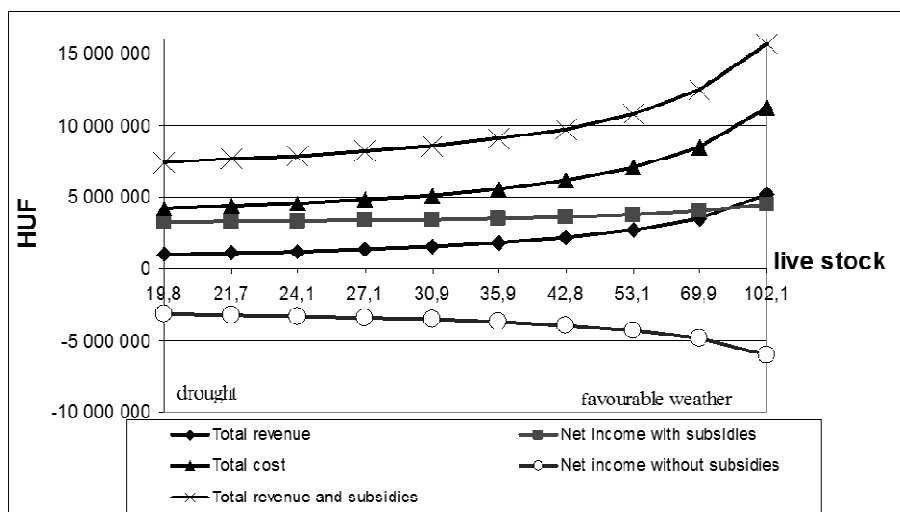
**Table 5. Producer prices of beef according to carcass types (SEUROP), costs of live weight production and gross margin values (2004-2006)**

HUF/kg	2004	2005	2006
<b>Average R class</b>	488,52	625,78	629,04
<b>Average O class</b>	470,23	588,42	622,24
<b>Average P class</b>	462,43	586,01	616,28
<b>Average of E-P</b>	472,37	602,02	623,78
<b>Live weight own cost</b>	364,55	367,40	371,98
<b>Gross margin</b>	49,98	101,32	98,58

Source: Own construction by AKI PAIR (2010) and BÉLÁDI-KERTÉSZ (2006, 2007)

The most important influencing factor of profitability in the beef cattle sector is daily growth, which is mostly determined by feeding methods. The higher the daily growth, the lower the prorated cost of fattening, as the fattening period is shortened; although the price of compound feeding stuffs exceeds the price of forages (BUZÁS-SZABÓ, 2009). Profitability is nearly impossible without subsidies under the present economical circumstances. The financial contributions (such as different premia and headage payments) have been general in the EU for a long time. The extensive (grazing) animal husbandry methods play an important role in landscape protection and rural development and also in developing the retention of rural communities, which makes a reasonable theoretical base of the different supports (STEFLE, 2002).

The Hungarian beef cattle sector is not viable without the EU or national (top-up) subsidies because a great proportion of the farms is not able to produce enough income to cover the production costs, even in ideal climatic circumstances. This situation is illustrated in Fig. 1, which is adapted from a previous study that examined the cattle keeping capacity of 100 ha land in case of drought (the yearly rainfall is less than 500 mm) and under favourable weather conditions. As it is shown in Fig. 1, the total revenue without subsidies cannot cover the total costs. The net income is neither increase even under favourable weather conditions.



**Figure 1. Animal keeping capacity of 100 ha grassland under different weather conditions**  
 Source: Mészáros (2010)

The different payments supporting beef cattle sector – financed by EU and national sources – and the related decrees are summarized in Table 6.

**Table 6: EU and national top-up payments in the beef cattle sector**

Payment	Amount (HUF/head)	No. of Decree
Suckler cow premium coupled to production	31 500	30/2006 (IV.12.) 82/2005 (IX.15.)
Suckler cow premium based on references	9350	29/2007 (IV.20.)
Extensification payment	17 050	42/2008 (IV.4.)

Source: own construction by Ministry of Agriculture and Rural Development decrees

Additional support may be claimed by the farmers for grasslands and pastures, in accordance with the regulations of the Ministry of Rural Development (the former Ministry of Agriculture and Rural Development). Compensatory payments may be applied for grasslands and pastures of unfavourable areas, areas under Natura 2000 protection and areas under agri-environmental schemes (extensive grassland management).

The financial supports of agricultural production are contributed by the European Agricultural Fund for Rural Development in the 2007-2013 financial and programming period. In Hungary the New Hungary Rural Development Programme (NHRDP) was prepared on the utilization of the financial support of the EAFRD, with the following main objectives: to establish a competitive and sustainable agriculture with viable farm structure and rational land use, to support diversification of enterprises and to improve marketing approach and knowledge level in agricultural production (MAGYAR MEZŐGAZDASÁG ÉS ÉLELMISZERIPAR SZÁMOKBAN, 2009).

## SUSTAINABILITY ECONOMIC AND ENVIRONMENTAL ASPECTS

Sustainable agricultural production – especially under the present economic and ecologic conditions – is an inevitable strategy for the future. Besides the animal keeping capacity of the land, which is determined even by weather circumstances, the environmental aspects should also be taken into consideration. These requirements may improve the spread of ecological farming technologies. In economical aspects, the production of – primarily extensive – species may be reasonable in such areas, which may produce lower income but at lower cost level. The grasslands of the Great Hungarian Plain have considerable natural and touristic values. These values may be endangered by the decrease of grazing and by the fragmentation of the pastures. The use of extensive production methods is common at areas with low production capacity (Fülöp, 2009). In Hungary, 72% of the total agricultural land is suitable for agricultural production, of which grassland and pastures represent only 13% (KSH, 2010).

The yield of grassland generally is not offered for direct sale, this output is mainly utilized by transformation in the animal husbandry sectors. In line with the decrease of the number of grazed animals, the deterioration of the grasslands has been started. The former grassland areas have been covered by weed and bush population. The additional inputs for increasing the yields, such as regular nutrients substitution, have been cancelled for financial reasons (SZÉLES, 2001).

In 2009 a study was prepared model calculations in order to examine the animal keeping capacity of the Hortobágy area under different weather conditions, based on the data of a certain farm (Fig. 2). In this study the decision criterion in the calculation of optimal livestock number was maximum income. In the calculations the grazed and harvested yield of grassland (160 ha) was taken into consideration both in drought and favourable weather conditions. The starting point of the examinations was that specific livestock number, which summer and winter fodder demand may be covered by grassland at both weather conditions, i.e. ecological animal keeping capacity. (MÉSZÁROS-LENCSEÉS, 2009).



**Figure 2. The income of extensive beef cattle production by different livestock number in different weather circumstances**

Source: MÉSZÁROS-LENCSEÉS (2009)

The minimum of the ecological animal keeping capacity of the examined grassland is that livestock number, which may be supplied by the winter hay production of the grassland in drought, while its maximum is the livestock number related to summer grass production yields under favourable weather conditions.

As a result of the examination of ecological animal keeping capacity it may be stated, that the net income is negative in the case of drought at any stock number even with subsidies. For this reason the used decision criterion (maximum of income) has been changed in such way that the loss of drought year should be covered by the positive income of the year with favourable weather. The maximum livestock number, where this condition could be realized, was 32 beef cattle. (MÉSZÁROS-LENCSES, 2009)

### SUMMARY

The Hungarian beef cattle sector will probably keep its export oriented role in the future. The domestic beef consumption has decreased in the past decades and this tendency is not expected to be altered, either by the change of consumers' behaviour or by the reduction of the prices. Nevertheless, the beef cattle sector has come into the front in the recent years in aspects of landscape protection. The traditional old Hungarian species may have greater importance in the future, as a result of the supported extensive methods based on the use of grasslands and pastures.

The producers of the beef cattle sector may apply for several supporting measures, financed both by EU and national financial sources; without this support the beef production would produce huge losses for the enterprises of the Hungarian beef cattle sector. This situation may be worsened by the implementation of the SPS system, particularly for beef producers without land. The solution could be to establish co-operation and to strengthen the vertical and horizontal integration; it would probably improve the deal position of the stakeholders of the beef cattle sector and also the profitability of the sector by producing processed products of higher added value.

### REFERENCES

- AGRÁRGAZDASÁGI KUTATÓ INTÉZET Piaci Árinformációs Rendszer (2010):  
<https://pair.aki.gov.hu/pair-public/general/home.do?lang=hu>. Letöltve: 2010. 10. 14.
- BÉLÁDI-KERTÉSZ (2006): A főbb mezőgazdasági ágazatok költség - és jövedelemhelyzete 2005-ben a tesztüzemek adatai alapján, 2006/7. szám 201.p.
- BÉLÁDI, KERTÉSZ(2007): A főbb mezőgazdasági ágazatok költség - és jövedelemhelyzete 2006-ban a tesztüzemek adatai alapján, 2007/7. szám 136.p.
- BODA M.(2001): Biomarha nem kergül. Biokultúra, 12. évf. 2. sz. 4-5. p.
- BUZÁS GY., SZABÓ F. (2009): Húsmarha tenyésztési ismeretek: A marhahús termelés jövedelmezőségi viszonyai II. rész, Magyar Állattenyésztők Lapja. XXXVII. Évf., 2009/3. szám, 6-7.o.
- FÜLÖP GY. (2009): Természetkímélő gyepgazdálkodás I., Szaktanácsadás, Letöltve: 2010. október 22., <http://www.biokultura.org/szaktanacsadas/publikaciok/gyepgazdalkodas1.htm>,
- FVM: MAGYAR MEZŐGAZDASÁG ÉS ÉLELMISZERIPAR SZÁMOKBAN (2009):  
[http://www.fvm.gov.hu/doc/upload/201001/hungarian\\_2009.pdf](http://www.fvm.gov.hu/doc/upload/201001/hungarian_2009.pdf), Letöltve: 2010. 10. 22.
- WWW.KSH.HU

- MÁRAI G. (2008): Melyiket válasszuk? Az öko és hagyományos szarvasmarha-hústermelés gazdasági vizsgálata. *Biokultúra*, 19.évf. 3. sz. 12-14. p.
- MÉSZÁROS K. (2010): A föld, mint korlátozott erőforrás hatása az extenzív húsmarhatartás jövedelmezőségére Magyarországon, XXXIII. Óvári Tudományos Nap, 2010. október 7. „A magyar élelmisze gazdaság jövője a KAP reform tükrében“
- MÉSZÁROS K., LENCSÉS E (2009): Ökonómiailag és ökológiailag fenntartható extenzív állattartás a Hortobágyon. 2009. április 2-3., Kaposvár., II. Nemzetközi Gazdaságtudományi Konferencia,
- POPP J., POTORI N.: A főbb állattenyésztési ágazatok helyzete, Agrárgazdasági Tanulmányok. Agrárgazdasági Kutató Intézet,
- STATISZTIKAI TÜKÖR: <http://portal.ksh.hu/pls/ksh/docs/hun/xftp/gyor/jel/jel30903.pdf>,  
Letöltve: 2010. 10. 28.
- STEFER J.(2002): A magyartarka fajta szerepe és perspektívája a kisüzemi szarvasmarhatartásban. *A magyartarka*, II. évf. 3. sz. 12-13. p.
- TÓTH E.(2007): Agrárpiaci kilátások az EU-ban, *Agroinform*,  
<http://www.agroinform.com/aktualis/?act=showItem&id=3203>, letöltve 2009.04.18.

## COMPERATIVE STRATEGY AND EFFICIENCY ANALYSIS OF MILK PRODUCTION CHAINS IN DIFFERENT EU COUNTRIES

KRIEVIŅA, AGNESE <sup>A,B</sup>, MIGLAVS, ANDRIS <sup>A</sup>

Latvian State Institute of Agrarian Economics<sup>a</sup>  
Struktoru 14, 1039 Riga, Latvia  
Latvia University of Agriculture<sup>b</sup>  
Svētes 18, 3001 Jelgava, Latvia  
[agnese@lvaei.lv](mailto:agnese@lvaei.lv)

### **ABSTRACT – Comparative strategies and efficiency analysis of milk production chains in different EU countries**

The reforms of the EU dairy sector raise concerns about the further functioning of the sector at the EU and regional level. The objective of this paper is to evaluate the total efficiency of milk production chains in different EU countries in relation to the business competitiveness obtaining strategy applied. There are different strategies applied among the countries. The most value adding oriented dairy industries are in Spain, Belgium and Italy, but the dairy industries of Ireland and the United Kingdom are the most outstanding representatives of cost leadership. On farm level also different strategies may be observed. Comparing the efficiency levels for the whole milk production chain, representatives of the both main strategies are present - the Netherlands and Ireland with their cost leadership strategy and also Belgium with its value adding strategy. When to evaluate the labour efficiency, Spain, Belgium and also Italy demonstrate a strategy based on the use of labour intensive higher value adding approach, whilst the Netherlands, Ireland and Belgium, also the United Kingdom, Germany and Sweden seem to maintain higher capital intensive cost efficiency strategies.

**Keywords:** value added, dairy chain, milk price, strategy, efficiency

### **INTRODUCTION**

Already almost 10 years reforms are taking place in the EU dairy sector, not excluding even complete liberalization of the sector – and in 2016 completely giving up the quantitative limitations on the production, including at the regional level. This raises concerns about the further functioning of the sector both at the EU and its different region level. At this paper we assume that the whole business volume of the EU dairy sector is sufficient enough not to significantly lose its share on the world market due to the ongoing reforms of the sector.

The *objective* of this paper is to evaluate the total efficiency of milk production chains in different EU countries in relation to the business competitiveness obtaining strategy applied.

The following questions are to be answered: 1) weather similar competitiveness obtaining strategies are used within the whole EU market area; 2) how does the dairy sector efficiency differ in the range of EU countries.

In economic and management literature, there are two widely used business competitiveness obtaining strategies – cost leadership (cost advantage) and differentiation (value advantage) (for example, CHRISTOPHER, 2005; LIPCZYNSKI et al., 2004; PORTER, 1998). The cost leadership focuses on production costs, ensuring that they are as low as

possible. This strategy is based on the supply-side approach. There are varied sources for the cost efficiency, including the pursuit of economies of scale, proprietary technology, preferential access to raw materials and other factors (PORTER, 1998). The differentiation, in its turn, focuses on the giving some unique product characteristics for the products which appeals to the customers and distinguishes these products from the products of the competitors. This strategy sometimes is also called the value-added strategy (ANDERSON et al., 2000), which the authors would like to specify as the value adding strategy. The uniqueness of the product is rewarded with a premium price (PORTER, 1998). The additional value of the product can be tangible or intangible (product brand), as well as it can be in the form of additional service (CHRISTOPHER, 2005). This strategy is based on the demand-side approach. The costs are reduced in all areas that do not affect differentiation (PORTER, 1998). Nowadays scale and scope effects are still important in dairy industry, but looking at the big international players, differentiation becomes more important (EWERWAND et al., 2007).

One of the widely used indicators of the competitiveness and efficiency is value added. Generally the value added refers to the total return earned by the team of workers, capital providers and the government, and it shows the total amount of money available for reinvestment and retained earnings (RIAHI-BELKAOU, 1992). As the value added created by sector is the source of income of the persons employed in the sector and also of further investments to increase the production efficiency, the amount of the value added determines business sustainability and competitiveness in attracting labour force, as well as ensuring competitive products on the market.

## **MATERIAL AND METHOD**

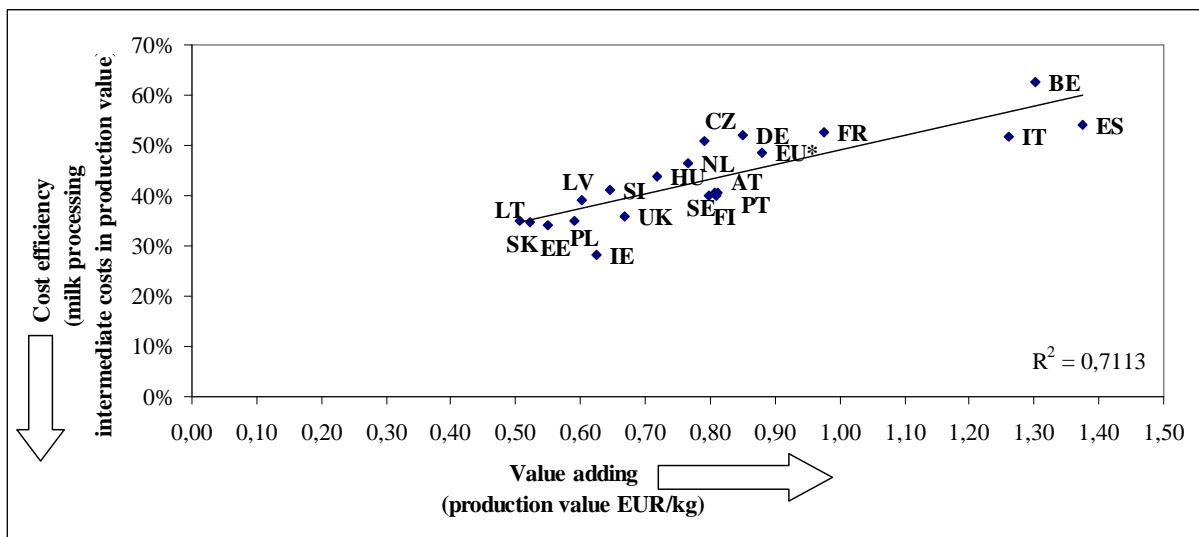
For doing analysis the data from the Eurostat public database on manufacture of dairy products were used, along with the data on milk production and external trade, combined with milk statistics of DG Agri. The analysis at the farm level is based on the data from FADN (Farm Data Accountancy Network) public database on dairy specialisation farms. The comparison and the EU average indicator includes those EU countries for which data were available to make summary dairy chain calculations (in total 20 EU countries, except Cyprus, Malta, Bulgaria, Romania, Denmark, Luxembourg and Greece). For calculations and the analysis, the data of 3-year average have been used for the latest available years (2006-2008).

In the context of the paper, the value added is production value at producer prices less intermediate consumption; to obtain the value added at factor costs, the value added is corrected with the balance of current subsidies less taxes. The value added and other indicators used are calculated per milk quantity processed (obtained as the total milk deliveries less raw milk export plus import) or produced, as well as per employee full time equivalent (labour input as 40 hours a week) in dairy industry and per AWU (annual work unit – 1,840 hours within a year) in milk production.

Methods of statistical analysis, graphical analysis and logically constructive analysis were employed in data analysis.

## RESULTS

First we tried to recognise, whether dairy industries in all the countries do belong to the similar strategic approach in maintaining the competitiveness. For this we calculated the average production value per kg of raw milk and also the share of the processing intermediate costs (total intermediate costs subtracted by the raw milk purchase value) in the total production value. The comparison of the value EU dairy industries attract from the market per kg of raw milk shows that there are different strategies applied among the countries. According to the available data, the most value adding oriented dairy industries are in Spain, Belgium and Italy (Figure 1). The dairy companies in these countries created 1.37-1.26 EUR per milk kg processed on average in 2006-2008. Generally all new Member States (except Czech Republic, Hungary and Slovenia) attract smaller value from the market than the old Member States, with Lithuania, Slovakia and Estonia being at the bottom of the list (0.51-0.55 EUR/kg). In a separate position from other older Member States stand Ireland and the United Kingdom – with almost 20 % less priced milk on the market as compared to the EU-20 average, which clearly indicates on different strategy applied in these countries.



**Figure 1: The position of the EU dairy industries in terms of the value attained from the market and the share of the milk processing costs on average in 2006-2008**

Source: own calculations, based on Eurostat, DG Agri data (2011)

When comparing cost efficiency, the cost leader is Ireland, followed by Estonia and Slovakia. The dairy companies in these countries on average had lower share of the milk processing costs in the product value, and along with Lithuania also had the lowest absolute costs per milk quantity processed. Other new Member States (except Czech Republic, Hungary and Slovenia) can also be considered as countries currently applying cost leadership strategy. The highest absolute costs per milk quantity processed and the highest relative costs can be observed in those countries that are focused on the value creation (Belgium, Spain and France). The correlation analysis shows that there is quite strong relation between the value attained from the market and the share of the industrial intermediate costs in the total production value.



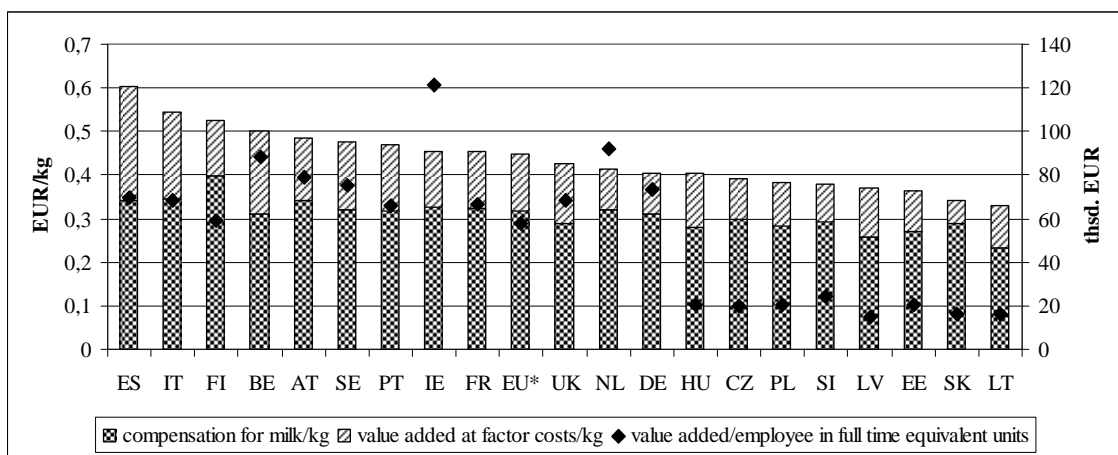
Does it mean the countries with higher value adding strategy are more efficient on the market? To answer this question, first we calculated the total income generated by the industry to compensate milk, labour and further capital, as well as the structure of sharing of this income between milk producers (as milk purchasing price) and the industry (as value added at factor costs). The results are presented in *Figure 2*.

The calculations shows that on general countries focusing on value adding strategy are successful in providing higher profit and compensation for labour and raw milk resources per processed milk quantity. All the leaders in value adding have this indicator above the EU average level. At the same time, the presence of Finland and Austria among the Top 5 indicates that by combining these two strategies dairy companies also may achieve high income level per milk kg processed.

Ireland and the United Kingdom, that also can be considered as oriented on cost leadership, have income at about and lower the EU average level, along with the Netherlands and Germany, and, according to the level of this particular indicator, they don't differ much from some new Member States – like Hungary, Check Republic, Poland.

However it's clearly visible, that all new Member States create incomes below the EU average level, with the lowest level in Lithuania, Slovakia and Estonia.

Comparing the labour efficiency measured as value added per full time employee, we can distinguish 3 groups – Ireland, Belgium and the Netherlands belonging to the top, all new Member States belonging to the bottom and rest ranging in between. It gives some basis to outline the Irish dairy industry as the brightest example of cost efficiency strategy in dairy industries of the whole EU.



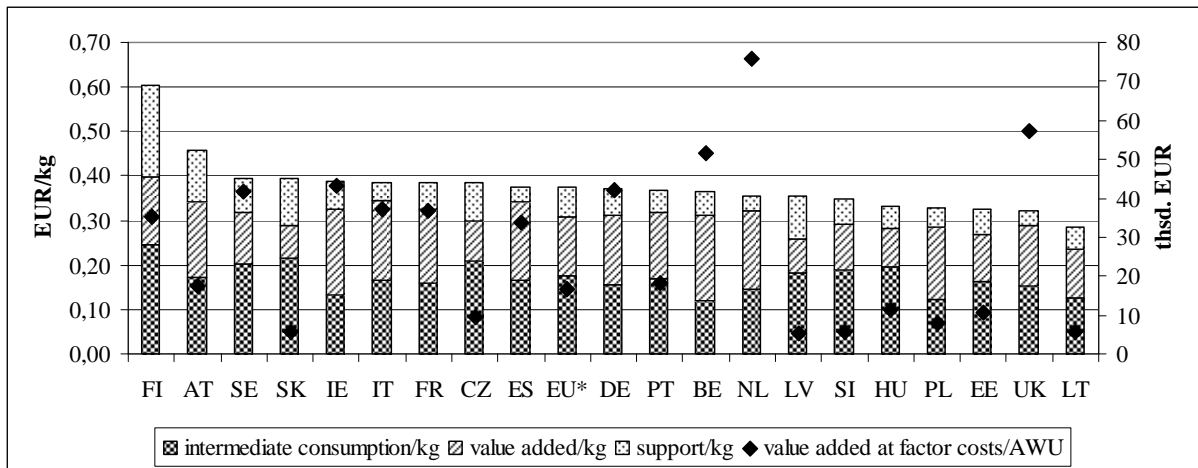
**Figure 2: Incomes of the EU processing industries to compensate for milk and production factors per milk and labour input on average in 2006-2008**

Source: own calculations, based on Eurostat, DG Agri data (2011)

Probably high cost efficiency level in Dutch and German industries due to their technological strategies which ensure lower labour input and consequently higher incomes of the persons involved in the sector (measured by the value added per full-time employee) does allow to ensure milk prices paid to the farmers above the average EU level despite on the lower level of the total incomes generated per processed milk kg.

The obtained result for Spain, Italy and France which (along with Belgium) created the highest production value per kg indicate that in these countries the creation of it is not only connected with additional use of intermediate goods, but also is based on higher labour input.

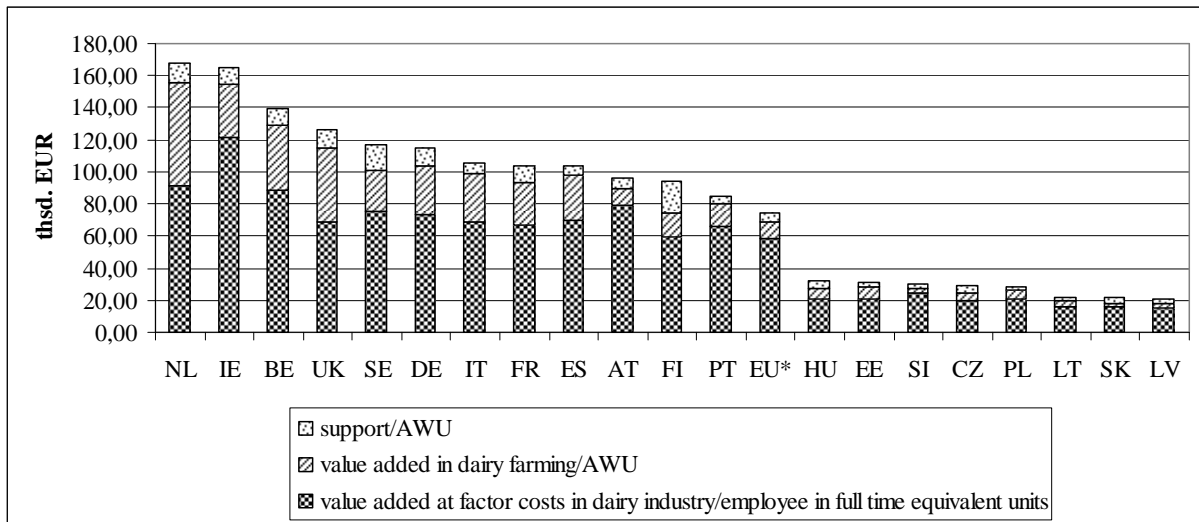
Among the new Member States, the highest value added per employee is created in Slovenia, Estonia, Hungary and Poland, but the lowest - in Latvia, Slovakia and Lithuania, with Latvia and Lithuania also having the lowest milk prices.



**Figure 3: Incomes and production costs of dairy farms per milk and labour input in the EU countries on average in 2006-2008**

Source: own calculations, based on FADN, DG Agri data (2011)

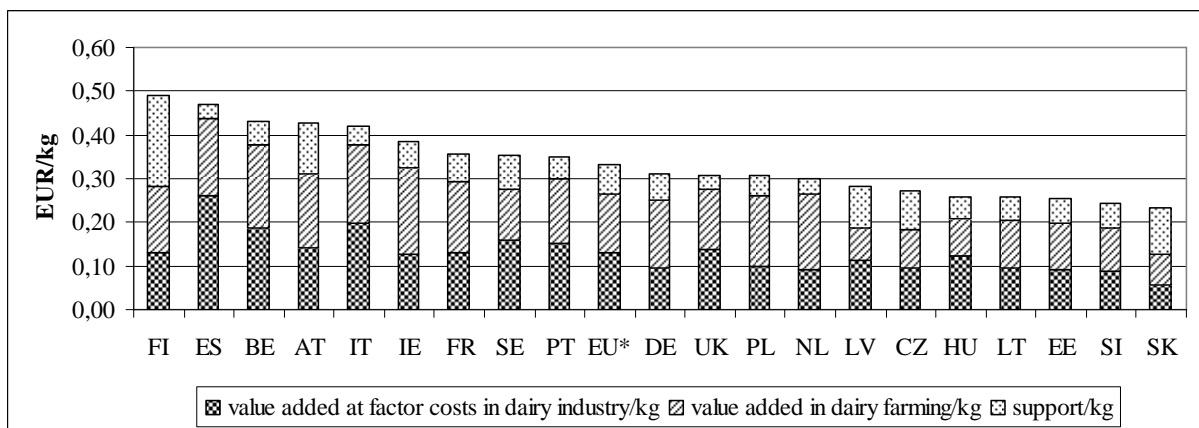
Turning to the primary milk production level (*Figure 3*), at the milk prices received from the dairy industry, available income support and the existing cost efficiency, the highest incomes of the dairy farms measured by the value added at factor costs per AWU can be observed in the Netherlands, the United Kingdom, Belgium, Ireland and Germany and also Sweden. Except Ireland and Sweden, in all of these countries incomes of the farmers from the milk price and subsidies per milk quantity produced are below or almost at the EU average level. So the high incomes are ensured by higher intermediate cost higher efficiency and lower labour input (also in Ireland and Sweden).



**Figure 4: Value added at factor costs per labour input of the dairy chains in the EU countries on average in 2006-2008**

Source: own calculations, based on Eurostat, FADN, DG Agri data (2011)

Considering the obtained results for the whole milk production chain, including the both - dairy industry and also farm level, the highest numbers of value added per labour input unit are achieved by the dairy chains in the Netherlands, Ireland and Belgium, but the lowest results do show Latvian, Slovakian and Lithuanian dairy chains (*Figure 4*), although they are not far away from other new Member States.



**Figure 5: Value added at factor costs per milk input of the dairy chains in the EU countries on average in 2006-2008**

Source: own calculations, based on Eurostat, FADN, DG Agri data (2011)

When to analyse the same amounts of the value added attributed towards kg of milk processed by the chain (*Figure 5*), we do observe a bit different picture – Finland, Spain, Belgium, Austria and also Italy are the leaders, well above the EU average levels, while Germany, the Netherlands and also the United Kingdom are even below the EU average level.

The range is concluded by the new Member States, indicating, they might do a lot to achieve efficiency levels comparable to the older EU Member States. Of course, Finland

and, partly - Austria stand separately, due to comparatively higher share of support payments in the total amount of value added.

However Spain, Belgium and also Italy demonstrate a strategy based on the use of labour intensive higher value adding approach. Whilst the Netherlands, Ireland and Belgium, also the United Kingdom, Germany and Sweden seem to maintain higher capital intensive cost efficiency strategies, and they may provide higher per person income levels to the people engaged in the dairy production chain.

## **CONCLUSIONS**

1. There are different strategies applied among the countries. According to the available data, the most value adding oriented dairy industries are in Spain, Belgium and Italy. The dairy industries of Ireland and the United Kingdom are the most outstanding representatives of cost leadership, when to analyse the price obtained from the market per unit of raw milk processed.
2. The correlation analysis shows that there is strong relation between the value attained from the market and the share of the processing intermediate costs in the total production value.
3. In general, countries focusing on value adding strategy are successful in providing higher profit and compensation for labour and raw milk resources per processed milk quantity.
4. Looking at the labour efficiency measured as value added per full time employee, we can distinguish 3 groups – Ireland, Belgium and the Netherlands belonging to the top, all new Member States belonging to the bottom and the rest ranging in between.
5. High cost efficiency level, like in Dutch and German industries ensure lower labour input and consequently higher incomes of the persons involved in the sector.
6. On farm level also different strategies may be observed. The highest incomes of the dairy farms measured by the value added at factor costs per AWU can be observed in the Netherlands, the United Kingdom, Belgium, Ireland and Germany, despite the prices paid to the farms are close to or below the EU average.
7. Comparing the efficiency levels for the whole milk production chain, representatives of the both main strategies are present - the Netherlands and Ireland with their cost leadership strategy and also Belgium with its value adding strategy.
8. When to evaluate labour efficiency, Spain, Belgium and also Italy demonstrate a strategy based on the use of labour intensive higher value adding approach. Whilst the Netherlands, Ireland and Belgium, also the United Kingdom, Germany and Sweden seem to maintain higher capital intensive cost efficiency strategies.
9. In general, our research provides the basis to the hypothesis that higher capital intensive cost efficiency strategy may provide higher per person income levels to the people engaged in the dairy production chain.

## **ACKNOWLEDGEMENTS**

The paper has been supported by the European Social Fund within the project “Support for the implementation of doctoral studies at Latvia University of Agriculture” (sub-activity 1.1.2.1.2. Support for the implementation of doctoral studies), agreement No. 2009/0180/1DP/1.1.2.1.2/09/IPIA/VIAA/017, contract No. 04.4-08/EF2.D2.03.

## REFERENCES

- ANDERSON D., HALL C. (2000): “Adding Value to Agricultural Products”, Texas Agricultural Extension Service, Texas
- CHRISTOPHER M (2005): “Logistics and Supply Chain Management. Creating Value-Adding Networks”, Pearson Education Limited, Harlow, p.3-41
- EWERWAND E., INGENBLEEK P., BACKUS G. (2007): “From Commodity to Customer Value. The Transition from a Production-oriented to a Market-oriented European Dairy Industry”, LEI, the Hague, p.11-12
- LIPCZYNSKI J., WILSON J. (2004): “The Economics of Business Strategies”, Pearson Education Limited, Harlow, p.132-153
- PORTER M (1998): “Competitive Advantage Creating and Sustaining Superior Performance”, The Free Press, New York, p.11-26
- RIAHI- BELKAOUI A (1992): “Value added reporting. Lessons for the United States”, Quorum Books, New York, p.172

## THE LINGUISTIC LANDSCAPE OF THE CENTER OF HÓDMEZŐVÁSÁRHELY

GALGÓCZI-DEUTSCH MARTA

University of Szeged Faculty of Agriculture  
Andrássy street 15. Hódmezővásárhely, 6800 Hungary  
[deutsch@mgk.u-szeged.hu](mailto:deutsch@mgk.u-szeged.hu)

### **ABSTRACT-The linguistic landscape of the center of Hódmezővásárhely**

Hódmezővásárhely is a rapidly developing town attracting an increasing number of tourists from other countries. Therefore it is important to display information in at least one world language, mainly English, in places of interests that are likely to be visited by tourists. In my study I have examined the linguistic landscape of the town center including sights, services and the High Streets to see how well prepared the town is for the foreign visitors. I found that in all places of interest and services bilingual or multilingual information is available in different scope while streets apply foreign language for symbolic reasons.

**Keywords:** linguistic landscape, Hódmezővásárhely, public signage, sights, multilingualism

## INTRODUCTION

Hódmezővásárhely is a rapidly developing town that is situated in the South-Eastern region of Hungary. The town attracts an increasing number of tourists both from inland and abroad year by year. Therefore, it is important to attend the linguistic needs of foreign visitors who do not speak the Hungarian language and display the relevant information in at least one world language.

Hódmezővásárhely is a town with a population of about 48.000. Due to its thermal water, healthcare services (private dentistry services are offered and packages of dental care accomodation and shutter for foreign patients, especially for UK citizens.), sights and museums the town is becoming a more and more favored destination for both health, wellness and holiday tourist. Therefore, the use of English and German languages in public signage and especially that of informative function is increasingly important in order to make their stay easier more comfortable.

My objective with the present study is to draw the linguistic landscape of the center of Hódmezővásárhely in order to assess the preparedness of the town for accepting foreign visitors from language perspective. In the focus of my study is the town center, as it is more likely to be the destination of visitors, particularly foreign visitors

Before examining the town's linguistic landscape itself, it is important to overview the history and the notion of linguistic landscape. The roots of linguistic landscape as a discipline reach back to semiotics, but as an independent research field it is a fairly new phenomenon. The linguistic landscape is the presence of written language in public spaces that is present in our daily life: signs and noticeboards are visible in the streets, public buildings and shops (GORTER et al., 2008). The term 'linguistic landscape' was introduced by Landry and Bourhis in 1997 and they defined it as the term for linguistic phenomena that mark the public spaces, including street signs, the names of places, streets, buildings and institutions. Therefore, the centers of cities are culturally and linguistically colorful (GORTER, 2006). The linguistic landscape studies focus on the analysis of written

information in streets in a certain, limited area (GORTER et al., 2008). Such places can be shopping centers, schools, offices, companies, buses, swimming pools, streets (SPOLSKY, 2009). Spolsky and Cooper distinguish eight main types of public signage: ‘street signs, advertising signs, warning notices and prohibitions, building names, informative signs (directions, hours of opening), commemorative plaques, objects (postbox, police call box), graffiti’ (SPOLSKY, 2009). Other researchers, like Shohamy and Waksman or Guilat expand the scope of linguistic landscape to the visual materials in public spaces as well (SHOHAMY et al., 2009). In my study, however, I only intend to examine the written signs. The rules and regulations referring to the language use are the most apparent in linguistic landscapes that is in the public signage (BACKHAUS, 2009).

In case there are bilingual signs, it is important to study their layout upon their examination: which is the first language in the signage: the dominant or the minority/foreign language? Are the size and type of the letters the same or different? (BEN RAFAEL et al., 2010). Is exactly the same piece of information included in the foreign language? These data tell us who the major target group in conveying the information is and how much likely speakers of other languages are considered to read the signage. However, not only the presence of one or two languages on signs, but their absence provide information for the linguist (SPOLSKY, 2009). In my examinations I also study the layout of the bilingual signs in order to gain extra information about the priority of languages used.

In case of numerous cities the usage of two or more languages in the linguistic landscape is primarily the manifestation of the relation of dominant and minority languages. However, in Hódmezővásárhely, not a minority language is what establishes the second language usage in public signs (owing to the lack or very low rate of minority languages in the population), but rather the use of English and German that can be either due to the foreign tourism or fashion (PILLER, 2003). Therefore, in my study I examine the appearance of the above mentioned languages.

Landry and Bourhis distinguished two major functions of public signs: informative and symbolic functions (SPOLSKY, 2009). In the case of the bilingual signs in Hódmezővásárhely, too, it is possible to distinguish between these two functions. As I will demonstrate it in the followings, signage in museums or hotels providing information in bilingual form have real informative value, whereas shop names in streets have rather symbolic value.

## **MATERIALS AND METHODS**

To study the linguistic landscape of a given territory I used similar method that Griffin (GRIFFIN, 2004) did. I defined the scope of the town—the center—that I intended to examine with the help of a map. I chose the center as it is the part most possibly visited by tourists. Within this scope I determined the sights, places of interest and some services that a tourist is likely to visit or use: hotel, museums, bank, post office, café and the High Street with street signs and shop names. In these places I took photographs of the signage that contained bilingual, multilingual or monolingual signs. I examined the photos taken and with their help I could draw the linguistic landscape of the center: I studied the number of bilingual or multilingual signs, the type of information they contain and the written format they have and related the foreign language content to the Hungarian one.

## **RESULTS AND DISCUSSION**

In this section I study and assess the bilingual signage of places of interests one by one. As mentioned above not only bilingual or multilingual signs are relevant for the study, but their lack as well. Therefore I examine both bilingual/ multilingual signage and monolingual ones respectively.

### **'Emlékpont' Museum**

In the Museum visitors can see the reminiscent and memories of the town's life under the Soviet regime. There are different artifacts, object exhibited along with written and oral narratives of those who lived in that era. Upon examining the museum from the linguistic landscape viewpoint, it can be observed that all narratives, memory plaques, pamphlets, and biographies are in Hungarian language with the exception of some Hungarian-English plaques declaring what can be seen in the exhibition room. As far as the museum guide is concerned, if someone is interested in the English version, he can hire audio guide or a tour guide who presents the trip in English. Both the audio guide and the tour guide cost extra fee. There are few pieces of information printed in a bilingual edition. There is one type of pamphlet giving an overview of the Museum is in Hungarian-English edition, with Hungarian language in the first place and English below, letters are of the same size and type. The text is quite scarce, rather picture material. Furthermore, there are two pieces of memory plaques of the outside statues. Similarly, first in Hungarian then in English, same size and type of letters.

Also, there are bilingual signage on the entrance door, with opening hours and ticket prices. However, here English is in the first place followed by Hungarian and letters in the English text are bigger in size. In this signage not exactly the same pieces of information are written, as the content of the information 'entrance is free with residence card of Hódmezővásárhely' is written only in Hungarian. It can be assumed that the information that may be considered of prior relevance to foreign tourists (opening hours, fees) is not only given in English, but its importance is further emphasized visually. At least, the content that is relevant for them, thus it can be the reason why the free entrance possibility is not written in any other languages as probably this information is absolutely redundant for non-Hungarian speakers.

It can be concluded that the appearance of bilingual signs in English with informative function is scarce in the museum. Only the very basic information is displayed in two languages. Besides, only English language is included.

### **Synagogue and Museum**

Hódmezővásárhely has a restored Synagogue with a Holocaust Museum in the premise. The museum is often visited by tourist groups and foreign visitors, too. To cater for the needs, the museum has several bilingual and some multilingual issues. In the museum there are authentic reminiscent of the World War II that have special relevance to the town. There are also statistics and historical facts written under the artifacts in monolingual Hungarian. One of the main interests of the exhibition is the series of recorded narratives and interviews about the deportation and the camps told by holocaust survivors of the town. The narratives are bilingual: they are narrated in Hungarian with English subtitles. There are multilingual written materials available in the museum: the history of the synagogue and the content of the museum is presented in three foreign languages: English, French and Spanish, with the same content and format.



As far as English guiding is concerned, it is provided by the guide of the museum, there is no need to requesting it beforehand or paying extra fee for the service.

The museum is apparently well prepared for accepting foreign visitors. All documentation is available in English, even if the information is written only in Hungarian within the Museum, it can be found in English as well in the brochure or can be listened to from the guide. Moreover, basic information is displayed in three foreign languages. Also, it can be concluded that the information written in foreign languages has informative not symbolic value.

### **Pottery House**

The town has a long-time fame for pottery and embroidery. The pottery house is a traditional farm house from the early 20th century. Situated in the center of the town, it displays the fragment of village people's life in the 1900s along with artifacts of traditional pottery and embroidery. There are no written pieces of information as the museum can only be visited with a guide upon request. Also, English language guiding can be requested with no additional fee, thus the museum can be fully enjoyed by foreign visitors.

### **Tornyai János Museum**

At present the museum is under restoration, thus no information is available about bilingual signage.

### **Gingko Sas hotel**

The hotel is destined to cater for wellness, holiday and conference tourism. In what follows I present the bilingual and monolingual signage that can be found in the hotel. It is probably the most plentiful source of bilingual signs as it is destined to serve for a large number of foreign customers as well being a wellness hotel and conference spot as well.

All the other relevant information was bilingual in a way that Hungarian language was followed by English, always below written in the same size and type of letters. Bilingual information included price list, bar and restaurant menu card, bike rental, smoke prohibition and signs for location and giving directions.

Generally, it can be concluded that the hotel is the place in town that is the most prepared for non-Hungarian speaker visitors. The bilingual signage they apply-using the distinction by Landry and Bourhis-have more of an informative than symbolic function. That is, they provide the non-Hungarian speaker guests with relevant information about the hotel and its facilities.

### **‘Fekete Sas’ café**

The café do not have any signage on display except the opening hours which is in monolingual Hungarian. However, the menu card is available in three foreign languages besides the Hungarian: English, German and Italian, with the same information included. As in case if the café the menu is the most relevant information for a non-Hungarian speaker, it can be concluded that the place if prepared for foreign visitors from different countries.

### **Banks**

As far as banks are concerned they do include certain information in English besides Hungarian. However, no other languages are used. Most information for costumers is written in monolingual Hungarian. The bilingual signage includes information about

security, the use of ATM after bank closing time and information about exchange rates. Money exchange and ATM are indeed the most frequent functions foreign visitor can use, therefore these have high informative value. However, the menu on the machine providing the numbers for various services that could also be useful for non-Hungarian speakers at times is only in monolingual Hungarian.

### **Post Office**

I studied the signage of post office as in some cases it can be necessary for a tourist to use the service it offers (e.g. sending postcard). Here all signage, relevant information and the menu of the ticket machine with the service types at the post office are in Hungarian only. It may be a problem for foreign visitors as they have no information about which button to press for the required service. However, no service is available without it. There is only one multilingual sign that contains two types of prohibitions. It is written in four foreign languages: Hungarian, English, German, French and Russian. In case of both prohibitions Hungarian is the first language, in bigger letters, highlighted by red background, while the other languages received smaller letters on a green, less emphasized background. The sign prohibits taking photos and mobile phone use. It can be concluded that the multilingual information serves only the interest and safety of the office itself but provides no help for the foreigner to utilize the services. Therefore, it is almost impossible for a non-Hungarian speaker to use postal services without asking for help. Although there is the signage of prohibition, I would assert that the multilingual sign of the post office have no real information value for a foreigner.

### **Bilingual signs in the city center**

The city center is the area in a city that a foreign tourist is the most likely to walk along with. For this reason I included the streets of the center in my study. Along the High Street (Andrássy street) of Hódmezővásárhely further signs written in different languages (mainly English) can be found: ‘Jegyző-Notary’ and the names of shops: Trendy, Drogerie Markt (DM), Yesss, Golden Meat, Veritas, Goods Market. There is also name in mixed Hungarian and English: Szuperpress.

These names have no informative function (except Golden Meat may have some informative function with suggesting being a butcher’s), but rather symbolic function. The reason for this is probably the fashion: foreign language signage is fashionable and provokes attention, provides people with the feeling of internationalism and may be associated with higher quality than shops with Hungarian names (Piller, 2003). Also, there are shops that have names in foreign language because they are part of a foreign company chain. Therefore, in this case, English language or other foreign language signage has purely symbolic function.

Other signage that locates streets and places of interest and importance (museums, restaurants, schools, swimming pool, sports center) on one board are written only in monolingual Hungarian, however they would be definitely important for non-Hungarian speaker visitors as well as they provide useful information about location and directions.

## **CONCLUSIONS**

Considering the presence of the bilingual signs in the center of the city it appears that the places which are likely to be visited by tourists from other countries are prepared for their

acceptance. Especially the hotel situated in the city center that has the highest possibility for being a tourist destination has almost all the information about the services, offers, directions written in English. Museums, as places of interest have the basic information in English, but offer either written description of the artifacts or English guiding upon request. Within the service sector banks provide the substantial information in English, too, however, the post office has very scarce information in other languages than Hungarian. Moreover, the information written in more languages serves exclusively the interest of the office and do not provide any help for foreigners.

Based on the distinction of Landry and Bourhis, it can also be concluded that the bilingual texts have informative function: their aim is to provide information and transmit the content of the Hungarian texts. However, in the high street, the information that can be found in English is purely symbolic: no information is provided; it is rather the name of shops that are in English instead of Hungarian.

In conclusion it can be assumed that Hódmezővásárhely is linguistically keeping pace with the increasing foreign tourism making tourists' stay in town convenient. The foreign language applied in bilingual signage is mainly English, as it is the most widely spoken world language and can cater for the needs of tourist in most European countries. However, there are multilingual pieces of information as well that include French, Spanish, Italian or German languages. It can be hypostatized that with the town's tendency of becoming more adaptable for foreign tourism (e.g. health tourism) the appearance of bilingual and multilingual signage in the linguistic landscape of the Hódmezővásárhely will further increase.

### **ACKNOWLEDGEMENTS**

This study was conducted under the supervision of Dr. Fenyvesi Anna, University of Szeged Department of English Studies.

### **REFERENCES**

- BACKHAUS P. (2009): "Rules and regulations in linguistic landscaping. Comparative perspective", Shohamy and Gorter: Linguistic landscape. Expanding the scenery. Routledge, UK. p.157-173
- GORTER D. (2006): "Linguistic Landscape: A new approach to multilingualism", Multilingual Matters Ltd, UK
- GORTER D., CENOZ J. (2008): "Knowledge about language and linguistic landscape", Nancy H. Hornberger: Encyclopedia of language and education, 2090-2102.
- GRIFFIN J. L. (2004): "The presence of written English on the streets of Rome. A review of English in Italy, with evidence of its infiltration into Public life", English Today 78. 2004 April, p. 3-8
- PILLER I. (2003): "Advertising as a sign of language contact", Annual Review of Applied Linguistics, 23, Cambridge University Press, p. 170-183
- SHOHAMY E., BEN-RAFAEL E., BARNI M. (2010): "Linguistic landscape in the city" Multilingual Matters Ltd, UK
- SPOLSKY B. (2009): "Prolegomena to a sociolinguistic Theory of public signage" Shohamy and Gorter: Linguistic landscape. Expanding the scenery. Routledge, UK, p. 25-40

## **TOURISM, SOCIAL AND ECONOMIC BALANCE TOOL AND CULTURE IN RURAL AREA OF ROMANIA**

**UNGUREANU GEORGE<sup>1</sup>, CHIRAN AUREL<sup>2</sup>, CIUREA ION VALERIU<sup>1</sup>, GÎNDU ELENA<sup>1</sup>,  
BREZULEANU STRJAREL<sup>1</sup>**

<sup>1</sup>USAMV Iași, Aleea M. Sadoveanu 3, 700490, Romania  
[ungurgeo@uaiasi.ro](mailto:ungurgeo@uaiasi.ro)

### **ABSTRACT - Tourism, social and economic balance tool and culture in rural area of Romania**

This paper brings into question the organization of tourism since it is a tool for balance, are generating significant income, jobs - thus reducing the unemployment rate, of civilization - by improving sanitary conditions and behavior social, aesthetic cultivation of taste, to continue and increase economic activities in a weak agricultural production, thereby enhancing quality of life itself.

Through this activity a direct contact between tourists and the local population is created, ensuring a better possibility to encounter new cultures and opinions. Knowledge spreads not only among those who practice agrotourism at the pensions, but also among the local dwellers with whom the tourists get in contact during their holiday and for the latter as well. Furthermore it is suitable for establishing friendly relations and preserving the local traditions, making culture and the society of rural a permanency. Thus harmony between authentic and modern is created, putting textures and traditional carpets next to a computer. tradition is kept, but modern is kept, but modern is not ignored.

The authors have proposed that the first part to address a number of theoretical concepts relating to subject matter, and in the second to examine the specific issues that are found or not in reality.

It is known that during the Roman period most of the trips were for shopping, cultural or military, and their paths inevitably going through the countryside. At the same time as the evolution of human society and the structure is diversified travel, as in the Middle Ages, especially traveling merchants, but often meet ambassadors, priests and pilgrims, scientists, artists, journeymen and students. Some of these travelers have decided to convey their experiences. We support this in writing aimer Picaud French monk who in 1130 made a guide for pilgrims who want to reach Santiago de Compostella, or Basho Japanese priest, who in 1960 wrote a poem entitled "Narrow Road to the North."

Aiming to present the evolution of facilities, Christureanu Cristina, in "Economics and politics of international tourism" is quite suggestive quatrain: "stung by mosquitoes, bitten by lice / I managed to sleep in a bed / While horse urine / Right next to my pillow".

**Keywords:** tourism, local population, economic balance, culture

## **INTRODUCTION**

Therefore, tourism is an activity extremely beneficial for tourists who are trying to relax and relax and forget the stress of everyday worries and service providers in this field who make large profits by charging this activity.

## **RESULTS**

Agrotourism comprises all the touristic activities unfolded in the rural area, outside the areas destined to "the tourism of lights" (in cities), "the blue tourism" (seaside), "the health tourism" (in spas), and "the white tourism" (in mountaneous areas). The agrotouristic

potential in the Romanian village is extremely complex, comprising natural and cultural-historic elements of great variety and touristic attraction. Through this, agrotourism is a mean of integral utilization of rural environment, with its agricultural, touristic, anthropic and techno-economic potential. Apart from other types of rural tourism and countryside vacations spending, agrotourism does not comprise anything else but the activities through which the family that accommodates tourists obtains income from this, and not only from the accommodation activities, but also from the agricultural ones. Thus, two agricultural households were analysed, each of them having different activities, one of them performs the agrotouristic activity besides the agricultural one.

### **The analysis of income and costs at the agrotouristic pension (household A)**

The agrotouristic pension is situated in Chiril Village, Crucea commune, 29 km away from Vatra Dornei municipality. It is located at the feet of the Rarău Mountains and also on the course of Bistrița River. The pension is placed in an area that offers very good conditions of spare time spending. It has an accommodation capacity of 20 places, in 2 and 3 persons room as it follows: 4 family rooms, 4 double rooms, equipped with all utilities necessary to perform this activity. The management staffs are represented by the members of the family and there are two more persons hired, one full time and one part time.

**Table 1: Total investment in Agri-tourism activity**

	<b>INVESTMENT IN:</b>	<b>UNIT-€</b>	<b>VALUE</b>	<b>PERCENTS</b>
1	PENSION BUILDING	€	26052	91,59
2	FACILITIES (SHOWERS, ETC)	€	1302	4,58
3	FENCE (WALL)	€	466	1,64
4	INVENTORY	€	622	2,19
5	OTHER	€		
	<b>TOTAL</b>		<b>28443</b>	<b>100,00</b>

The initial capital requirement is usually higher in relation to average agricultural household income. Because the agricultural household A cannot be afford it is need barrow money from bank or other sources.

For payback of the investment value in this projection was use the actual interest rate (14 %) from Romanian Bank from investment in ROL currency.

**Table 2: Agri-tourism expenditure (4 double rooms)**

	<b>Item</b>	<b>Unit</b>	<b>Value</b>	<b>Percents</b>
1	Energy	€	397	11,35
2	Employers expense	€	2239	6,39
3	Tax for social protection	€	671	1,92
4	Medical fees	€	156	0,448
5	Raw materials	€	13435	38,391
6	Drinks	€	10076	28,79
7	Repairs, maintenance	€	622	1,77
8	Tax for added value	€	4467	12,76
A.	Total direct costs	€	21210	60,61
9	Interest rate	€	12738	36,39
10	Administrative expenditure	€	933	2,66
11	Miscellaneous	€	113	0,324
B.	Total variable costs	€	13784	39,39
	Total	€	34995	100,00

Because the risk is increasing in case of borrow money, farmers who want to implement agritourism activity in agricultural household should examine the particulars of their own situation; the agricultural household location, the characteristics of their land and natural resources and the potential consumer population of the surrounding area. They should also assess their own individual strengths and interests regarding agritourism activity. The implement new activity may also reflect the financial needs and liquidity problems of the agricultural household.

The exploitation situation is:

The surface of agricultural land owned by the agrotouristic farm is 2,50 ha, of which 96.8% arable land that is exploited in order to obtain produce, part of them for domestic consume, and the difference for capitalization through agrotourism.

**Table 3: Land use**

<b>Land use</b>	<b>Surface of agricultural land</b>	<b>%</b>
Agricultural land	2,42	96,8
Non- agricultural land	0.08	3,2
Total	2,50	100

The animal force is formed by 2 cows, 2 calves, 2 pigs, 20 hens and 20 chickens (table 4). The only produce sold on the market in order to obtain profit, are the dairy produce and a part of meat production.

**Table 4: The number of animals**

<b>Effective structures</b>	<b>Number</b>	<b>Stock Value (ROL)</b>
Cows	2	5400
Calves	2	3000
Pigs	2	600
Hens	20	240
Chickens	30	90

The value of a cow is 2,700 ROL, thus the value of cows stock is 5,400 ROL, also 1 calf represents 1,500 ROL, resulting, thus, a value of 3,000 ROL for 2 calves. The value of pigs stock is 600 ROL which represents that a pig costs 300 ROL. Concerning the value of bird stock, a hen is 12 ROL and chicken is 3 ROL/piece. Thus results the total value of animal force income is 9,330 ROL.

Concerning the destination of animal production, this is mainly for domestic consume and agrotourism activity, the rest for marketing.

The zootechnical sector is destined to obtaining products of animal origin necessary for the agrotourism activity. The produce obtained are: milk, beef, pork, chicken, eggs. A part of the obtained production in this sector is destined to marketing, which has a favourable influence on the increase of household profit. The income in the zootechnical sector, the one obtained from produce selling on the market, as well as that destined to agrotourism, values 11,100 ROL.

The agricultural production profit, compared with that of zootechnical production, is 4,102 ROL higher, and, the profit obtained from agricultural produce marketing and its use in the agrotouristic activity, is of 15,202 ROL compared to 11,100 ROL, the profit of zootechnical production. This fact is owed to the marketing, in a higher proportion, of agricultural produce, than that of zootechnical one because buying alimentary products made of meat implies higher expenses.

The touristic activity performed by this household leads to an annual revenue influenced by the accommodation cost which includes a meal, and by the pension's extent of occupancy, as it follows:

#### **The extent of occupancy**

When establishing the accommodation costs, there must be into account the personal expense and the costs perceived by the other pensions in the area, as well as the expenses of raw materials and consumer goods.

Out of 365 days in a year, the pension is occupied only for 205 days; nevertheless, the profit obtained from accommodation is of 52,550 ROL. The household has total annual revenue or:

$T_i = \text{income from zootechnical production} + \text{Income from agricultural production} + \text{Income from tourism activity}$

$$T_i = 11,100 + 15,202 + 52,550$$

$$T_i = 78,852 \text{ ROL}$$

The household costs are distributed and the incomes too, an categories: costs of zootechnical production, costs of agricultural production and costs of tourism activity.

#### **Costs of animal production**

The total costs of animal production are of 6,161 ROL, with annual revenue of 11,100 ROL. Regarding the costs of production on crops, these are determined: costs of fertilizers and seeds or saplings, of transport of the products from the harvesting place to the storage one, these costs include costs of fuel, labour, costs of mechanical field works (wedding, harvesting), costs of seasonal labour, all these depending on crop and on fluctuating costs (table 3).

### **The structure of the costs of production on crops**

The highest costs of production are recorded at fodder plants, 1,545 ROL, followed by potato crops with 1,125 ROL. The fee on property is 450 ROL, total on the whole arable surface.

### **The value and structure of costs in tourism activity**

The presented data shows that the highest weight (one third) is represented by costs of salaries, followed by the costs of electricity (16.38%), costs of food acquisition (12.72%), annual liquidation (11.37%), insurance and social services (9.10%), restorations (2,95%) and advertising (2.28%) out of the total costs.

At the agrotouristic pension, the costs added are those of agrotouristic activity: 43.940 ROL, thus the total costs are of:

c = costs of zootechnical production + costs of crops production + costs of agrotouristic activity

$$c = 6,161 + 3,884 + 43,940$$

$$c = 53,985 \text{ ROL}$$

### **Analysis of profit and costs in an agricultural household (household B)**

In the first household practises, the agrotouristic activity and owns a land surface of 2.50 ha, the second analysed household practises only agriculture, the income resulting from agricultural produce marketing (milk, meat, potatoes, vegetables).

### **The modality of land use**

The agricultural land is destined to potato crops, a very small surface to corn beans, onion, other vegetables and annual fodder plants. The surfaces occupied by these crops are different in size.

### **The structure of crops**

It is noticed that the largest land surface is occupied by fodder with 0.62 ha (38.75%), followed by potato crops with 0.6 ha (37.5%); vegetables occupy a surface of 0.20 ha (12.5%), the corn with 0.1 ha (6.25%) and onion with 0.1 ha (5.0%) out of the total surface of 1.60 ha.

Most of these crops are destined to marketing, the rest is used for domestic consume, animal feeding and seeds.

The total profit of agricultural production is 4,498 ROL, quite low annual revenue compared to that of the agrotouristic pension.

The household's animal force is a total of 56: 3 cows, 2 calves, 1 pig, 30 hens and 20 chickens.

### **The total economic efficiency of the analysed households**

One of the most important indicators of economic efficiency in agrotourism is profitability. Defined as a relation between the obtained result and the means used, profitability is an indicator under the basis of which are estimated the performance obtained, and also the possibility of making profit. Profitability is a currency excess, the balance between total returns and total costs.

The profitability of the activity is analysed on the basis of the indicators expressed in relative size, but also on the basis of those expressed in absolute size. Among the indicators expressed in absolute size, can be mentioned:



- gross profit – expressed as a difference of total revenue and total costs;
- net profit – calculated as a difference of gross profit and income profit.

The difference of profit between the two households can be easily noticed, household A being the most profitable thanks to the practising of agrotourism; in this case, the income is remarkably much higher so the resulted gross profit is 24,867 ROL and the net profit is 3978.72 ROL, compared to the second household which does not perform agrotourism activities, and has a gross profit of 9,795 ROL and a net profit of 1567.2 ROL. From efficiency point of view, the first household (agrotouristic pension) has a higher profitability.

As in other economic activities, in agrotourism too it is pursued the obtaining of a sufficiently high profit so that it can ensure the paying of capitals, the maintenance of existent economic potential and to increase the economic efficiency according to the evolution of touristic market and to the random factors.

An important role, in the analysis of the profitability of activity, plays the indicators expressed in relative size.

Among these is remarked the rate of profit calculated according to the formula:

$$R = P/RS \times 100 \text{ or } R = P/C \times 100 \text{ where}$$

R – rate of profit

P – profit

RS – rate of sales

C – total costs

- household A has a rate of profit of:

$$R = P/C \times 100$$

$$R = 24,867/53,985 \times 100$$

$$R = 46.06\%$$

- household B has a rate of profit of:

$$R = P/C \times 100$$

$$R = 9,795/8,423 \times 100$$

$$R = 116.28\%$$

The economic profitability means the efficiency of total or part of the assets utilization. It is expressed through the rate of economic profitability which should be superior to the rate of inflation. A sufficiently high rate of economic profitability should allow the renewal and increase of fixed assets in a short time. The rate of economic profitableness is based on the profit for the period and the total assets, thus:

$$PR = (\text{profit for the period before taxation}/\text{total assets}) \times 100$$

- household A has an economic profitability of:

$$PR = (24,867/35,600) \times 100$$

$$PR = 69.85\%$$

- household B has an economic profitability of:

- $PR = (9,795/11,750) \times 100$

- $PR = 83.36\%$

The financial profitableness is estimated through the rate of financial profitableness of long term capital, and through the rate of profitableness of personal capital calculated according to the formulas:

FPr = (Profit for the period before taxation / long-term capital) x 100, where: long-term capital = personal capital + medium or long-term credits

- household A has a financial profitability of:

$$\text{FPr} = 24,867/42,750 \times 100$$

$$\text{FPr} = 58.17\%$$

- household B has a financial profitability of:

$$\text{FPr} = 9,795/21,400 \times 100$$

$$\text{FPr} = 45.77\%$$

**Table 5: Size and structure of the categories of utilization**

Specification	UM	Surface	% from total
Total surface	ha	50	100
Agricultural	ha	47,5	95
Arable	ha	30	63,15
Pastures	ha	10	21,05
Meadows	ha	5,5	11,57
Vegetables	ha	2	4,23
Non-productive	ha	2,5	5

From the presented data can be noticed that both of the households are lucrative, but the agrotouristic pension has a higher profitability compared to the common household. Having a net profit of 3978.72 ROL and a rate of economic profitability of 69.85%, the pension can afford to invest in new objectives.

The social-economic efficiency can be entirely studied at the level of a touristic complex product or of a company, but it can also be analysed at the level of each constitutive activity of touristic product (result).

## CONCLUSIONS

The Agri-tourism activity has two major purposes:

The first is to provide leisure and recreation for the public;

The second is to increase farmers income by use the own products and avoid in this case the expenses of transport and taxes compare with another kind of tourism.

The standard small agricultural household can be motivated to implement new activity because there is a lot of other advantage:

- agri-tourism activity build rural development and increase the job opportunities;
- assure continuity of agricultural activity in mountain region where the agriculture is very poor;
- authentic products and unique experience are made available to the agricultural households;
- provide opportunities to show which products will be important in future, established crops that are needed for consumption in restaurant; agri-tourism activity has potential for new sources of revenue from products and services that can be incorporated as part of “ working “ agricultural households;

- agri-tourism activity can generate revenue and important cash flow during the off-season;
- agri-tourism activity also, provides opportunities to create recognition of the landowners that practice this activity;
- to increase the level of social behaviour within relationship with another members from same or another community;
- to grow-up the aesthetic spirit that can improve also the hygienic- sanitary situation.

In conclusion, Agri-tourism activity can provide additional income to farmers and rural community. It can provide additional supplement revenue that can make a difference between a profit loss for agricultural producers, agribusiness and rural community. It is a way to “add value” to crops and livestock currently grown on the farm. It also has the potential for building relationship between agriculture and industry.

## REFERENCES

- ACATRINEI MARILEANA (2002) – Tendințe în dezvoltarea turismului rural. Turismul rural românesc.
- BRAN FLORINA, MARIN D., SIMON TAMARA (1998) – Economia turismului și mediul înconjurător, Editura Economică, București.
- BREZULEANU S., CIUREA I.V., UNGUREANU G., MEREU NICOLETA (2002) - Aspects du développement rurale du Departement de Bistrița-Năsăud- Universitatea de Științe Agricole și Medicină Veterinară, Facultatea de Agricultură, Lucrări Științifice.
- BREZULEANU S. (2004) – Management agricol – teorie și practică. Editura Performantica Iași.
- CIUREA I.V., CHIRAN A., BREZULEANU S., GINDU ELENA, UNGUREANU G. (1998) - Researches regarding the efficiency of technical-economic activities of some mountain farms from western carpathians. Programul TEMPUS-PHARE – Contributi allo studio dell’a transizione dell’agricoltura rumena verso il mercato: aspetti strutturali, economici ed estimativi. Editione Conquiste, Bologna.
- UNGUREANU G CIUREA I.V., BREZULEANU S ,2003 Analysis of the agricultural households with medium size in Romania, Lucrări științifice, Seria Agricultură, CD

## CONNECTION OF FARMING AND LANDSCAPE FORMING IN THE BENEDICTINES

MAGYAR VERONIKA

Corvinus University of Budapest, Department of Landscape Planning and Regional  
Development

Villányi út 29-43, 1118, Budapest, Hungary

[veronika.magyar@uni-corvinus.hu](mailto:veronika.magyar@uni-corvinus.hu)

### **ABSTRACT – Connection of farming and the landscape forming in the Benedictines**

Where the orders settled, they began the landscape forming. The monks ensured their livelihoods, by forming the landscape, using it rationally. The settlement of the particular orders and during the following centuries, one aspect was to ensure their livelihoods. The position influenced their scope of activities, including their impact, on the landscape. The Benedictines laid a great emphasis on farming, and the adapting to the conditions, and onto its maximum utilisation. The wish of St. Benedict was, that his followers settle down on a place, and make their environment human, as a result, the Benedictines cultivated land across Hungary, drained swamps, made purposeful farming, created flourishing agriculture. The agriculture and the landscape forming is closely contacted to each other, Pannonhalma, Tihany and the other estates are good examples.

**Keywords:** Benedictines, farming, landscape forming, cultivated land, flourishing agriculture

## INTRODUCTION

Religion plays a central role in the human's life. Over the centuries more and more religions and orders appeared. Religious centers, necessary buildings for the exercise of religion, and other structures have been established in order to ensure their livelihood, and they changed, formed the landscape. What they established and created in the scenery is permanent, and make an impact in our days, so the image and character of the landscape is define and effects. That special position and activity is related to each order. Some particular orders dealt with ministering, teaching, grooming, but there were those, in which the arable farming was dominant, instructed by the order such as the Benedictine. The order, beside the obligatory religious action, the arable farming was very important for them. The farming and the landscape forming are in a tight context with each other, and I going to write about this connection.

## MATERIAL AND METHOD

In the first step I made a historical research in this topic to deal with it thoroughly. I studied the literature of the order's history and formation, their appearance in Hungary, in particular regarding Pannonhalma. I chose Pannonhalma for the sample area, because it was the first monastery in Hungary, and also has been the centre of the Benedictines since the beginning. The research followed in this the map collection and in the archival for the pilot place, to prove the description with visual material.

## RESULT

The scenery comes through a continuous transformation as the result of human activities. In the area where the humans appear, the original function, facade and significance of the landscape will change. The settlement of some orders and during the following centuries, one aspect was to ensure their livelihoods. The settlement of the orders is area specific. There is a Latin proverb: „Bernadus valles, montes Benedictus amabat, oppidia Franciscus, celebres Ignatius urbes.”, so Benedick liked the mountains, Bernat liked the valleys, Francis the cities, and Ignac liked the big cities. (Gecse, 1995) The position influenced their scope of activities, including their impact, on the landscape. A great emphasis was laid on the farming, and the adapting to the conditions, and onto its maximum utilisation. The agriculture, the grape- and fruit growing, the animal farming or the fishery enjoyed priority depending on the orders or conditions. Great St. Basil wrote in her book, *Life rules I. that:*” First of all /we have to choose/ farming, because it provides the food for our existence...” (I. Aszk 38.). St. Benedict’s wish was that his followers settle down on a place, and make their environment human, as a result, the Benedictines cultivated the land across Europe, drained swamps, made purposeful farming, created flourishing agriculture. St. Francis of Assisi and his brother had brotherly relationship with the nature, but they did not want convert it, just to live in it, praise God for it. By the vow of poverty they had a commitment, to treat the material goods with respect, not to own them, but to use them properly. (Puskely, 2006) “But the servants of the Church were not only the providers of spiritual goods. They were educators, leaders of the people at farming too... They destroyed forests, dried out marshes, dug channels... Villages were generated. “- wrote Menyhért Érdújhelyi (Érdújhelyi 1903, 3).

The farming and the landscape forming are in a tight context with each other, especially this is true for the Benedictines, because bleak, uninhabited areas were made rank, their monasteries were built, so the landscape was formed and changed. These changes are important, and not only at that time, but the forthcoming time they have had effect. I will illustrate my statements with domestic example.

The watchword of abbeys is „Cruce et aratro” at the Benedictines that is with a cross and with a plow. The Benedictine monasteries established flourishing agriculture in a short time all over Hungary. (Puskely, 2006) The centre of the national Benedictine order is Pannonhalma, which is the earliest founded monastery. It was founded Grand Prince Géza in 996, but that work was finished by St. Stephen. (Romhányi, 2000) The farming was on the St. Martin’s Hill and the surrounding area from 11<sup>th</sup> century, bottom of the slope and in valleys it was arable cultivation, within three-crop rotation was applied the, while on slopes there were vineyards. (Puskely, 2006) The constant development was interrupt by the Tartaric invasion, the Turkish invasion, and the regulation of Joseph II. In 1802, the order was reinstated, and the new task of the Benedictine was the education of the youngsters. The system of the order was changed, because the teaching became more prominent, so the agriculture was relegated in the background. (Gecse, 1995) In the 1-4. Figure we can trace the change of the landscape.

On a 1680 depiction (Figure 1) the monastery’s building is well discernible. The depiction was made after the expulsion of the Turkish, and accurately reflects the fact, that during the occupation the area was completely deserted the nature took control of the area. The

settlers broke up virgin lands again, but the growing population prompted them to make many great cultivated areas. Especially the forests' clearing was severe in the end of 18<sup>th</sup> century. The new lands were taken away from forests, pasture, fields and completely useless areas. The names show this as well: Old Pines, Forest bottom, Flat, Little Field. The grapes were replanted, and planted them to new areas. The wine-growing was the main occupation in this area. The pace of development was fast. The cultivation methods and pace were adjusted to the needs and capabilities (Tóth, 1998) Some houses surrounded the abbey at the foot of the mountain, and in the surroundings and in the hills there are fields. The settlement due to the presence of the order, because the viable places have strength to modulate the settlement, which would suffer from the shocks, but did not disappear, but re-populated, and they were blooming again duly for the presence of the order. (Tóth, 1998) The appearance of a settlement means a considerable change in the landscape, as the settlement appears a new landscape element, the load of the landscape grows furthermore, the numbers of people living there were growing, their livelihoods had to be ensured, so the new land had to be taken into cultivation. The following representation is the first military survey (Figure 2), it was made in 1784. It can be seen how much development and transformation had been in this area. The settlement was continued to grow, in the hill the viniculture was carried on, and while in the surrounding areas there are fields, and on the not arable, steep slopes there was woods. In the Benedictine observed the development of the fishponds. The river, at the foot of the mountain, was inflated in several places. The second military survey was made in this area between 1846-47 (Figure 3). The areas of the viniculture were grown, this shows, that this area was suitable for this agriculture. The damming were continued to increase, because the number of the abbey increased constantly, so that more produced food was needed. The 1880 survey (Figure 4) shows, that the area of the vines was reduced, but it defines the landscape still. The damming disappeared, a swampy, moorland area took shape on its place. The landscape changes show that other values came into the foreground. Today, in Pannonhalma the farming activity is minimal besides the teaching (growing herbs, lavender plantation).

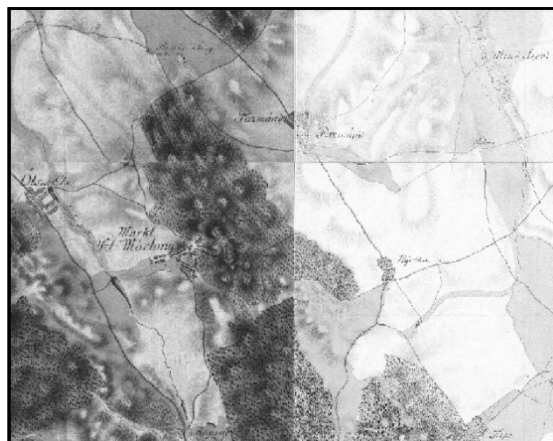


**Figure 1: The abbey in 1680 (Benedictine monastery on St. Martin-Hill)**

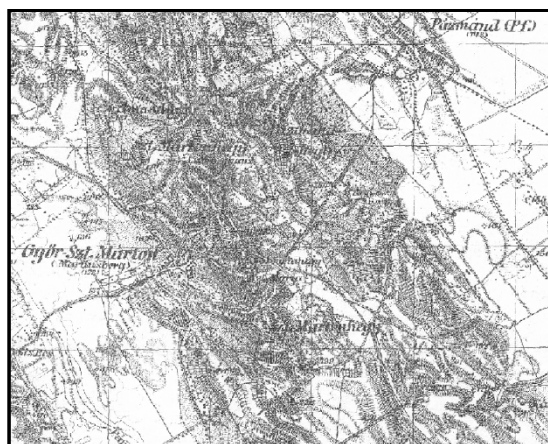
Source: Iconismus astorum urbium et regionum Hungariae ex Museo Hungarico, Depiction



**Figure 2: Pannonhalma and its neighbourhood in the first military survey**  
Source: The first military survey, 1784, VII 14



**Figure 3: Pannonhalma in the second military survey**  
Source: The second military survey 1846-47, XXVII 50



**Figure 4: Pannonhalma in the third military survey**  
Source: The third military survey, 1880, 4959/4

## CONCLUSIONS

Trough the demonstrated domestic and foreign example it can be seen, that farming and landscape forming are connected to each other, but its significance, his measure change continuously. Initially the aim was, the interest of the assurance of the self-sufficiency, the more land was feature of under cultivation, this activity in the case of the Cistercian was well organized and planned, for all works had the aim and its way. The initial changes were the biggest changes in the landscape, because, where earlier forest or barren was, the monastery was built, and they made tillages and fishponds. With the sapping of the time these not as strange landscape elements, but they appeared as the elements defining the character of the landscape, and the newer interventions meant the changes. In the course of the centuries the landscape changed, because the habits, the values and the order it-self working was transformed, so the farming, what was the main source of living, was sidelined onto 20<sup>th</sup> century, the neighbourhood was populated duly for the processes of urbanization, and other revenue sources provided the living for the order. The agricultural landscape characteristics disappeared by today, in some places its traces can be found, the 21<sup>th</sup> century shaped and formed values and landscape took it over.

## REFERENCES

- ÉRDUJHELYI M. (1903): Influence of the monasteries and companions in the agricultural development in Hungary before Mohács. Budapest.
- GREAT ST. BAZIL: Liferules I. Translator: Orosz, László. 1991. Nyíregyháza.
- GECSE G. (1995): The history of monasticism. Seneca.
- Iconismus astorum urbium et regionum Hungariae ex Museo Hungarico, Depiction 30.
- Puskely M. (2006): The glossary of the Christian monasticism. Kairosz.
- ROMHÁNYI B. (2000): Monasteries and companion chapters in the medieval Hungary. Budapest, Pytheas.
- The first military survey, 1784, VII 14
- The second military survey 1846-47, XXVII 50
- The third military survey, 1880, 4959/4
- TÓTH, J. A. OSB. (1998): The history of farming in Pannonhalma in mid-18<sup>th</sup> century. Pannonhalma, Bencés Kiadó.



## **ROLE OF INHABITANTS LIVING OUTSIDE OF TOWNS IN RURAL AREAS**

**GÁLNÉ, HORVÁTH ILDIKÓ**

Németh László Gimnázium és Általános Iskola  
6800 Hódmezővásárhely, Ormos E. u. 18.  
[horvi967@freemail.hu](mailto:horvi967@freemail.hu)

### **ABSTRACT**

Since collectivization of the agriculture in the past few decades, scientific literature defines the population living outside of towns or villages agriculture peasantry. It is false, because it was not an occupational construction any more; all of them all changed a lot in the look of commerce. The peasantry got its share of a determining role in the Hungarian society's establishment in the course of the centuries; let it be an economy, sociology, a tradition, e.g. The last changes of twenty years did not let the farms untouched. New inhabitants arrived and others left this form of living, therefore nowadays it shows a quite heterogeneous picture to us considering their occupation, their conduct, their social role, appeared on the farms.

By today everything has changed a lot from the aspects of both employment structure and farming activity. From the beginning of the 60s, for their children the school became the most important channel of social mobility.

Its role was increased by two factors, on one side mechanical and technological development together with industrialization, on the other side termination of private estate property which cancelled the question of inheritance. The young generation finishing schools meant the labour supply. They generally finished trade or technical schools. These young people did not move back to their parents' home, to the farm. They stayed in the town, started a family there and though they helped parents with the seasonal work, their children have become alienated from both this way of life and this view of life.

The peasantry had a considerable role in formation of the Hungarian society throughout the centuries in the fields of economy, sociology, traditions etc. Changes in the last twenty years could not leave the farms untouched. There are new inhabitants on farms who can give a fairly heterogeneous picture regarding their trades, way of living or social role.

**Keywords:** infrastructural conditions, population on farms, public security, resort farm, farm for agricultural production, dwelling farm

### **INTRODUCTION**

2% of the country's population live on farms which is 6-8% of the inhabitants of the Great Plain. It means that the farms give home for about 200.000 people, as well as means of subsistence, place of recreation for some, and the feeling of freedom for the others. (UHLIG R. 2008)

Social-economic judgement of farms has not been definite since the beginning of their existence. There were several pros and cons about their grounds. For the last 150 years the opinions have been varying meanwhile farms have been disappearing and appearing on the Great Plain.

## **MATERIAL AND METHODS**

Putting the question of grounds away it is a fact that the populations who live there form, with their activity, an organic part of the Hungarian population and similarly to the inhabitants of closed settlements take their share in the everyday life of the country regarding both economic and social factors. All in all, it is important to keep in mind the question: is it reasonable to support the survival of farms as a unique settlement and economic unit, or to leave them alone in the flow of globalization?

## **RESULTS AND DISCUSSION**

Regarding the formation of farms on the Plain it is necessary to lay it down that the towns with enormous outskirts had the most extended farm system. After the Turkish rule in the confines of the reviving settlements, periodically inhabited dwellings were built with the aim of cattle raising, then later so-called gardens were formed where plants were cultivated. This way of life meant a double bind. By home they meant the house in the market-town for grandparents who could not work any more or for the children who went to school there. Meanwhile „in the farmhouse only the peasant family members lived from springtime till nature’s repose” (SZENTI T. 2001) who moved to the town house for winter, in the break of agricultural work.

In the last third of the 19th century the farm system on the Plain developed into a „world of farms” (SZENTI T. 2001). With the fragmentation of the lands, which is the result of distribution between heirs, the connection with the town loosened and so not every farm family had a house in the town. At the turn of the 19th and 20th centuries the third part of the population lived on farms in the outskirts of market-towns. (SZENTI T. 2001) Dwelling and working place formed a unit that time where the peasant families cultivated plants and raised animals, selling their extra crop and livestock.

A special connection was formed between the town and its outskirts. Products of the guilds in market-towns and goods produced on farms were exchanged in the weekly markets and in the annual fairs. However, reality was never so ideal. Administration of the matters on the side of people living far from the town, schooling of their children (elementary schools), the condition of dirt roads; all of them emerged as just claims which were not solved by the leaders of the towns, although even the farm population took part in the general and proportionate sharing of taxation. Thus, it can be easily understood that it meant tension between the town and farm population.

„(the farmer) Wants to have a better road, wants to have an access to the postal services at least twice a week, wants the doctor to consult out on the farms...These are not really revolution wishes but strives to make just claims fulfilled for those financial support which is scraped together with much effort and with honest work from year to year by the Hungarian on the farm for the sake of the inner-city area” (GESZTELYI NAGY L. 1932).

In decades coming after this, life of the population in the outskirts did not become easier, in spite of the fact that schools were built in the world of farms. However, a great number of questions was not solved, thus for example, health and vet provision which could be found only in the village or in the town, maintenance of dirt roads and in several places even their development were abandoned.

After the Second World War a great number of poor peasant families could obtain a plot with land distribution, the long-time wished small estates could secure the living, the farm buildings were renovated, and houses were built on empty plots.

However, collectivization in the 50s destroyed the development of the farm system. That time it was forbidden to build new buildings, it was only possible to mend the older ones. (SZENTI T. 2004)

To sum it up, „the earlier social-economic basis of the existence of farms has vanished, and as a result the process of destruction has started”. (BECSEI J. 2002)

This process is still in progress, the bigger part of the farm population have moved to the nearby settlements, they have given up their earlier way of life and found work in factories. The older ones worked as unskilled or semi-skilled workers, the younger ones and children learned trades, the ones with excellent faculties graduated at a university or college. Among the farm population of the Plain the re-groupment of occupation passed off in a clear and direct way.

The much more comfortable way of life in towns, the infrastructural supply of higher level contributed so much to the diminution of population in the outskirts that some sociologists foreshadowed the final disappearance of the Hungarian farm system. (HORNYÁK S. 2009)

During the years of the political transformation a lot of people expected a kind of Renaissance of the farms. After dissolution of the co-operative farming system a lot of people moved to the farms. They made the effort to put the old, raunchy buildings into a habitable state, while the wealthier ones built new houses.

However, fate of farms did not change. Composition of the population in the outskirts is considerably homogeneous, so are their economic and financial situations. There is a lack of the necessary professional knowledge, the necessary capital and it is a frequent problem that certain layers are not interested.

Public security has ceased on farms, house-breaking and burglary are both frequent, so are theft, and production of forbidden products.

The specialty of the man-made environment on the Plain is the alternation of ruined, abandoned farmhouses and modern palace-like buildings.

In spite of these facts there is a change in migration of population. While, in earlier times people migrated from the farms or villages into the towns, nowadays this direction seems to turn round.

Examining the composition of the population on farms, we have to take into consideration several factors. First of all, the age composition seems to be important. 100-150 years ago, at the beginning of formation of farms, people at active age lived on the farms, while the older ones and children in the town.

From the 1950s only those workers at active age stayed on their farms who were somehow in connection with the land, working either at the local co-operative farm, or at the state farm, or in the town having a farmhouse together with a household land around it. In their case, even after formation of extensive farming, their household, much-demanding farms did not disappear. These families very often had a house in the town, in the nearby village where their old parents or children at school-age lived. It was typical of families who did not have an access to an elementary school in the outskirts.

In the 80s the original population grew old or died and their farmhouses were sold. These buildings were frequently bought by families who lived in the town-mostly in blocks of flats- with the aim of recreation or farming. The majority of these farms was inhabited provisionally at the weekends or during vacations. To the farms used for agriculture the

owner went every day to feed the animals but not even these dwellings had permanent inhabitants.

In the years after the political transformation the population on farms increased. A part of the inhabitants of today's farms moved to the outskirts to take possession of the lands got back with compensation. Those with capital and professional knowledge established farms, horse and resort farms which work very well nowadays. Only these types of farms have a real chance to survive. (CSATÁRI et. al.2005)

Those with a smaller amount of capital, agrarian problems in connection with selling agricultural goods make production, life of farms impossible. There is no chance to improve the machine stock with the lack of capital. The lack of the suitable business federation of the farmers endangers the existence of their farms and their life there.

Others bought habitable farms in hope of cheaper living: lower general expenses, food that can be grown in the kitchen garden etc. Some of these farms have been renovated and they are inhabited even today with the hope of being able to move back to the town after saving some money. Other buildings, being in a dangerous state, were abandoned by their new dwellers that moved back to the town to live in lodgings or temporary accommodation. Families who live in the social peripheries, in hard conditions belong to this group. (SZENTI T. 2004)

The older people who experienced the storms of the farm history in the last 40 years belong to the group of farm population which is in the most difficult situation. It is not their fault that their income is low, their dwellings are worthless and condemned, since because of their low income they cannot afford moving into the nearby settlements. What makes their situation even worse is that the infrastructural supply of their immediate environment is low; there is often the lack of even the fundamental services (electricity, road etc.). Their possibilities are limited and since they are stuck to their homes it is impossible to change their situation. All of these violate the interests of their everyday life because their environment not always and in not everything ensures to live the way of life which would follow from their social situation or which they would deserve. In their case social welfare and support would have an important role.

Role of the population on farms filled in society is undisputable. They have always played an important role in the circulation of country life with the agricultural products, taxes, surtaxes (GESZTELYI NAGY L. 1932), traditions and professional knowledge. During agricultural collectivization both the co-operative and state farms were started with their personal belongings (machines, draught animals), livestock, besides their labor force and lands.

From the beginning of the 60s, for their children the school became the most important channel of social mobility. Its role was increased by two factors, on one side mechanical and technological development together with industrialization, on the other side termination of private estate property which cancelled the question of inheritance. The young generation finishing schools meant the labor supply. They generally finished trade or technical schools. These young people did not move back to their parents' home, to the farm. They stayed in the town, started a family there and though they helped parents with the seasonal work, their children have become alienated from both this way of life and this view of life.

## CONCLUSIONS

The public opinion regards farms as appealing, romantic places which are condemned to death. After the political transformation glimmered the hope for a short while that they would regain their earlier, almost utopist function. It is known that it is impossible because of the lack of both the suitable infrastructure and services. If these two factors are not improved, it is beyond question that the farms cannot survive. Thus, it is exposed to danger that the typical culture landscape on the Great Plain will soon disappear.

While in the western part of Europe the population migrate from the towns to the country, in Hungary it is not ensured to provide the existing values, farms with good economic and touristic conditions even the most fundamental provisions.

It is a complex task to solve these problems and politicians, settlement researchers, the farm-college have summarized the most important tasks. Thus, besides development of the infrastructure and basic provisions, it should be discussed how to improve the public security of farms, and in some parts of the Great Plain the real business federation of population in the outskirts has not been solved. It is necessary to create the conditions of sustainability taking the different natural-economic conditions of the regions with farms into consideration.

## BIBLIOGRAPHY

- UHLIG R. (2008): Magyar Tanya. VKSZI Magyar Tanyakert Programiroda hirlevele, 2008.01.15.
- SZENTI T. (2001): Tanyarendszerunk multja es egyik jovokepe. Hitel, 2001.8. pp. 68-79
- GESZTELYI NAGY L. (1932): A tanyavilag es nepe. Nyugat, 1932.21.szam
- SZENTI T. (2004): A tanyalakok lelki egeszsege. Hitel, 2004.6. pp.47-63.
- BECSEI J. (2002): A tanyarendszer jovobeni alakulasara ható tényezok, Magyar Tudomány, 2002. 9.
- BARTHA SZABO J. (2002): Nemzeti feladat – lenne – a tanyak es tanyas tersegek megorzese, fejlesztese! <http://www.gondola.hu/cikkek/65265>, 2010.07.29.
- HORNYAK S. (2009): Tanyak feluton. Uj Magyarország Vidékfejlesztési Program.Videkjáró <http://www.umvp.eu/?q=magazin/tanyak-feluton>, 2011.02.21.
- CSATÁRI B. ET. AL., SZERK. KANALAS I. (2005): A homokhatsagi tanyak jelene es progresszivitásuk kérdesei, MTA RKK Alföldi Tudományos Intézete Tanyakutatás 2005. Kutatási jelentések, 5. füzet, Kecskemét

## **IMPLICATIONS OF RURAL AREAS AND DEMOGRAPHY IN THE DÉL-ALFÖLD REGION**

**BODNÁR GÁBOR**

Szent István University Economic Faculty  
Institute of Economic Science  
5600 Békéscsaba, Bajza street 33.  
bodnar.gabor@gk.szie.hu

### **Abstract - Implications of Rural Areas and Demography in the Dél-Alföld Region**

This present essay of mine examines demographic aspects of the Dél-Alföld NUTS 2 level region. Having read relevant scientific literature, I define the urban and the rural territorial units, making it possible to examine the qualities of such categories. Micro regions constitute the fundamental units of my research. Micro regions then are subjected to factor-analysis with an emphasis on the demographic conditions. My analysis is descriptive and it seeks for the understanding of the complexity and diversion of current demographic processes in the area. The contrast of urban and rural prosperity is highlighted. My analysis investigates a complex and important current issue.

**Keywords:** rural areas, demographic analysis, complexity, Dél-Alföld region

### **INTRODUCTION**

Omnipresent processes of urbanization that has been occurring continuously since the beginning of the twentieth century has two particular characteristics in terms of territorial structural aspects. These are the urban and the rural qualities (CSATÁRI 2001). CSATÁRI (2000) states that global urbanization does not benefit evenly these as the latter is always at the “far end” of the processes, in other words, it is the loser of globalization.

BARANYI (2004) elaborates that economic transition induces deep territorial crisis which has been on since the transition began. One of the important features of such a phenomenon is the lag of Hungary’s eastern half which is represented by countless indicators. Territorial units in Alföld have clear manifestations. Statements of BARANYI (2004) are definitely true for a particular part of Alföld, that is, Dél-Alföld.

In Hungary’s current state, agriculture is still a dominant field in comparison to developed Western European countries and regions. In these too rural regions the level of joblessness is high in every age group nevertheless its intensity differs a little bit. What is more, educational attainment is rather low in general. On the top of that, citizens are aging there and the population is decreasing. This decline started earlier in Dél-Alföld than elsewhere in the country and the process has become dynamic since the 2000s (BALCSÓK 2009).

This situation initiates the emerging importance of researches that shed highlight on demography and its changes. Another reason for greater focus on the topic is that demography has a very tight relationship with geography, meaning that economic geography cannot neglect demographic attributes (GYÉMÁNT-KATONA 2010).

Demographic changes are the key ingredient to the understanding and prediction of social changes (AMCOFF-WESTHOLM 2006). AMCOFF and WESTHOLM (2006) believes that it is the age element of societies that lets us read social and economic indicators.

GYÉMÁNT and KATONA (2010) adds the idea that demographic manifestations are outcomes and causes at the same time. However, we cannot consider these two processes as equals, since disposable data show only a moderate correlation between GDP per capita and mortality rate.

AMBROSIO-ALBALA and DELGADO (2008) highlights the importance of societies' participation in rural development when stating that the basis of territorial development strategies should be rural areas as social constructions, concluding from prior development programme failures.

Society and especially the ratio of its components is quite disadvantaged. Small settlements and villages tend to decay with a growing intensity. Furthermore, the inhabitants of such areas make an eroding society technically, that is, a decrease of the population in a way that cannot be stopped, let alone reversed (L. RÉDEI 2001).

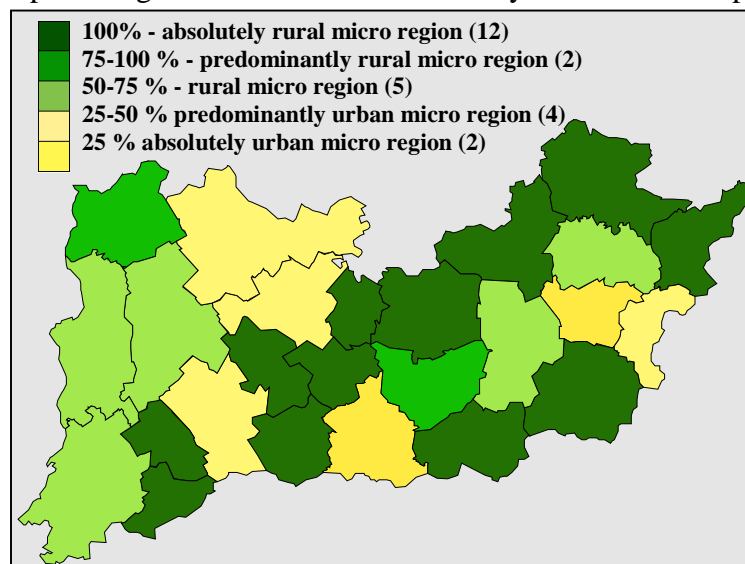
This aforementioned process, resulting from demographic structure, is also present in the Dél-Alföld region according to BARANYI (2004) as he examines a greater territory, i.e. the whole Alföld. He concludes that there is no positive social impact in the region apart from local patriotism (both mentality and identity). This emerges a need for the examination of demographic content of the so-called poor rural areas in comparison to urban regions.

## MATERIAL AND METHOD

The actual meaning of the quality 'rural' can be defined according to the size, functions, artificial environment of these territories, however, since cities can be defined in a way that is far more obvious, we can consider villages as non-city settlements and rural areas as non-urban areas (CSATÁRI 2001).

### **Defining the types of the micro regions in Dél-Alföld**

The analysis that draws the distinction between rural and urban micro regions (urban/ rural index) can lead to the creation of the type of the micro regions. Figure 1 shows relative number of people living in settlements with a density lower than 120 per km<sup>2</sup>.



**Figure 1: Rural and Urban micro regions in Dél-Alföld in 2009**

CSATÁRI (2001) believes that it is reasonable to lower the standard OECD measure from 150 per km<sup>2</sup> to 120 to distinguish between rural and urban areas in the case of Hungary.

By doing so, we can categorize the Hungarian micro regions into these two groups. The index lets us tell the ratio of the population living in a settlement with a population density less than 120 per km<sup>2</sup> in each micro region.

As a result (see Figure 1), the micro regions of Dél-Alföld are categorized either as urban or rural. There are two micro regions which are definitely urban whereas other 4 are city-like. On the other hand, 12 of the total 25 territorial units qualify as absolutely rural. Two of them are particularly rural, while 5 has rural features.

### **Method of data reduction**

I obtained data from the TEIR online database. During the selection of relevant data, I took the *67/2007. (VI.28.) decree as the normative basis*. In practice, Hungarian micro regions are categorized by their state of development and define their need for financial support according to this item (KSH 2008).

None of the five indicator groups included in this decree has a name that indicates demographic content but taking a closer look at each bunch, it becomes clear that demography related data are present and have a quite important role. Furthermore, if we take a look at former decrees (*e.g. 30/1997. (IV. 18.)*) or scientific results (CSATÁRI 1999), we find that the then used demographic group of data partly overlaps the ones that are used now, the difference only being their alignment or classification to groups.

This present study involves three indicators from the aforementioned government decree (OGY 2007) with regard to the OGY 1997 and its revision (CSATÁRI 1999).

These are:

1. *Migration discrepancy: mid-term average, persons per 1000, 2006-2009*
2. *Mortality rate (deaths per 1000 inhabitants), pcs, 2009*
3. *The ratio of the population older than 60 to the whole, %, 2009*

I used factor-analysis to process the indicators. This dimension reductive method is typically used when greater number of determinants is at play but it works with my three components as well.

This method has few prerequisites concerning the items to be used, one being correlation between the data. I carried out each of these analyses and the results permitted the use of factor analysis.

For the analysis, I used a statistics software called SPSS which is widely recognised according to the number of works that examine its methodology (KETSKEMÉTY – IZSÓ 2005; LENGYEL – KATONA 1999; NEMES NAGY 2005, 2007). The above mentioned 3 series of data have become one, making it possible to group the micro regions according to their factor value. Then I used EuroOffice 2008 for the depiction of the results.

*The most suitable method to categorize the micro regions would have been cluster analysis but in this case, because of the small number of items, I did not consider it reasonable. Those could simply be sorted into five groups based upon their factor values.*

I give these groups names: *Most developed micro regions, Relatively developed micro regions, Slightly developed micro regions, Undeveloped micro regions, Most undeveloped micro regions.*

Hence, based on these results, I obtained an extensive picture concerning the demographic qualities of the Dél-Alföld region which also allows me to assess the status of rural areas.



## RESULTS

The number of developed (in demographic terms) micro regions in the Dél-Alföld region is very small. Altogether, there are two areas, namely the Kecskemét and Szeged micro regions where demographic conditions are favourable. This actually means that they are far above the average in the region, as they have rather good results in all the three included indicators. Kecskemét micro region leads the list (Table 1), its first place can be attributed to its youthful population, which in statistical terms means a lower rate of inhabitants older than 60 to younger than 60.

**Table 1: Demographic rank of micro regions of Dél-Alföld in 2009**

<i>Rank</i>	<i>Micro region</i>	<i>Rank</i>	<i>Micro region</i>
<b>1</b>	Kecskemét	14	<b>Szeghalom</b>
<b>2</b>	Szeged	15	<b>Szentes</b>
<b>3</b>	<b>Hódmezővásárhely</b>	16	<b>Kalocsa</b>
<b>4</b>	Békéscsaba	17	<b>Makó</b>
<b>5</b>	Kiskunhalas	18	<b>Orosháza</b>
<b>6</b>	Kiskunfélegyháza	19	<b>Sarkad</b>
<b>7</b>	<b>Kunszentmiklós</b>	20	<b>Kistelek</b>
<b>8</b>	<b>Mórahalom</b>	21	<b>Szarvas</b>
<b>9</b>	<b>Kiskőrös</b>	22	<b>Bácsalmás</b>
<b>10</b>	<b>Baja</b>	23	<b>Csongrád</b>
<b>11</b>	<b>Kiskunmajsa</b>	24	<b>Jánoshalma</b>
<b>12</b>	<b>Békés</b>	25	<b>Mezőkovácsháza</b>
<b>13</b>	Gyula		

Source: own calculation from TEIR data

*Table 1 shows the demographic rank of all 25 micro regions of Dél-Alföld region, which is based on my multiple analysis of three demographic indicators. Table 1 does not include factor values because those have no numeric meaning but only serve the rank order. Rural micro regions signed bold letters.*

The micro region of the third county's centre is the fourth in the list which means to be placed in the next group among four other relatively developed micro regions.

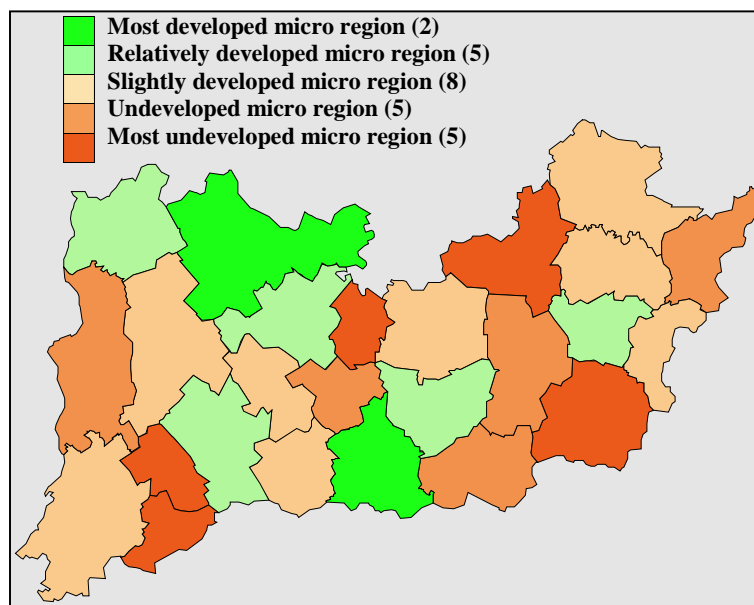
Four out of the total five in this group are micro regions, centred by middle-sized cities: Békéscsaba, Hódmezővásárhely, Kiskunfélegyháza and Kiskunhalas.

Therefore it become obvious that micro regions with greater cities count as developed or relatively developed according to their demographic conditions.

These are similar in a way that their mortality rate and the rate of mature people are not much worse than those of the leaders. On the other hand, their migration balance clearly determines their second-class position. Although this indicator of Hódmezővásárhely micro region is positive, it is only a slight plus, while the other three (Békéscsaba micro region, Kiskunfélegyháza micro region and Kiskunhalas micro region) have negative balance. Interestingly, Kunszentmiklós micro region appears at the fifth place in this second group. Despite the fact that it is only the last one in its group, it clearly belongs there, regardless its rural quality according to its urban/rural index. It can be thus

concluded that despite its rural feature it has almost as favourable indicators as the micro regions which have middle-sized or bigger cities.

The remaining three groups comprise only rural micro regions. These constitute far less prosperous demographic conditions in relation to the former group, a fortiori the first one. Eight micro regions are placed in the group of slightly developed micro regions, making it the biggest group of territories. These are all rural areas, although not all to the same extent. In terms of migration balance, Mórahalom micro region has the only positive value which is not significant. The micro region of Gyula is the second with a slightly negative balance whereas the rest six obviously deal with migration to other areas. Mortality rate can be considered as average in all of the micro regions in this group. Unfortunately though, the rate of the mature population is quite adverse. This is the indicator that determines the position of most of the micro regions (Figure 2).



**Figure 2: Demographic development of Dél-Alföld micro regions in 2009**

Source: own creation from TEIR data

The last two groups include five micro regions each. These are the most undeveloped areas in the territory of my research. The last group contains micro regions with a mortality rates equal to sixteen per mill or higher along with high rates of maturity, numbering nearly a quarter of the population. The group is most heterogeneous in terms of migration, which obviously determines Mezőkovácsháza micro region's last place.

## CONCLUSIONS

To sum up, Dél-Alföld region has absolutely distinct micro regions in terms of demographic conditions according to the urban/rural index. Every urban micro region is situated in the first two categories, indicating their developed features. On the other hand, virtually all rural micro regions appear to be undeveloped or underdeveloped. The only exception to this is the micro region of Kunszentmiklós, which, in spite of being a rural area, it is a relatively developed micro region. Hence its place is among the urban micro regions in the relatively developed group.

The majority of the micro regions in Dél-Alföld can be considered as average. There are only few with outstanding (2 micro regions) or conspicuously weak (5 micro regions) results. All the same, all of these average territory units are rural, which implies the fact that rural features and demographic disadvantages are closely related in Dél-Alföld. In addition, the difference between rural and urban micro regions becomes even sharper if we consider the absolute lag of the five micro regions in the last group. The difference is far less vivid between the micro regions of first and the second or the third and the fourth development category. This means the absence of a concrete and general relation between the degree of being developed and the degree of being urban in the case of these relations.

## REFERENCES

- 67/2007. (VI.28.) OGY határozat a területfejlesztési támogatásokról és a decentralizáció elveiről, a kedvezményezett térségek besorolásának feltételrendszeréről  
(30/1997. (IV. 18.) OGY határozat a területfejlesztési támogatások és a decentralizáció elveiről, a kedvezményezett területek besorolásának feltételrendszeréről
- AMBROSIO-ALBALA, M. – DELGADO, M. (2008): „Understanding rural areas dynamics from a complex perspective. An application of Prospective Structural Analysis”, 12th EAAE Congress, Gent (Belgium), 26-29 August 2008. Online. Available: <http://195.0.30.90/EAAE/delegates/414.pdf> (accessed 20 february 2011)
- AMCOFF, J. – WESTHOLM, E. (2006): „Understanding rural change – demography as a key to the future”, *Futures*, 39, 4, p. 363-379. Online. Available: [http://www.sciencedirect.com/science?\\_ob=MIimg&\\_imagekey=B6V65-4M0J4RP-1-H&\\_cdi=5805&\\_user=642170&\\_pii=S0016328706001285&\\_origin=browse&\\_zone=rslt\\_list\\_item&\\_coverDate=05/31/2007&\\_sk=999609995&\\_wchp=dGLbVtb-zSkWA&\\_md5=cb65dbb37fb2e8dc6be626b66e938ebe&\\_ie=/sdarticle.pdf](http://www.sciencedirect.com/science?_ob=MIimg&_imagekey=B6V65-4M0J4RP-1-H&_cdi=5805&_user=642170&_pii=S0016328706001285&_origin=browse&_zone=rslt_list_item&_coverDate=05/31/2007&_sk=999609995&_wchp=dGLbVtb-zSkWA&_md5=cb65dbb37fb2e8dc6be626b66e938ebe&_ie=/sdarticle.pdf) (accessed 20 february 2011)
- BALCSÓK I. (2009): „Társadalmi jellemzők a Dél-Alföldön” In: NAGY G. (ed) Dél-Alföld, Dialóg Campus, Pécs–Budapest
- CSATÁRI B. (1999): „A kedvezményezett kistérségek besorolásának felülvizsgálata”, MTA RKK, Kecskemét.
- CSATÁRI B. (2000): „A vidéki sokszínűség és a magyar területfejlesztési kistérségek”, In: KOVÁCS T. (szerk.): Integrált vidékfejlesztés: V. Falukonferencia, MTA RKK, Pécs, p. 441-449
- CSATÁRI B. (2001): „A vidék földrajzi kérdései”, In: DORMÁNY G., KOVÁCS F., PÉTI M., RAKONCZAI J. (szerk.): A földrajz eredményei az új évezred küszöbén, SZTE TTK Természeti Földrajzi és Geoinformatikai Tanszék, Szeged, p. 1-9  
<http://geography.hu/mfk2001/>
- GYÉMÁNT R. – KATONA T. (2010): „Demográfia”, Pólay Elemér Alapítvány, Szeged
- KETSKEMÉTY L. – IZSÓ L. (2005): „Bevezetés az SPSS programrendszerbe”, ELTE Eötvös Kiadó, Budapest
- KSH (2008): „Tájékoztató a kiemelten támogatott kistérségekről 2008”, KSH, Budapest  
<http://www.ksh.hu/pls/ksh/docs/hun/xftp/idoszaki/pdf/kistersegimutato.pdf>
- L. RÉDEI M. (2001): „Demográfia”, ELTE Eötvös Kiadó, Budapest
- LENGYEL I. – KATONA T. (szerk.) (1999): „Statisztikai ismerettár”, JATEPress, Szeged

NEMES NAGY J. (szerk.) (2005): „Regionális elemzési módszerek”, ELTE Regionális Földrajz Tanszék, Budapest

NEMES NAGY J. (2007): „Kvantatív társadalmi térelemzési eszközök a mai regionális tudományban”, Tér és társadalom, 1, p. 1-19

***SECTION 2: ANIMAL SCIENCES AND WILDLIFE MANAGEMENT***

**Moderátorok/Moderators:**

Prof. Szűcsné dr. Péter Judit

Prof. Dr. Özkan Elmaz

**Secretary:**

Barta Tamás

## **HABITAT USE OF ROE DEER IN A FLOODPLAIN FOREST AND THE NEIGHBOURING AGRICULTURAL AREA**

**TÓTH BÁLINT, BLEIER NORBERT, LEHOCZKI RÓBERT, SCHALLY GERGELY AND CSÁNYI  
SÁNDOR**

Szent István University, Institute for Wildlife Conservation  
Páter K. street 1., Gödöllő H-2100,  
tr.balint@gmail.com

### **ABSTRACT: Habitat use of roe deer in a floodplain forest and the neighbouring agricultural lands**

The purposes of this study were 1) to determine the annual and seasonal home range sizes of roe deer captured and radio-tagged in a floodplain forest, and 2) to evaluate the habitat-use in light of the differences in vegetation between the floodplain forest and the neighbouring agricultural lands. We used one year localization data of six roe deer equipped with GPS-GSM collars in January 2007. Their home ranges were estimated with minimum convex polygon and kernel home range (with 60% and 90% probability contours) methods. To evaluate the habitat-use we also utilized the land cover map of the study area. The size of the MCP home ranges varied between 500-1000 hectares. The size of the KHRs (90% probability contours) varied between 30-120 hectares, while the core areas (60% probability contours) were between only 5-35 hectares. The core area of each roe deer contained at least 10% forested habitat; while the agricultural habitat type played a significant role only in four of the cases (the proportion of agricultural land was higher than 50% only in three of them). Significant differences were found between home range sizes and also between the proportions of the used habitat types. The results of yearly vegetation-preference calculations showed that each studied roe deer avoided the agricultural lands. Based on these results we suppose that different space-use strategies can exist among roe deer living in our study area.

**Keywords:** roe deer; home range, habitat, floodplain forest, vegetation preference

## **INTRODUCTION**

Roe deer is one of the most important big game species for wildlife management in Hungary, occurring throughout the whole country (CSÁNYI ET AL., 2003, CSÁNYI ET AL., 2006a). To widen our knowledge about the habitat use and behaviour of European roe deer, the Institute for Wildlife Conservation (Szent István University) has lead a research programme in Jász-Nagykun-Szolnok county, Hungary since 2001 (CSÁNYI ET AL., 2003, CSÁNYI ET AL., 2006a,b). Based on the results up to now, in an average year the home range of males was approx. 349 ha, while that of females was approx. 309 ha (CSÁNYI ET AL., 2009).

The aim of our examinations is to identify the extent of the yearly and seasonal home ranges of roe deer tagged in a floodplain forest and to value the habitat usage in terms of the vegetational differences, with an emphasis on the usage of floodplain forest and agricultural land. Our questions were: (1) Do the home ranges of roe deer tagged in a floodplain forest contain agricultural fields? If so, to what extent? (2) Are there some seasonal characteristics in the habitat-use if the individual roe deer visit the rural areas?

## MATERIAL AND METHOD

### The study area

The field of the research was the area of Hofi Géza Vadásztársaság Egyesület (game management unit). The size of the area is 5238 ha, with mostly agricultural fields (73.75%). Forest is only 6.56% of the studied area – mainly floodplain forests of the Tisza river, as it is the northern borderline of the area. The game management unit has excellent brown hare and pheasant populations, as well as a quantitatively and qualitatively good roe deer population.

### Capturing and marking

Capturing and tagging of roe deer took place on 17-18 January 2007 in the floodplain forest. We supplied altogether 10 animals with GPS-GSM collars (GPS PRO Light-1 Collar) which are able to provide satellite localization and use a GSM system for data transmission. The collars were made by the German Vectronic Aerospace GmbH.

### Data collection with radiotelemetry

The collars recorded localization points every three hours, which were stored on a SIM-card, and were sent in SMS format to the ground receiver through the GSM system. We then imported the localization information to the computer with Vectronic's own software. The number of localization points for each studied individual are showed in *Table 1*.

**Table 1: Data of studied roe deer and the number of their localizations in 2007**

Collar code	sex of individual	age at tagging	Number of localisation points				Sum
			Winter	Spring	Summer	Autumn	
S1	female	2 years	332	729	733	715	2509
SG1	female	1 year	333	730	736	722	2521
B1	male	3 years	338	731	731	720	2520
B2	male	3 years	331	729	735	726	2521
S2	female	2 years	331	735	718	720	2504
S3	female	2 years	329	724	723	712	2488

### Data processing and evaluation

To visualize the localization data, to calculate and represent the home ranges and to calculate the usage of vegetation types we used the ESRI ArcView GIS (Version 3.1) software. We determined the home ranges of individuals with minimum convex polygon (MCP; WHITE & GARROTT, 1990; SAMUEL & FULLER, 1996) and kernel home range estimates (KHR; SEAMAN ET AL., 1999). In our research we used 60% and 90% probability contours and we considered these areas as home ranges (KHR 90) and core areas (KHR 60). To reveal the usage of certain vegetation types we intersected the MCP and KHR home ranges with the land cover map of the research area (updated every year). This digital land cover (vectorial) map shows the various natural and artificial habitats of the area. The two main vegetation types in this study are forest and agricultural land. After the intersecting process we exported the calculated areas to MS Excel and we calculated the proportions of the usage of various vegetation types. To determine the preferred and the avoided (unpreferred) vegetation types we used Ivlev's preference-index calculation method (CSÁNYI ET AL., 2006a). The calculations have been made based on the year (2007) and on seasons. In this study we represent the data of two males, three females and one non-adult female of the ten tagged animals (*Table 1*).

## RESULTS

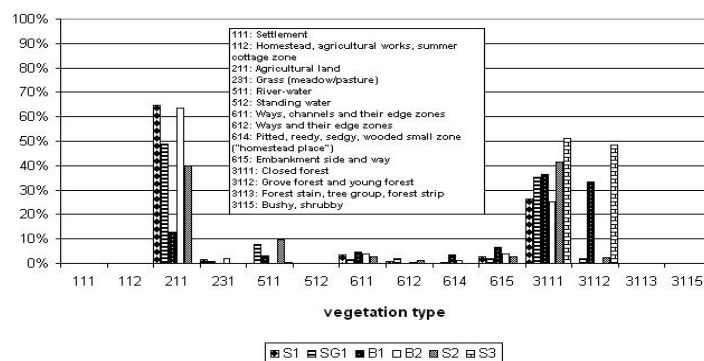
### The size of yearly home ranges and the proportion of used vegetation types

The size of the MCP home ranges varied between 500-1000 hectares (Table 2). The size of the KHR (90% probability contours) varied between 30-120 hectares, while the core areas (60% probability contours) were only between 5-35 hectares.

**Table 2: The sizes of the annual home ranges were estimated with minimum convex polygon (MCP) and kernel home range (KHR) methods**

Collar code	Yearly		
	Minimum convex polygon (ha)	Kernel home range	
		area on 60%(ha)	area on 90% (ha)
S1	487,44	5,35	43,08
SG1	521,05	9,95	68,8
S2	1011,31	34,76	118,29
S3	620,57	10,07	33,94
B1	549,81	9,73	32,83
B2	896,27	15,13	55,62

The various vegetation types appear in different proportions in the MCPs of the individual roe deer. It was striking that agricultural lands constituted the largest area proportions in the home ranges of each studied roe deer (Figure 1.). Based on the KHR90 estimates (Figure 1.), agricultural lands dominate in three individual roe deer home ranges (S1, SG1, B2) and the other three (S2, S3, B1) show a preference for forestlands. The home range of S3 does not contain agricultural lands, but contains more than 95% forest habitat. In general we may establish that – apart from the two main vegetation types that are important for seemingly all of the examined individuals - the „ways, channels and their edge zones” and „embankment side and ways” are also essential in their home ranges. The results of KHR60 estimates were similar to KHR90, but the area proportions of dominant vegetation types became more expressed.



**Figure 1: Space-use of studied roe deers in relation to their home ranges estimated with kernel home range method in 2007 (90% probability contours)**

### The size of seasonal home ranges and the proportion of used vegetation types

The size of the seasonal MCP home ranges varied between 50-600 hectares (Table 3). The size of the seasonal KHR (90% probability contours) varied between 4-160 hectares, and the seasonal core areas (60% probability contours) were only between 1-60 hectares. In general we may establish that summer home ranges are the smallest, while the winter and



the spring home ranges are the largest. (We have to notice that roe deer marking was in January, so we had only half of the localization points in winter compared to the other seasons.)

**Table 3: The sizes of each studied roe deer seasonal home ranges estimated with minimum convex polygon (MCP) and kernel home range (KHR) methods**

Collar code	Minimum convex polygon (ha)				Kernel home range calculation							
	Winter	Spring	Summer	Autumn	Winter		Spring		Summer		Autumn	
					area on 60% (ha)	area on 90% (ha)	area on 60% (ha)	area on 90% (ha)	area on 60% (ha)	area on 90% (ha)	area on 60% (ha)	area on 90% (ha)
S1	308,24	357,13	76,35	136,32	56,91	154,9	33,38	87,52	1,24	4,5	14,76	38,64
SG1	310,95	382,43	108,76	158,76	57,62	157,34	42,26	94,75	1,91	6,11	27,17	80,55
S2	161,09	97,67	414,31	524,9	11,56	48,16	12,64	31,81	26,14	83,76	49,07	197,23
S3	133,85	531,88	54,38	131,48	11,38	24,03	7,91	18,93	3,44	21,13	16,96	46,44
B1	329,82	174,75	52,68	129,67	13,67	50,27	15,12	42,48	5,43	23,22	4,91	24,69
B2	373,15	586,18	244,19	201,01	16,35	59,32	6,44	18,66	7,8	41,04	14,77	46,26

We present the characteristics of habitat selection based the KHR 60 estimate (Table 4). The proportion of agricultural lands in the tagged roe deer home ranges were the highest in winter and spring, the lowest in summer and autumn. We have to emphasize that in the proportions of the main vegetation types in the core areas in a single season, considerable differences can be observed between the seasons and also between the individuals.

**Table 4: The proportion of habitat-types in each studied roe deer seasonal home ranges estimated with kernel home range (KHR) method (60% probability contours).**

Collar code	Yearly		Winter		Spring		Summer		Autumn	
	Agricult. Area	Forest	Agricult. Area	Forest	Agricult. Area	Forest	Agricult. Area	Forest	Agricult. Area	Forest
S1	55,13%	31,40%	49,74%	39,89%	62,71%	28,15%	13,39%	0,00%	24,82%	63,40%
SG1	66,29%	12,61%	49,31%	39,01%	69,03%	22,63%	43,68%	0,00%	29,42%	60,43%
S2	27,41%	94,92%	50,80%	43,19%	29,24%	65,57%	0,00%	87,00%	58,42%	29,64%
S3	0,00%	100,00%	0,00%	100,00%	0,00%	100,00%	0,00%	100,00%	0,00%	100,00%
B1	0,93%	60,90%	26,23%	56,47%	8,69%	77,09%	0,00%	100,00%	0,00%	98,97%
B2	59,37%	29,00%	57,19%	29,78%	84,62%	0,00%	83,65%	10,33%	37,15%	55,14%

### The results of the estimate of vegetation preferences

It is clear from the results that all the examined individuals avoided agricultural areas based on the yearly data (Table 5). This is stated in contradiction with the fact that there were individuals (S1, SG1, B2) for which agricultural areas formed the largest part of their yearly home range. Looking at the distribution of the localization points of these individuals on the map, it is visible that the localization points which are on the agricultural lands are near some kind of natural habitat patches. Examining the seasons separately, with one single exception (S1 summer), the avoidance of agricultural areas can be observed everywhere. In the yearly calculation, with one exception (S1), the examined roe deer showed a positive preference towards forest lands. However in the seasonal calculation with two exceptions (S1 summer, SG1 summer), the marked individuals preferred the forest. We also examined the popularity of all the other vegetation types. The used vegetation types were the “ways, channels and their edge zones”, “ways and their edge

zones”, “pitted, reedy, sedge, wooded small zones”, and the lawn area. Five examined individuals showed positive preference towards “roads, channels and their edge zones”.

**Table 5: Results of the yearly and seasonal vegetation-preference calculations**

individual	Yearly		Winter		Spring		Summer		Autumn	
	ac.	forest	ac.	forest	ac.	forest	ac.	forest	ac.	forest
S1	-	--	-	+	-	+	+	--	-	+
SG1	-	+	-	+	-	+	-	--	--	+
B1	--	++	--	++	--	+	-	+	--	++
B2	-	++	-	+	x	x	-	+	-	+
S2	-	+	x	+	-	+	--	+	-	x
S3	--	+	--	+	--	+	x	x	x	+

+: 0-0.49: positive preference      -: 0-0.49: negative preference  
 ++: 0.5-0.99: positive preference    --: 0.5-0.99: negative preference  
 grey cell: exception                    x cell: not significant value  
 ac: agricultural land

## CONCLUSIONS

The yearly MCP sizes exceeded the average values established in our previous examinations (CSÁNYI ET AL., 2003, CSÁNYI ET AL., 2006a,b). Based on our results the difference between MCP and KHR90 was in order of magnitude. This also means that the most important areas used by the tagged individuals are merely some ten hectares. In fact, the KHR60 areas (core area) did not attain ten hectares (!) in the case of three individuals. There were considerable differences in the home range sizes between seasons and also between individuals.

We predicted that forests play an important role in the habitat use of the observed roe deer. Taking it as a starting point that roe deer is a sylvan or gallery sylvan species of philogenetic origin (LISTER ET AL., 1998), we captured and marked them in the floodplain forest. Although there were individuals whose MCPs covered more agricultural fields than forests, this habitat type constituted the largest parts of their core areas. Each individual's core area contained at least 10% forested habitat, while the agricultural habitat type played a significant role only in four of them. However the proportion of agricultural fields was high only in three of them (at least 50%). Significant differences were found between the sizes of the individual home ranges and also between the proportions of the used habitat types. However there was one individual that spent the whole year in the floodplain forest. The results of yearly vegetation-preferences showed that each studied roe deer avoided agricultural lands and preferred the forest habitat. Numerous factors influence the habitat selection and the size of the home range: food availability and cover (TUFTO ET AL., 1996; BORKOWSKI & UKALSKA, 2008), population density (KJELLANDER ET AL., 2004), elevation of the habitat (MYSTERUD ET AL., 1999), and human disturbance (HEWISON ET AL., 2001). Based on these results we suppose that different space-use strategies can exist among roe deer living in our study area. That brings up an additional question: what defines the differences experienced in the individual habitat use and how do these differences influence the successfulness of the individuals?

## ACKNOWLEDGEMENTS

We would like to especially thank the Hofi Géza Vadásztársaság Egyesület, for providing the site of the research program. In capturing and data collection the work of the colleagues and students of the Institute for Wildlife Conservation was very important and greatly appreciated. We would also like to thank the Department of Fishery and Hunting, as well as the Ministry of Rural Development for their support of this research.

## REFERENCES

- BORKOWSKI J., UKALSKA J. (2008): WINTER HABITAT USE BY RED AND ROE DEER IN PINE-DOMINATED FOREST. *FOREST ECOLOGY AND MANAGEMENT*, Vol. 255 (3-4): 468-475.
- CSÁNYI S., LEHOCZKI R., SOLT SZ. (2003): Space use of roe deer in open, agricultural landscapes in Hungary. – *Vadbiológia* 10: 1-14
- CSÁNYI S., LEHOCZKI R., SCHALLY G., BLEIER N., SONKOLY K. (2006a): Habitat use of roe deer in agricultural habitats in the Great Plain, Hungary. – *Vadbiológia* 12: 7-20
- CSÁNYI S., LEHOCZKI R., SONKOLY K., BLEIER N., SOLT SZ. (2006b): Space use of roe deer in open, agricultural landscapes in Hungary. – Research report, Gödöllő
- CSÁNYI S., LEHOCZKI R., BLEIER, N., SONKOLY K. (2009): Habitat use of roe deer in agricultural habitats. Poster abstract of Scientific Conference, NYME Erdőmérnöki Kar, Sopron. 82. o.
- HEWISON, A. J. M., VINCENT, J. P., JOACHIM, J., ANGIBAULT, J. M., CARGNELUTTI, B. & CÍBIEN, C. (2001): The effects of woodland fragmentation and human activity on roe deer distribution in agricultural landscapes. – *Can. J. Zool.* 79 (4): 679–689.
- KJELLANDER P., HEWISON A. J. M., LIBERG O., ANGIBAULT J.-M., BIDEAU E. AND CARGNELUTTI B. (2004): Experimental evidence for density-dependence of home-range size in roe deer (*Capreolus capreolus* L.): a comparison of two long-term studies. *Oecologia*, 139: 478–485
- LISTER A. M., GRUBB P., SUMMER R. S. M. (1998): Taxonomy, morphology and evolution of European roe deer. 23-46. in: Andersen R., Duncan P., Linnell J. D. C. (editors) *The European roe deer: the biology of success*. Scandinavian University Press, Oslo
- MYSTERUD, A., LARSEN, P. K., IMS, R. A., OSTBYE, E. (1999): Habitat selection by roe deer and sheep: does habitat ranking reflect resource availability? – *Can. J. Zool.* 77(5): 776-783.
- SAMUEL, M. D. & FULLER, M. R. (1996): Wildlife radiotelemetry. 370-418. pp. - In: Bookhout, T. A. (szerk.) *Research and management techniques for wildlife and habitats*. – The Wildlife Society, Bethesda, MD
- SEAMAN, D. E., MILLSPAUGH, J. J., KERNOHAN, B. J., BRUNDIGE, G. C., RAEDEKE, K. J. ÉS GITZEN, R. A. (1999): Effects of sample size on kernel home range estimates. *Journal of Wildlife Management*, 63: 739-747
- TUFTO J., ANDERSEN R., LINNELL J. (1996): Habitat use and ecological correlates of home range size in a small cervid: the roe deer. – *Journal of animal Ecology* 65: 715-724
- WHITE G. C., GARROTT R. A. (1990): Analysis of wildlife radio-tracking data. – Academic Press, San Diego 383

## **THE GENETIC PRESERVATION OF HUNGARIAN SPECKLED HEN AND THE SPECKLED TRANSYLVANIAN NAKED NECK HEN IN HÓDMEZŐVÁSÁRHELY**

**BENK ÁKOS – VIDÁCS LAJOS**

University of Szeged Faculty of Agriculture,  
6800 Hódmezővásárhely, Andrásy út 15.  
benkakos@mgk.u-szeged.hu

### **ABSTRACT – The genetic preservation of Hungarian Speckled Hen and the Speckled Transylvanian Naked Neck Hen in Hódmezővásárhely**

University of Szeged Faculty of Agriculture has been dealing with the cross-breeding of Hungarian speckled hen to maintain the species since 1977. We keep two varieties of the Hungarian speckled hen, the feathered-neck variant and the bare-neck type on the pilot farm. The three colour variations of the domestic hen species were bred from the Hungarian lea-land bird by the middle of the 20th Century. Because of the spread of intensive poultry keeping the population of this species has become endangered. Beside the gene preservation, we endeavour to find the best way for the production-purpose utilisation of the speckled hen stock. On the basis of our experiments the laying hens can be used in small scale egg production. We examined the egg production, the eggshell colour and the hatching results

**Keywords:** Hungarian Speckled Hen, Speckled Transylvanian Naked Neck Hen, genetic reservation, egg production

### **INTRODUCTION**

From the fifties years of the twentieth century the poultry hybrids fully transformed the structure of species. Due to the emergence of hybrids, the number of hen varieties, which play a role in the poultry-farming economy, greatly reduced. (HORN, 1981) To produces high-performance hybrids only 5-6 different types of lines are used, however the pure-bred varieties are increasingly relegated to the background. (SZABÓNÉ WILLIN, 1996).

The protected traditional species represent a great genetic value. In order to be maintained the complete genome of chicken is necessary to protect the species situated in the Carpathian Basin, which include the Hungarian Speckled Hen and the Speckled Transylvanian Naked Neck Hen to. The degradation of native (old traditional, local) varieties, their decline, and disappearance, says BÖGRE – DOHY (1991) is a drastic form of a process, when the total gene pool of a breed (genotype group) is wasted.

The conscious, persistent, very intense selection, the one-sided (specialized) recovery targets, the production near the “biological ceiling” and all economic requires and expectations all have serious effects on this process. BODÓ (1991) notes in his work, which he wrote in order to protect the genetic reserves, the evolution of various biotechnology techniques results the more productive domestic breeds displace the local varieties with less productivity throughout the world.

In this process, the risk of extinction of species and populations is growing faster. The traditional varieties have value even if they are currently undetectable. The Hungarian

Speckled Hen is a result of a cross-breeding system between the Hungarian domestic hen and many foreign species and after that were followed a pure-breeding. (MÁRTHA, 1962). BÁLDY (1957) wrote the following about the economic value of the Hungarian chicken: the Hungarian backyard chicken is best suited for keeping as they are the most industrious food seekers, unpretentious, trained animals, well-adapted to our extreme climate. The experiments and studies carried out in Hungarian Speckled Hen stock kept since 1977 on the Pilot Farm of the Szeged University Faculty of Agriculture also served the purpose of finding the place of Hungarian poultry in hen production of goods (SÓFALVY, 1990)

## **MATERIAL AND METHODS**

The native speckled hen stock was founded in our pilot farm in 1977. The aim is to maintain and conserve the breed. We are breeding two species: the Hungarian Speckled Hen (further: feathered neck) and Speckled Transylvanian Naked Neck Hen (further: naked neck). We maintain 4 lines from the feathered neck breed and 1 line from the naked neck breed.

The elite stock is placed in 35 compartments. In 7 compartments we establish strains per-lines. We register the feathered neck variety lines with 21, 22, 24, 28 codes, and the naked neck line with a 26 code. The lines are separated by age groups, so that two-year-old hens are placed in three pens, and one-year-old hens are put in four pens. We put young, one-year-old cockerels in each pen. After the end of summer colonization the supernumerary pullets and cockerels will be sold.

In the laying period the egg production of each pen is recorded. Our trap-door nest technology is suitable for the measurement of individual egg production as well. In the statistical analysis the calculations have been made using the Microsoft Office Excel 2007 and the SPSS 15.0 for Windows program packs.

## **RESULTS AND DISCUSSION**

Our breeding aim is to maintain indigenous Hungarian hens as separate species. The constant preservation requirement is to maintain the original external and internal features with the lowest gene loss and avoid the inbreeding. Our stock in the gene preservation program belongs to a classified elite stock.

According to the accepted rules of the gene preservation the most important aspect is the security of species, which we can provide with sufficient standard animal number. The reserve number should be determined so that the elite stock can be replaced at any time in unchanged number and unchanged genetic composition. The performance assessments of indigenous poultries are intended to maintain the species in constant form and to prevent the gene loss. The egg production examination in some cases might also mean the selection of birds which have extremely positive or negative production.

In our stock hatching takes place in spring every year preceded by a 7-10-days' egg collection period. The hatched chickens are marked with individual numbers wing bands, and they are taken to a nursery building". There are separate places for the feathered neck stock and the naked neck stock. The measurement of live weight will take place every 4 weeks.

The preselection is made at 10 weeks based on body development, feathering, health status and skin colour. Chicks which are not suitable for the breeding program will be selected. In 15 weeks of age cocks are separated from pullets. In cocks stock there is a greater selection pressure, we keep those cocks who have optimal body development level, optimal feathers and skin colour corresponding to the standard. The colonization of pullets will be held in 20 weeks of age.

After the colonization we monitor the egg production capability of each genotype according to lines. The laying period begins in September and lasts until June next year. Then the two-year-old hens are disposed of, and the one-year-old hens undergo a moulting period.

In the production of one year old hens the 22 line supplied the highest performance. However, its standard deviation was also the highest. There was no significant difference ( $p < 5\%$ ) between the feathered neck and naked neck breeds. The average egg production of two-year-old hens confirms that trends reported in the literature that there is a decline in the number of eggs compared with the first laying period production. We don't find significant difference ( $p < 5\%$ ) between the feathered neck and naked neck breeds production.

In the one- and two-year-old hens stocks we made a representative egg measurements. We can see in *Table 1.* that the one-year-old hens eggs show a homogeneous distribution, and there can not be detected statistical difference between the lines ( $p < 5\%$ ).

**Table 1. The egg weights of one-year-old hens**

Line	n	Egg weigh (g)	
		x±s	CV%
21.	75	55.82±4.21a	7.55
22.	75	56.33±5.08 a	9.02
24.	75	56.47±5.28 a	9.36
28.	75	56.21±4.67 a	8.31
26.	75	54.35±5.18 a	9.54
<b>Average</b>		<b>55.89±4.91</b>	<b>8.79</b>

The naked neck hens (26. line) produced smaller eggs, but the difference is not significant ( $p < 5\%$ ).

It is found in the two-year-old hens production, that near the decreasing of the number of eggs the egg weight was increased. The measured egg-weights comply with the Hungarian meal standard. The standard deviations are not significant.

**Table 2. The egg weights of two-year-old hens**

Line	n	Egg weigh (g)	
		x±s	CV%
21.	75	59.47±3.86 a	6.49
22.	75	58.77±4.68 a	7.97
24.	75	58.54±5.26 a	8.99
28.	75	59.22±3.57 a	6.04
26.	75	57.31±3.96 a	6.71
<b>Average</b>		<b>59.00±4.42</b>	<b>7.5</b>

The egg production of the stocks was studied from 20 weeks of age (colonization). The production level of 30% was reached after the 6th production week. Top production occurred after the 21th production week.

In wintertime in December as a result of the outgoing system and the short and cold days the egg production of naked neck hens fell below the 10%. The observed fluctuations of persistence can be explained by climatic influences. Performances before the moulting were over 40%.

We examined the eggs shape index of the stock, which is the ratio of the egg length and width. The naked neck line producing significant ( $p < 5\%$ ) more longish eggs, than the feathered neck variant. The shape index values in both varieties correspond to the breeding eggs standard.

In *Table 3.* we can observe that the feathered neck hen's egg weight in each examined time (reaching the 30% production level, in top production level, and under 30% production level) are bigger. Single trend in both breeds that the highest measured weights are in top production time. This is not supported by the literature, because the performance tests have shown that the egg weights are the highest at the end of the egg production period.

**Table 3. Quantitative properties of the eggs**

Production level	n	Egg weight (g)	Height (cm)	Latitude (cm)	Shell strength (N)	Albumen weight (g)	Yolk weight (g)	Shell weight (g)
F-neck <sup>1</sup> 30%	80	55.10	5.59	4.28	25.80	31.01	16.61	7.09
N-neck <sup>2</sup> 30%	20	53.33	5.61	4.21	22.87	29.71	16.31	6.87
F-neck top production	80	61.49	5.81	4.47	24.80	33.84	19.75	7.62
N-neck top production	20	59.25	5.76	4.39	20.47	31.55	19.88	7.46
F-neck under 30%	80	60.64	5.82	4.43	28.13	30.64	20.27	7.35
N-neck under 30%	20	55.05	5.66	4.30	23.40	29.53	18.16	6.84

<sup>1</sup>Feathered-neck

<sup>2</sup>Naked-neck

The higher egg weights measured in top production period can be explained by the fact that the yolk weight for the top production period has increased significantly. In top production period the eggshell strength in both species are the weakest, which are in contrast to the other Hungarian bred hens (Yellow Hungarian Chicken, White Hungarian Chicken) eggshell strengths, which show lower values at the end of the laying periods. (GALLUS\_05). The dried eggshell weight in both species was the biggest in top production period, which can be explained by the size of the eggs.

The eggshell colour is important to consumers opinion. The preliminary studies and publications have shown that the Hungarian speckled hen produces mixed eggshell colours. The four-scale colour distribution examination showed that he beige coloured eggs occur the largest percentage in the feathered neck breed, while we could register brown

shelled eggs in largest proportion in naked neck hens stock. The typical Leghorn-type, white egg-shell has not occurred during the laying period.

Hatching to replace the breeding stock happens once a year. The growing of the young animals begins in April. The hatchery eggs are candled on 10th day of incubation period. The results of incubation are presented in *Table 4*.

**Table 4. The results of incubation**

Line	Age (year)	Incubated egg (nr)	Infertile egg %	Bloody egg %	Suffocated egg %	Hatched egg %
21	1	315	7.6	4.4	6.0	81.9
	2	125	6.4	4.0	12.0	77.6
22	1	341	4.4	5.0	23.8	66.9
	2	148	2.7	6.1	14.2	77.0
24	1	339	7.1	7.1	12.7	73.2
	2	122	7.4	7.4	11.5	73.8
26	1	346	10.4	4.0	23.4	62.1
	2	98	11.2	3.1	14.3	71.4
28	1	359	10.0	3.6	9.5	76.9
	2	151	8.6	6.0	23.2	62.3
<b>Total</b>		<b>2344</b>	<b>7.7</b>	<b>5.0</b>	<b>15.2</b>	<b>72.1</b>

The results show that the highest percentage of infertility occurs in naked neck stock. The highest percentage of bloody eggs was in the 24 line. The highest proportion of rotten (suffocated) eggs was in the 22 code. The hatching percent projected on inlaid eggs was 72.1 %, which can be considered a good result for this genotype.

Learning from the experience of previous years, where the hatching percentage was lower and the number of infertile eggs was higher, we put 3 cockerels on 20 hens in each compartment. The results draw attention to the fact that could be achieved narrower cock:hen sex ratio than 1:10 ratio, furthermore reserve cockerels should be ensured, especially if the candling results are disadvantageous.

Between the examined hatching parameters there was no significant difference ( $P < 5\%$ ). The proportion of infertile eggs, there was significant difference ( $P < 5\%$ ) between the one-year and two-year-old hens, as a consequence of the less favourable results of two-year-old hens. We investigated the differences between the lines, separately for the one-year and two-year-old hens. Significant difference ( $P < 5\%$ ) was not observed.

## CONCLUSIONS

- The Hungarian Speckled Hen and the Speckled Transylvanian Naked Neck Hen egg production can not be a competitor to the intensive varieties and hybrids.
- Species produce the greater quantity of eggs in the first egg production period.
- The average weight of eggs in the second year is greater than in the first laying period.
- Contrary to the published literature in our stock we can measure the largest eggs in top production period.
- After 6th week of the colonization the egg production level reaches 30%, and the top production is after the 21st laying week.
- The average shape index values correspond to the meal- and breeding eggs standard.



- The naked neck species produce longer eggs.
- The smallest shell strength can be found in top production period.
- The colour of the eggshell belongs to the colour category (light, beige, brown). There is a difference between the egg shells colour of two species, while the feather neck variety produced the largest amount of beige-coloured eggs, the naked neck variety mostly produced brown eggs.
- The incubation results showed that the two years old hens's hatching results are worse.
- The narrowed sex ratio increased better incubation results.

To summarize, the Hungarian Speckled Hen and the Transylvanian Naked Neck Hen are suitable for households to produce meal-eggs as well as hatching and breeding-eggs. Our breeding program can be called a success breeding work because of our species production correspond with national breeding program's parameters and we was able to maintain our species with the lowest gene loss.

### REFERENCES

- BÁLDY B. (1957): A Baromfi tenyésztése. Mezőgazdasági Kiadó, Budapest. 370 p.
- BODÓ I. (1991). A géntartalékok megőrzése az állattenyésztésben, Akadémiai doktori disszertáció. 11-34.; 149-155.
- BÖGRE J.-DOHY J. (1991): Gondolatok a generáció és az állatnemesítés néhány új aspektusáról, az „adekvát mutációk” tükrében, Állattenyésztés és Takarmányozás 40/3, 195-201.
- HORN P. (1981): Tyúkfajták és hibridek (in. A baromfitenyésztők kézikönyve szerk.: Horn Péter). Mezőgazdasági Kiadó, Budapest 300-314. p.
- MÁRTHA ZS. (1962): A magyar tyúk nemesítésének első időszaka. A Magyar Mezőgazdasági Múzeum Közleményei, Mezőgazdasági Múzeum, Budapest. 63-83.
- SÓFALVY F. (1990): Őshonos kendermagos tyúkállomány génvesztés nélküli megőrzése. Tessedik Sámuel Tiszántúli Mezőgazdasági Tudományos Napok, Szarvas. 77-78.
- SZABÓNÉ WILLIN E. (1996): A gazdasági állatok géntartalékainak megőrzése (in. Az állattenyésztés alapjai. Szerk.: Nagy Nándor). Mezőgazda Kiadó, Budapest. 276-278.

## AGRESSIVE AND SUBMISSIVE BEHAVIOURAL ELEMENTS OF CAPTIVE WILD BOARS IN FEEDING SITUATION

ÚJVÁRY DÓRA, SZEMETHY LÁSZLÓ

Szent István University, Institute for Wildlife Conservationü  
2103 Gödöllő, Páter Károly út 1., Hungary  
ujvarydori@gmail.com

### **ABSTRACT – Aggressive and submissive behavioural elements of captive wild boars in feeding situation**

Nowadays the interest for wild boar hunting especially achieving big and safe hunting bag is growing. It is the reason why many wild boar preserves or hunting gardens were established in the last decades. The density is determined by the interest of the maximum economic profit in most of the gardens regardless of what is optimal for the animals. The high density may cause a social stress, indicated *e.g.* by the fights, which may cause not only serious negative welfare consequences but decrease in productivity and less economic result consequently. The behaviour of wild boars in hunting gardens is poorly studied. The aim of our study was to describe and determine of the most important aggressive and submissive behavioural elements which may sign the stress level of the animals. The observations were taken in intensive wild boar gardens on feeding places at feeding times. We recorded with a video camera the animals and analyzed their behaviour with Solomon Coder. We described four aggressive (*running toward somebody, hit, chasing, bite*) and four submissive (*head lift, retreat, avoidance, escape*) behavioural elements. These elements can be ranked depending on time length and physical contact and show relation with the hierarchy order. We think that based on these elements, we can work out a guide to describe the stress level in wild boar gardens.

**Keywords:** wild boar, feeding situation, aggression, hierarchy, captivity

### **INTRODUCTION**

Unfamiliar wild boars are mixed in hunting preserves to achieve high density and to satisfy huntings' requirements. During this process the game managers ignore the most important factors which might affect the behaviour of wild boars: the density and the aggressive interactions. Although many researchers agree with the crucial influence of these factors on social behaviour, but the experimental circumstances are not comparable in many times, because the variables are not defined accurately and different levels of aggression are taken into consideration.

The high density may cause many negative consequences. The individuals compete for the available sources, what can be feeding-, drinking- and bed places. The sources, which are limited in space, could create competitive situation, and this, may induce a social stress and aggression (MCGLONE, 1985; HUGHES ET AL., 1997). The availability of the resources and its distribution in the environment influence the frequency and intensity of the aggressive interactions and the spatial distribution of the animals (DONE ET AL., 1996; ESTEVEZ ET AL., 2002). The social stress and injuries lead to a reduced reproduction (MENDL ET AL., 1992), less ingestion, and a smaller bodyweight increase. The social interactions do not happen randomly within a group (DUGATKIN AND EARLEY, 2003). Domesticated species are capable in a low numbered group to identify their group mates individually and attack their

similar or lower ranked companions (FORKMAN AND HASKELL, 2004). The density and the group largeness were studied by chickens living in large groups. It was found that in larger groups where the individual identification was absent, the aggression and the stress increased (CHENG ET AL., 2003) and the chance of feeding by lower ranked individuals decreased (MCBRIDE, 1970). In many other studies opposite results were found, the aggression decreased with increasing group number (hens: HUGHES ET AL., 1997; NICOL ET AL., 1997; chicken: ESTEVEZ ET AL., 1997; pig: NIELSEN ET AL., 1995; TURNER ET AL., 2001). Different species show different kinds of fighting behaviour in spite of the evenly stable hierarchy within the group. Dwarf goats, for example, keep high level of aggression but its behaviour is more ritualized with low costs, contrary pigs fight less frequently but more seriously with higher costs (LANGBEIN AND PUPPE, 2004). However the aggressive behaviour of wild boars are poorly studied (BEUERLE, 1975; ALTMANN, 1989), the same behaviour of domestic pigs is investigated frequently (NIELSEN ET AL. 1995, ANDERSEN ET AL. 2004, PUPPE 1998).

ANDERSEN ET AL. (2004) studied with a model the aggressive behaviour of unfamiliar weaning piglets at different group sizes (6, 12, 24 piglets/group). The model predicted increasing number of fightings per individual at larger group sizes, but number of pigs out of fightings also increased significantly. They concluded that the increasing number of potential competitors it is more profitable not to fight for most of the animals. In large population the probability that a pig become a winner is low, but its benefit is relative high. So, more pigs will avoid fighting or the average number of fightings should decrease, but the intensity will increase. NIELSEN ET AL. (1995) studied the effect of increasing competition of domestic pigs at feeding places to the individual performance and behaviour with changing the number of pigs. 5, 10, 15, or 20 pigs were kept together for 29 days with one feeder. The average level of individual aggression was lower in the two larger groups on mixing day than in smaller groups. They used the following behavioural categories: aggression (bite, threat, push, knock with head, chase, and fight), displacement (mount, nose, push or bite the pig in the feeder) and mounting. The aggressive interactions were scored by unknown way but none of them were described.

The individual competing character (i.e. competitive ability, familiarity) increased the hierarchical aggression more strongly, than the ability to protect the sources (FRASER ET AL. 1995). PUPPE (1998) observed the behaviour of pigs in pairs to reveal the effect of familiarity (familiar or unfamiliar) and relatedness (unfamiliar related or unrelated) to the agonistic interactions (AI) at different pen regions (pen area and trough area). Similar aged (12 weekly ones) and weighted pigs were put together and their behaviour was recorded 3 days (daily 10 hours) after mixing. The familiar and unfamiliar pairs showed AI with similar frequency at trough area, while the unfamiliar pairs showed significantly more AI at pen area. They considered AI only with physical contact of two individuals like fight (head to head knock, head to body knock, parallel/inverse parallel pressings, biting) or displacement

The behaviour of wild boar may be different from domestic pigs (the level of aggression is not so strong possibly). We investigated wild boar sounder living in captivity. Our aim was to distinguish the aggressive and submissive behavioural elements and observe their recognition by independent observers. Then we studied the frequency of these elements depending on the rank position.









## MATERIAL AND METHOD

We studied seven sows, including four wild boars and three crossbreds (Wild boar x Vietnamese pot-bellied pig). All of them have been living together for more than one year. We supposed that a stable hierarchy established among them. The examinations took place at the Horatius Animal Coordination Centre in Gödöllő. The test was made in their home pen and we reduced the daily food amount for 10 days to create a competition situation. We recorded their feeding behaviour daily for 20 minutes at the feeding-time (between 09:00h and 10:00h) with video camera positioned on a 2m high stand next to the enclosure. The sows have been used to the presence of humans, so we assume that the behaviour of them has not been influenced by the presence of the cameraman (who was also the experimenter). Each animal could be identified by its distinct physical characteristics. We set up a hierarchy among the sows based on observed wins and defeats per dyad. We analyzed the sows' behaviour with Solomon Coder. We analyzed the agreement of independent observers to the eight behaviour elements with Cohen-Kappa indices (MARTIN AND BATESON, 1993).

## RESULTS

We could distinguish four aggressive and four submissive behavioural elements (*Table 1.*). In many studies bite is also used behavioural element so we applied the definition by JENSEN AND YNGVESSON (1998). Most of the studies distinguish hit depending on which body part it is directed against. We did not separate them.

**Table 1. The observed behavioural elements in a feeding competition situation**

Dominant	Definition	Submissive	Definition
<b>Running toward somebody</b> 	Fast approach towards an other sow with a closed mouth max. lasting for 2 seconds.	<b>Head lift</b> 	Standing in one place orienting onto the attacker with raising head and voice while contracting its body.
<b>Bite</b> 	One sow delivered a knock with the head against the head, neck or body of the other sow with the open mouth (Jensen and Yngvesson 1998).	<b>Retreat</b> 	Moving away (fast or slow) from the attacker, facing its direction. The distance of the displacement is max. 2 meter.
<b>Chasing</b> 	Fast approach towards an other sow with a closed or open mouth lasting for more than 2 seconds.	<b>Avoidance</b> 	The evasion of the other individual showing passive behaviour with changing the direction or stopping feeding.
<b>Hit</b> 	One sow delivered a knock with the head against the head, neck or body of the other sow with closed mouth.	<b>Escape</b> 	Runaway into a contrary direction of the attacker caused by any of the aggressive behaviours (see above). The distance is more than 2 meter.



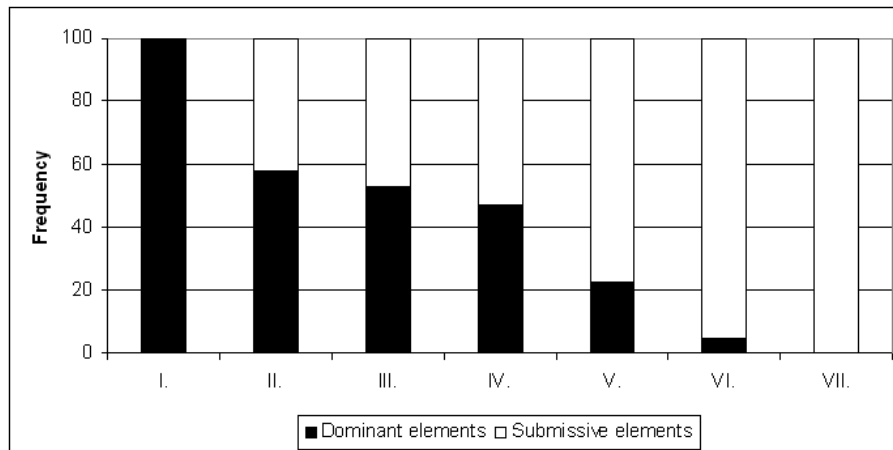
Drawings: Balázs Csoma

The calculated Cohen-Kappa indices in *Table 2*.

**Table 2. The calculated Cohen-Kappa indices**

	Observer 1.	Observer 2.
<b>Running toward sy</b>	1,000	0,870
<b>Hit</b>	0,771	0,615
<b>Bite</b>	1,000	0,636
<b>Chasing</b>	1,000	0,636
<b>Head lift</b>	0,767	1,000
<b>Retreat</b>	0,814	1,000
<b>Avoiding</b>	0,611	1,000
<b>Escape</b>	0,847	0,619

*Figure 1.* shows the frequency of aggressive and submissive behavioural elements depending on the rank position.



**Figure 1. The frequency of aggressive behavioural elements of the seven sows**

## DISCUSSION

One of the biggest gregarious animals is the domestic pig and its ancestor, the wild boar, there is many studies on aggressive interactions with domestic pigs (i.e. NIELSEN ET AL. 1995; TURNER ET AL. 2001; PUPPE, 1998) but these studies have different variables and experimental circumstances. Most of the studies investigate the behaviour of unfamiliar pigs after mixing, in this case the aggression is more overt and stronger. Investigation of a group with stable hierarchy is more difficult, because the aggression is lower and not so overt. That's why sometimes it is difficult to compare these results and to draw a generally conclusion. Moreover it is difficult to apply these methods for studying wild boars. Compare previous studies (i.e. NIELSEN ET AL., 1995; ANDERSEN ET AL., 2004, TURNER ET

AL., 2001) we concluded that it is necessary to define the examined behavioural elements as accurate as possible. It is still under discussion that when observing agonistic interactions we should consider only the overt agonistic behaviour, like the fight, bite, and displacement with physical contact or other elements also, like threat and gestures of fears (LEHNER, 1996). LANGBEIN AND PUPPE (2004) think that we should focus only to the overt interactions, because they deliver clear and unambiguous results between various observers. Furthermore they claimed to be sure in an outcome of an agonistic interaction we should consider not only the aggressive interactions but also the submissive elements show by the receiver. Tuchscherer et al. (1998) defined submissive patterns (any signs of displacement, turning the body or the head away from the other individual and any kind of escaping) but many studies do not consider submissive behaviour (i.e. NIELSEN ET AL., 1995; ANDERSEN ET AL., 2004). SAEBEL (2007) described retreat (“ausweichen”) as passive aggressive behaviour. In our study we distinguish four aggressive and four submissive behaviour elements, seven of them have not been used before only *bite* (i.e. JENSEN AND YNGVESSON, 1998). Our observed elements can be ranked based on physical contact (supposedly higher aggression) like hit, bite and on time length (running toward sy, chasing). Some of the submissive elements are answers to an initiated aggression (head lift, retreat, escape), which might express the level of submission (the more the displacement is, the higher flight is), avoiding is expressed without any aggression. We are planning further investigations to specify these levels and to find a relation between the aggressive and submissive elements.

The high Cohen Kappa indices show (0.60 to 0.80=good agreement; 0.80 to 1.00=very good agreement), that the behavioural elements are recognisable. According to LANGBEIN AND PUPPE (2004) behavioural elements, which do not show overt aggression (there is not any physical contact), are less definable and recognisable. However our results show that the observers are able to recognize the less overt behavioural elements after short practice if detailed description of behavioural elements is provided for them.

Taking these behavioural elements into consideration the hierarchy might be established accurate, it is possible to decide precisely which animal wins and loses in a fight. It is necessary to use the less overt agonistic and submissive behavioural elements to establish the hierarchy in groups living together for a long time. Moreover we suppose that with these elements we could observe the changing in the rank or the level of the aggression. This could help to estimate interferences in wild boar preserves, for example changing in the group composition after huntings or putting new individuals inside the group and to investigate these effects on production.

## REFERENCES

- ANDERSEN, I. L., NAEDAL, E., BAKKEN, M., BOE, K. E. (2004): Aggression and group size in domesticated pigs, *Sus scrofa*: when the winner takes it all and the loser is standing small”.-*Anim. Behav.* 68:965-975.
- ALTMANN, D. (1989): Sozialverhalten und Revierverteidigung in Beziehung zur Tageszeit beim Wildschwein *Sus scrofa* L. *Beitr. Jagd- und Wildforschung* 16:202-211.
- BEUERLE, W. (1975): Freilanduntersuchungen zum Kampf- und Sexualverhalten des Europäischen Wildschweines (*Sus scrofa* L.). *Z. Tierpsychol.* 39:211-258
- CHENG, H.W., SINGLETON, P., MUIR, W.M. (2003): Social stress differentially regulates neuroendocrine responses in laying hens: I. genetic basis of dopamine responses under

- three different social conditions. *Psychoneuroendocrinology* 28: 597-611
- DONE, E., WHEATLEY, S., MENDEL, M. (1996): Feeding pigs in troughs: a preliminary study of the distribution of individuals around depleting resources.-*Appl. Anim. Behav. Sci.* 47:255-262.
- DUGATKIN, L.A., EARLEY, R.L. (2003): Group fusion: the impact of winner, loser, and bystander effects on hierarchy formation in large groups.-*Behav. Ecol.* 14:367-373.
- ESTEVEZ, I., NEWBERRY, R., ARIAS DE REYNA, L. (1997): Broiler chickens: a tolerant social system? *Etologia* 5:19-29.
- ESTEVEZ, I., NEWBERRY, R., KEELING, L. (2002): Dynamics of aggression in the domestic fowl.-*Appl. Anim. Behav. Sci.* 76:307-325.
- FORKMAN, B., HASKELL, M.J. (2004): The maintenance of stable dominance hierarchies and pattern of aggression: support for the suppression hypothesis.-*Ethology* 110:737-744.
- FRASER, D., KRAMER, D.I., PAJOR, E.A., WEARY, D.M. (1995): Conflict and cooperation: sociobiological principles and the behaviour of pigs. *Appl. Anim. Behav. Sci.* 44, 139-157.
- HUGHES, B.O., CARMICHAEL, N.L., WALKER, A.W., GRIGOR, P.N. (1997): Low incidence of aggression in large flocks of laying hens.-*Appl. Anim. Behav. Sci.* 54:215-234.
- JENSEN, P., YNGVESSON, J. (1998): Aggression between unacquainted pigs—sequential assessment and effects of familiarity and weight. *Appl. Anim. Behav. Sci.* 58 (49-61).
- LANGBEIN, J., PUPPE, B. (2004): Analysing dominance relationship by sociometric methods—a plea for a more standardised and precise approach in farm animals. *Appl. Anim. Behav. Sci.* 87: 293-315.
- LEHNER, P.N. (1996): *Handbook of Ethological Methods*, 2nd ed. Cambridge university Press, Cambridge
- MARTIN, P., BATESON, P. (1993): *Measuring behaviour. An introductory guide.*-Cambridge University Press. 2nd edition.
- MCBRIDE, G. (1970): The social control of behaviour in fowls.-In: Freemann, B.M., Gordon, R.F. (Eds). *Aspects of Poultry Behaviour*. British Poultry Science, Edinburgh, pp. 3-13.
- MCGLONE, J. J., (1985): A quantitative ethogram of aggressive and submissive behaviours in recently regrouped pigs.-*J. Anim. Sci.* 61:559-565.
- MENDEL, M., ZANELLA, A.J., BROOM, D.M. (1992): Physiological and reproductive correlates of behavioural strategies in female domestic pigs. *Anim. Behav.* 44:1107-1121.
- NICOL, C.J., GREGORY, N.G., KNOWLES, T.G., PARKMAN, I.D., WILKINS, L.J. (1999): Differential effects of increased stocking density, mediated by increased flock size, on feather pecking and aggression in laying hens.-*Appl. Anim. Behav. Sci.* 65:137-152.
- NIELSEN, B.L., LAWRENCE, A.B., WHITTMORE, C.T. (1995): Effect of group size on feeding behaviour, social behaviour and performance of growing pigs using single-space feeders.-*Livest. Prod. Sci.* 44:73-85.
- PUPPE, B. (1998): Effects of familiarity and relatedness on agonistic pair relationships in newly mixed domestic pigs.-*Applied Animal Behaviour Science* 58:233-239.
- SAEBEL, J. (2007): *Verhaltensbeobachtungen am Schwarzwild (Sus scrofa L.) durch Videoüberwachung und Radiotelemetrie*. Diplomarbeit, Technische Universität Dresden
- TUCHSCHERER, M., PUPPE, B., TUCHSCHERER, A., KANITZ, E. (1998): Effects of social status after mixing on immune, metabolic and endocrine responses in pigs. *Physiol. Behav.* 64, 353-360
- TURNER, S.P., HORGAN, G.W., EDWARDS, S.A. (2001): Effect of social group size on aggressive behaviour between unacquainted domestic pigs. *Appl. Anim. Behav. Sci.* 74:203-215.

## COMPARISON OF EURASIAN WOODCOCK (*SCOLOPAX RUSTICOLA*, L.) MONITORING METHODS

SCHALLY GERGELY - SZEMETHY LÁSZLÓ

Szent István University, Faculty of Agriculture and Environmental Sciences, Institute for  
Wildlife Conservation  
Páter Károly u. 1, 2103 Gödöllő, Hungary  
sgergo@ns.vvt.gau.hu

### **ABSTRACT– Comparison of Eurasian Woodcock (*Scolopax rusticola*) monitoring methods**

Eurasian woodcock is a popular migrating game species in Hungary and in several European countries. For its wise management it is essential to collect reliable information of the breeding, wintering and also migrating populations. The aim of this study was to describe and analyze the differences among the monitoring methods used in different countries, and to give advices to improve the methods of data collection and evaluation of the monitoring system running in Hungary. Our study is based on the comparison of monitoring programs run in France, Russia, Belarus and in the Archipelago Azores. The key factor of all such surveys is the display behaviour of male birds, which is called roding. However there are some differences between them. We evaluated the different monitoring methods on the basis of scientific literature considering the place, time and duration of survey sessions, the collected data and the methods of their analysis. The main cause of differences is the different aim of the different studies. Hungary cannot obviously be taken as a breeding or wintering area, it rather plays an important role in migration. The aim of the monitoring in Hungary is to follow and characterize the flow of migration, and to estimate the minimal number of birds crossing our countries borders. The evaluation of data in Hungary is also different. However the methods of observations and the quantity of collected data allow us to evaluate our data in a similar way. It would be essential if we would like to compare our results to the results of other monitoring programs in Europe.

**Keywords:** Eurasian woodcock, *Scolopax rusticola*, monitoring, survey method, observation

## INTRODUCTION

To broaden our knowledge and to estimate the size of the migrating population of the Eurasian woodcock in Hungary, a country-wide monitoring program started in spring 2009. However woodcock (*Scolopax rusticola*) is a difficult species to count accurately, because it spends the day in woodland and feeds on fields during the night. There are three basic counting methods described by BIBBY ET AL. (1997): (1) Counts of displaying males where the counting unit is the displaying “roding” male. The counting period is throughout the breeding season. During spring and summer evenings, male woodcocks perform song flights over their breeding sites (roding). The breeding survey is based on a census of those males (FERRAND, 1993). As several birds may be counted at the same listening point where it is not easy to distinguish them, the collected data is simply the number of contacts (birds seen and/or heard). However, a positive correlation between the number of contacts and the number of different birds was proved by an acoustic analysis (FERRAND, 1993). (2) Drives with beaters where the counting unit is the individual bird being flushed by teams of beaters and dogs. Drives should be undertaken during the winter in the day-time. (3) Nocturnal feeding counts. The counting unit is the individual bird. These are counted as



they fly to or from nocturnal feeding areas at dusk or dawn. Counts can be undertaken throughout the year.

The Hungarian monitoring program is based on roding surveys, so in our study we focused on countries using methods similar to ours. The aim of this study was to describe and analyze the differences among the monitoring methods used in different countries, and to give advices to improve the methods of data collection and evaluation of the monitoring system running in Hungary

## **MATERIAL AND METHOD**

We evaluated the different monitoring methods on the basis of scientific literature considering the place, time and duration of survey sessions, the collected data and the methods of their analysis.

Our most important source of information was the network of the Woodcock and Snipe Specialist Group. It is a research unit of Wetlands International (WI) and of IUCN, the International Union for Conservation of Nature. Their annual newsletter is a contact organ to inform their members about the latest results of Woodcock and Snipe (*Gallinago spp.*) research.

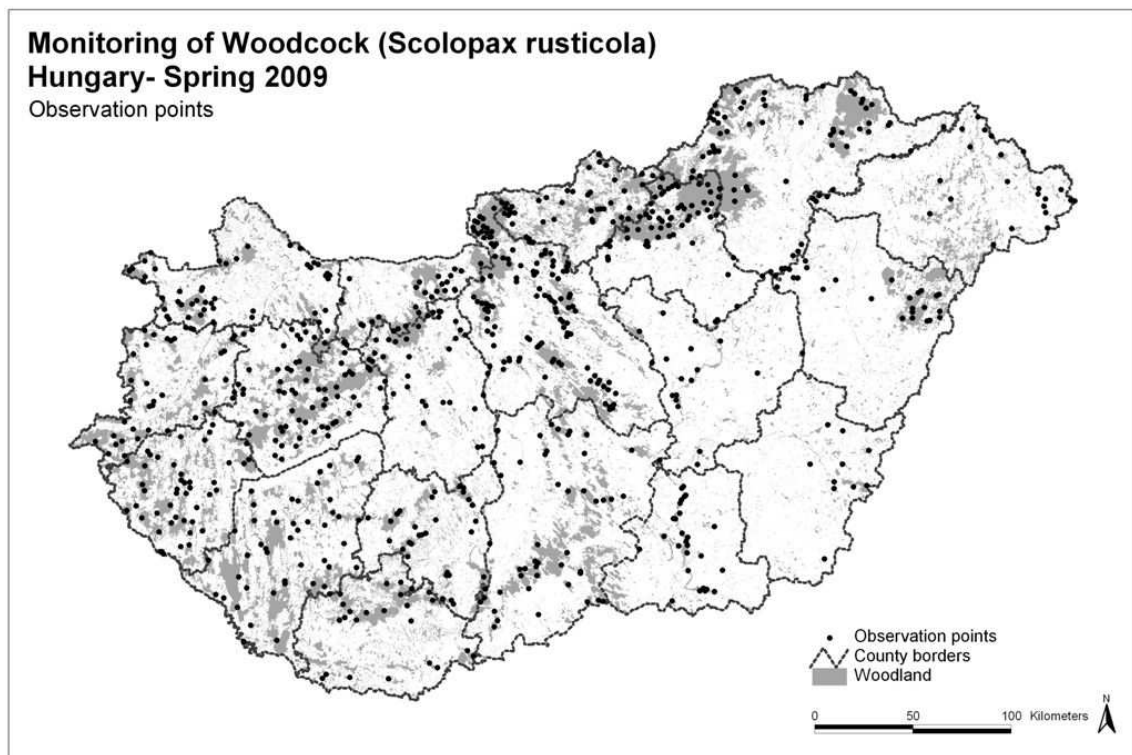
Furthermore, every five years on average, the WSSG organizes a workshop to provide information on Woodcock and Snipe research whereby their members are offered the opportunity to meet and improve the efficiency of the network. The last (sixth) workshop was held in Nantes, France. Previous ones were held in Denmark, Great Britain, Germany, and Poland. In the last five years the following countries published results of their monitoring programs regularly: France, Russia, Portugal (Archipelago Azores), and Belarus.

France is an important wintering area for the Eurasian woodcock, and it is also a breeding area. To manage this game species wisely an integrated monitoring system for the breeding and wintering woodcock populations has been developed (FERRAND ET AL., 2008), based on a census of roding males, the census of woodcocks flushed and/or shot during hunting trips, a census of woodcocks from targeted ringing sessions and other ringing data.

The majority of Woodcock wintering in Europe are nesting in the Russian forests. For a long time, it has been a necessity to monitor the number of this species during the display period. However, this has been put into practice only a few years ago with the financial and methodological support of the French Office National de la Chasse et de la Faune Sauvage. Questionnaires are filled out by observers for one evening of roding observed at one census point. The national roding census is conducted on one common day for the whole country – the last Saturday of May. In 2010 the National Woodcock Roding Census was organized by the Moscow scientific “Woodcock” group, the Association Rosokhotrybolovsoyuz, several hunting offices and the “Russian hunter” newspaper (FOKIN ET AL., 2010).

In contrast to its mainly migrant continental populations the Eurasian woodcock is a resident species in the Macaronesian archipelagos (Azores, Madeira and Canaries). Working at Pico Island, their main objectives were to characterize the roding activity of these insular populations, to select the best period of the breeding season to perform a roding survey and to evaluate how sensitive this method can be to variations in abundance because of hunting (MACHADO ET AL., 2008). They followed the survey protocol described by FERRAND (1993).

To estimate the size of the migrating population in Hungary, a monitoring program was initiated by the former Ministry of Agriculture and Rural Development and the Hungarian National Chamber of Hunters in 2009. Data collection and processing have been designed and carried out by Szent István University, Institute for Wildlife Conservation which also assumed to evaluate the results. The objective was to collect data from as many observation points as possible at the same period of time. These give then snapshots about different states of the migration. With the comparison of consecutive snapshots it is possible to estimate the dynamics, speed and extent of migration. The basis of the monitoring program is a roding survey weekly performed by observers on every Saturday (from 28th February to 2nd May in spring 2009, from 13th February to 1st May in Spring 2010). The observers record data on standardized forms. Data are: number of contacts (birds seen and/or heard), size of the visible area, duration of the survey, weather conditions and habitat types surrounding the observation point. The total number of observation points was 908 in spring 2010. *Figure 1* shows their distribution.



**Figure 1. Woodcock observation points in Hungary – spring 2009**

We compared the methods and results of their programs with the Hungarian monitoring program. The comparisons have been made considering the following questions:

(1) Why are they collecting data? (2) How do they collect data? (3) When do they collect data? (4) Where do they collect data? (5) How much data do they collect? (6) What results do they get?

## RESULTS

Our most important results are summarized in *Table 1*.

**Table 1. The main characteristics of the woodcock monitoring programs in five different European countries**

	France	Russia	Archipelago Azores (Portugal)	Belarus	Hungary
<b>Aim of the roding surveys</b>	Breeding population survey	Breeding population survey	Breeding population survey	Breeding population survey	Migrating population survey
<b>Coverage</b>	National	National	Local (Azores archipelago)	Local (Berezinsky Reserve)	National
<b>Since when</b>	1992	1999	2001	2005	2009
<b>N of observation points</b>	860 (in 2010)	2455 (in 2010)	22 (in 2009)	12 (in 2009) (between 2005-2008 it was 60)	908 (in Spring 2010)
<b>Annual frequency of observations</b>	1	1	1-2	1	12 in Spring
<b>Observation period</b>	Between Mid-May and Mid-June	The last Saturday of May	March-April	June	Between Mid-February and the beginning of May
<b>Counting unit</b>	Number of contacts (birds seen and/or heard)	Number of contacts (birds seen and/or heard)	Number of contacts (birds seen and/or heard)	Number of contacts (birds seen and/or heard)	Number of contacts (birds seen and/or heard)
<b>Results/evaluation of data</b>	National occupation rate, proportion of high abundance sites	Roding intensity	Breeding abundance	Mean N of contacts	Mean N of contacts; Dynamics of migration
<b>Additional monitoring programs</b>	Ringling trips, hunting trips, hunting bag statistics	Ringling trips, hunting bag statistics	Hunting trips, hunting bag statistics	Ringling trips, hunting bag statistics	Autumn migration monitoring (Nocturnal feeding count); Hunting bag statistics

(1) The aim of roding survey studies is the monitoring of breeding population in each country except for Hungary. Our aim is to estimate the size of the migrating population.

(2) There are only minor differences between the methods of data collection by roding surveys. They are mostly differences in additional data collection. There are two additional indices which allow the monitoring of woodcock migratory and wintering numbers in France: (a) the mean number of contacts/hour registered during ringling trips and (b) a hunting index (number of seen woodcocks/standardized hunting trip, duration= 3.5 hours) collected by the Club National des Bécassiers (GOSSMANN ET AL., 2009).

The main task of an additional project in Belarus is to ring Woodcock during the autumn migration (MONGIN ET AL., 2009). Woodcock ringling and study of migration were carried out in the Berezinsky Reserve vicinities on several stationery plots. The main study period was 16 September – 9 November. They recorded 391 birds during 51 night trips, 76 woodcocks were caught during the season.

(3) The timing of data collection is very similar in France, Russia, and Belarus (May-June). In Azores and Hungary observations are carried out earlier (March-April).

Censuses lasted 120 minutes in Russia and in Belarus too. The observations in Hungary last only one hour after dusk. In Azores observations always began at least 1 hour before sunset and stopped half an hour after the last contact was registered.

(4) The observation points cover the whole area of the country in France, Russia, and Hungary. The Archipelago Azores is a smaller part of Portugal, however the woodcock population there is resident, so the monitoring can be taken as full-cover. In Belarus the

covered area decreased with the decline of the number observation points in 2009. In France observations are carried out every year at listening points randomly chosen in forest habitats. A listening point is defined as an open area (clearing, plantation, etc) as close as possible to the centre of a 2x2 centigrade square. In Russia the observers should choose an open place in a forest, the criteria is that it should be suitable for roding and for observations. In Belarus the listening points were located in two squares (12x12 km).

(5) The number of the observation points was the highest in Russia, and the lowest in Belarus. Census of the breeding population in Belarus was carried out at 12 listening points during June in an area called Berezinsky Reserve. However until 2008 the number of the observation points in Belarus was much higher. The highest annual frequency of observations is in Hungary. In the Archipelago Azores the frequency of data collection was similar to ours, because the researchers tried to describe the characteristics of the intensity of roding throughout the breeding season. According to their results, they selected then a shorter period of time for monitoring the population trend.

(6) The most important results in France are (a) the national occupation rate (the % of listening points at which at least one roding male was observed). In 2010, the value was 23.6% (GOSSMANN ET AL., 2010). (b) The proportion of high abundance sites (number of contacts  $\geq 5$ ), was 7.9%. The population trend of the French breeding woodcock population has been analysed for the last 10-year period. The stability of proportion of positive site and of the proportion of high abundance sites characterizes this period. After a period of increase observed since the end of the 1990s, the breeding woodcock numbers in France seem to have reached a plateau.

The results of monitoring in Russia showed that roding intensity in 2010 was the lowest in the last 12 years. Owing to hot and dry weather conditions in summer 2010, roding stopped by 10 July, approximately 2 weeks earlier than usual (FOKIN ET AL., 2010).

## CONCLUSIONS

The methods of data collection are very similar in each country; the key factor is the display behaviour of male birds. It is obvious, because it is one of the most effective methods, which was described properly by FERRAND (1993) and could be easily adopted for the studies in the case of Russia, Belarus, and Azores. In Hungary, it was not adopted directly, but it is still analogous. The sampling is representative, standardized (repeatable), and regular in each studied country. There are only minor differences which are caused by local circumstances (e.g. timing, duration).

The main cause is the different aim of the different studies. Hungary cannot obviously be taken as a breeding or wintering area, it rather plays an important role in migration. The aim of the monitoring in Hungary is to follow and characterize the flow of migration, and to estimate the minimal number of birds crossing our countries borders. Therefore the monitoring in Hungary takes a much longer period of time - with the highest annual frequency - of observations than in France or Russia.

The evaluation of data in Hungary is also different from the countries mentioned in our study, because the different aims of the programs. However the methods of observations and the quantity of collected data allow us to evaluate our data in a similar way. It would be essential if we would like to compare our results to the results of other monitoring programs in Europe. It would also be a step forward in creating an international cooperation of monitoring programs which could allow us to see the population as a whole.

## ACKNOWLEDGEMENTS

Study of woodcock in Hungary was organized and financed by the Hungarian National Chamber of Hunters. We are thankful for all volunteers who participated in the Hungarian woodcock monitoring program. We would also like to thank Yves Ferrand, coordinator of the Woodcock and Snipe Specialist Group for providing us with essential information and scientific papers.

## REFERENCES

- BIBBY, C. J., BURGESS, N. D., HILL, D. A. (1997): Bird Census Techniques. Academic Press Limited, London. 257p.
- BLOKHIN, Y. Y., FOKIN, S. Y. (2006): National roding censuses in Russia. In: Ferrand Y (2006): Sixth European Woodcock and Snipe Workshop – Proceedings of an International Symposium of the Wetlands International Woodcock and Snipe Specialist Group, 25-27 November 2003, Nantes, France. International Wader Studies 13, Wageningen, The Netherlands, 114pp.
- FERRAND, Y. (1993): A census method for roding Eurasian Woodcocks in France. Biol Rep 16: 19–25.
- FERRAND, Y., GOSSMANN, F., BASTAT, C., GUÉNÉZAN, M. (2008): Monitoring of the wintering and breeding Woodcock populations in France. Revista Catalana d’Ornitologia 24: 44-52.
- FOKIN, S., BLOKHIN, Y., ZVEREV, P., ROMANOV, Y., KOZLOVA, M. (2010): Abnormal hot and dry summer in Russia in 2010: impact on the Woodcock breeding success and autumn migration. WI/IUCN-WSSG Newsletter 36: 8-12.
- GOSSMANN, F., BASTAT, C., GUÉNÉZAN, M., FERRAND, Y. (2009): 2008-2009 French Woodcock report. WI/IUCN-WSSG Newsletter 35: 34-37.
- GOSSMANN, F., BASTAT, C., GUÉNÉZAN, M., FERRAND, Y. (2010): 2009-2010 French Woodcock report. WI/IUCN-WSSG Newsletter 36: 25-28.
- MACHADO, A. L., FERRAND, Y., GOSSMANN, F., SILVEIRA, A. M., GONÇALVES, D. (2006): Woodcock (*Scolopx rusticola*) breeding biology in Pico Island (Azores, Portugal). In: Ferrand, Y (2006): Sixth European Woodcock and Snipe Workshop – Proceedings of an International Symposium of the Wetlands International Woodcock and Snipe Specialist Group, 25-27 November 2003, Nantes, France. International Wader Studies 13, Wageningen, The Netherlands, 114pp.
- MACHADO, A. L., FERRAND, Y., GOSSMANN, F., SILVEIRA, A. M., GONÇALVES, D. (2008): Application of a roding survey method to the sedentary Eurasian Woodcock *Scolopx rusticola* population in Pico Island, Azores. European Journal of Wildlife Research 54: 205-214.
- MONGIN, E., BOGUTSKI, Y., DAVIDYONOK, E., MONGIN, A. (2009): 2009 Belarus Woodcock Report. WI/IUCN-WSSG Newsletter 35: 8-9.
- MONGIN, E., BOGUTSKI, Y., DAVIDYONOK, E. (2010): 2010 Belarus Woodcock Report. WI/IUCN-WSSG Newsletter 36: 4-5.

## EVALUATION OF ENVIRONMENTAL CONDITIONS BY FISH HEMATOLOGY

IVANC A.<sup>1</sup>, DEKIC R.<sup>2</sup>, CETKOVIC DANIJELA<sup>2</sup>, MISCEVIC B.<sup>1</sup>, KÖNYVES T.<sup>1</sup>, VUKOSAV  
MARIJA<sup>1</sup>, OBRADOVIC S.<sup>3</sup>, SUTUROVIC EDITA<sup>1</sup>

<sup>1</sup>Faculty of Biofarming, Marsala Tita 39, 24300 Backa Topola, Megatrend University  
Belgrade, Serbia

<sup>2</sup>Faculty of Natural Sciences and Mathematics, M. University of Banja Luka, Bosnia and  
Herzegovina

<sup>3</sup>Fakultet za ekonomiju i inženjerski menadžment, Cvećarska 2, 21000 Novi Sad, Serbia  
aivanc@biofarming.edu.rs

### **ABSTRACT: Evaluation of environmental conditions by fish hematology**

In the work are shown basic principles of application of the haematological status in determination of physiological status of fishes, also a review of a number of research from this area is given. One part of the research includes analysis of parameters of hematological status of the individuals in their natural habitat, while the other part is focused on the research of these parameters in experimental conditions based on changes of some of the factors. Review include erythrocyte line parameters (erythrocyte number, hemoglobin concentration, hematocrit, MCV, MCH and MCHC) in different conditions in species: *Barbus balcanicus*, *Squalius cephalus*, *Thymallus thymallus*, *Oncorhynchus mykiss*, *Carassius gibelio*, *Perca fluviatilis*, *Cyprinus carpio*.

**Keywords:** Hematology, fish, environmental conditions

## INTRODUCTION

Fishes make contact with environment, so they are sensitive to physical and chemical changes in the environment, which can lead to changes in blood components (WILSON and TAYLOR, 1993), but also hematological parameters represent indicators of environmental status (DEKIĆ et al., 2009).

Hematological status represents a reliable means for detecting the physiological state of the organism, and, indirectly, the status of the environment, because its parameters react to environmental changes (IVANC and MILJANOVIĆ, 2001). The quantitative characteristics of the red and white blood lines are used for detecting the haematological status, which provides insight into a number of processes in the organism, and based on analysis of different blood components it can be judged about changes that appear in certain systems influenced by external and internal factors. Determination of haematological parameters and blood plasma biochemistry is used for evaluation of the health of wild and domestic animals. Values of these parameters are useful in interpretation of results which are connected to various diseases and eco-environmental conditions (SEKER et al., 2005).

From there the haematological parameters are identified as a very precious tool for controlling fish health (TAVARES-DIAS et al., 2008) and in interpretation of certain physiological responses that are caused by ecological parameters (IVANC et al., 1997). Also these parameters give relevant information during comparative study of certain species in different habitats, and related species in the same habitat (IVANC et al., 1994). By Rowan

(2007), haematological parameters are also widely used indicators of stress in the environment because the values of erythrocyte number, hemoglobin concentration, hematocrit, sedimentation rate, leukocyte number and differential blood are good indicators of presence of diseases or stressors. In the same time, by this author, changes in blood variables are caused also as a result of environmental changes, precisely changes in temperature, light, oxygen concentration and pollution (ROWAN, 2007). Importance of haematology in fish diseases diagnostics (ISHIKAWA et al., 2008), for evaluation of pollution influence and knowledge about environmental conditions (MURAD et al., 1990) is widely accepted, but for explaining blood analysis is needed knowledge about normal values of blood parameters (IVANČIĆ et al., 2005) and reference range of certain parameters (HRUBEC et al., 2000).

## MATERIAL AND METHODS

This study is based on a number of previous investigations on this subject made by the authors. They are dedicated to hematology of several fish species under different environmental conditions as well as laboratory experiments conducted to analyze effects of a specific environmental factor on hematological parameters. In all studies identical methods were used for blood collection and estimation of individual hematological parameters. Hematological status was estimated on the basis of the following hematological parameters: erythrocyte number (RBC), hemoglobin concentration, packed cell volume (PCV), mean corpuscular volume (MCV), mean corpuscular hemoglobin (MCH) and mean corpuscular hemoglobin concentration (MCHC).

The involved 7 species should be listed subsequently by: List of the 7 investigated fish species.

## RESULTS

The results of all studies are organized and listed by species, type of environmental influence or experimental factor on specific hematological parameters and presented in table 1 with indication of significance of differences between means.

In the study of hematology of Large spot barbel (*Barbus balcanicus*) in two streams of different water quality DEKIC (2010) found out that fish from the stream with smaller saprobic index (Jakotinska River) had significantly higher values of hemoglobine concentration, values of MCV and MCH, while individuals from Suturlija River, with higher saprobic index value had significantly higher erythrocyte number. According to conducted hydrobiological analysis, both analysed watercourse belong to  $\beta$ -mesosaprobic category, but based on saprobity index the water from River Jakotina has better quality. Saprobity index of River Suturlija was 2.04, while River Jakotina has value 1.83, and observed by seasons and months, values in River Jakotina has often been in transit category between two classes.

Such ratio of monitored parameters is related to poor water quality from Suturlija, which in the Large spot barbel from this river cause presence of higher number of young, immature erythrocyte forms and mature erythrocytes with significant lower hemoglobin concentration, in circulation, that fish produce as response to environmental conditions. Author concludes that poor water quality has two ways impact on hematopoiesis. It inhibited normal hemoglobin synthesis which resulted with lower MCH. On the other hand, requirement for oxygen transport encouraged increased hematopoiesis and increase young

erythrocyte number in blood which is shown by higher RBC, and lower MCV. Such statement is also indicated by size and shape of erythrocyte nucleus which is smaller and with a slightly changed ellipsoid shape compared to erythrocyte nucleus of individuals from Jakotina river.

Presence of lower MCV cause lower MCH, and also lower values of total hemoglobin. Hematological response to environmental conditions is different in different fish species. In hematology research of European chub (*Squalius cephalus*) from the same Jakotina River and more polluted Dragocaj River. Based on categorisation by Kol River Jakotina belongs to II class waters, while River Dragočaj belongs to III class waters. DJURDJEVIC et al., (2005) is concluded that this species in low quality streams also has higher values of hemoglobin concentration, but lower MCV, and unlike of large spot barbel chub has significantly higher MCHC but lower PCV in low quality water.

In Grayling, *Thymallus thymallus* (order Salmoniformes) hematology is monitored in fishes from open water stream Krusnica and farm conditions (DEKIC et al., 2009). It is very indicative that Grayling inhabiting Krusnica River and those farmed at Martin brod differed only in values of RBC and PCV which were significantly higher in fish living under natural conditions of river habitat. Authors are of the opinion that this was in correlation with higher activity level, which is well known to greatly influence hematological parameters of fish (IVANC et al., 1997a).

Beside parameters of hematological status which were recorded in individuals from two habitats with different water quality, experimental researches were also performed, where during the experiment occurred changes in some of the environmental factors. Such researches are performed on carp and perch at different exposure to water oxygen saturation, also on Rainbow trout at different growing temperatures, or on Prussian carp with sharp changes in ambient temperature (Table 1).

Hematological parameters of Rainbow trout are monitored on individuals from the pond and after that on individuals from the same population after thirty day at different ambient temperatures, 9°C and 14°C. Comparison of recorded results from three groups of individuals of Rainbow trout in different ambient conditions shows presence of significant difference in most parameters. So, the highest values of erythrocyte number are recorded in individuals that were analysed directly on the fishpond and were significantly different compared to values of individuals grown at 14°C but not compared to individuals at 9°C. Authors concluded that fish transport and experimental treatment did not effect on erythrocyte number, while increasing water temperature caused increase of MCV and decrease of erythrocyte number. This also resulted with increase in MCH. Opposite of the erythrocyte number values of MCV shows significant increase with temperature increase, and the difference is significant compare to individuals from the fishpond, while in comparison, values in experimental individuals shows difference on the border of statistical significance.

Looking at total results of erythrocyte line parameters of Rainbow trout from the fishpond and experimental conditions can conclude that there are slight difference between values in individuals from fishponds and individuals grown at 9°C. Significantly higher difference were recorded in comparison to values of the individuals from fishponds and individuals grown at 14°C. Based on the results it is evident that in fishes grown at 14°C comes to increase in MCV, which also cause higher hematocrit values although has lower erythrocyte number. Also in this individuals are recorded slightly higher values of hemoglobin concentration, and related to that, values of MCH in individuals grown at 14°C is higher, which probably represents adaptation on temperature increase and rate of



physiological processes. Influence of ambiental temperature increase on erythrocyte profile was done in experimental conditions on Prussian carp, *Carassius gibelio*. Fish were kept in aquaria at 10°C, for three weeks, and after that the temperature in one the aquaria was raised gradually to 20°C in three days period (DEKIĆ ET AL., 2011). Comparison of results of erythrocyte parameters in Prussian carp which was exposed to different ambiental temperatures shows presence of significant difference in most of analysed parameters.

**Table 1. Hematological parameters of several fish species under different environmental and experimental conditions**

Environment	Parameter	Hb g/l	PCV l/l	RBC x10 <sup>12</sup> /l	MCV fl	MCH pg	MCHC g/l eryt.
<i>Barbus balcanicus</i> from an unpoluted (Jakotina) and poluted stream (Suturlija)							
River Jakotina (A)	AVG	<b>74.55<sup>b</sup></b>	<b>0.437</b>	<b>1.099<sup>b</sup></b>	<b>398.55<sup>b</sup></b>	<b>67.95<sup>b</sup></b>	<b>171.498</b>
	STD	8.96	0.046	0.061	46.740	8.551	20.734
River Suturlija (B)	AVG	<b>67.48<sup>a</sup></b>	<b>0.411</b>	<b>1.148<sup>a</sup></b>	<b>359.08<sup>a</sup></b>	<b>58.80<sup>a</sup></b>	<b>165.79</b>
	STD	9.83	0.06	0.052	54.73	8.19	24.94
<i>Squalius cephalus</i> from an unpoluted (Jakotina) and poluted stream (Dragočaj)							
River Jakotina (A)	AVG	<b>75.02<sup>b</sup></b>	<b>0.423<sup>b</sup></b>	<b>1.464</b>	<b>289.59<sup>b</sup></b>	<b>51.39</b>	<b>182.93<sup>b</sup></b>
	STD	7.78	0.068	1.59	43.37	6.36	39.51
River Dragočaj (B)	AVG	<b>78.70<sup>a</sup></b>	<b>0.393<sup>a</sup></b>	<b>1.484</b>	<b>265.36<sup>a</sup></b>	<b>53.67</b>	<b>205.34<sup>a</sup></b>
	STD	7.97	0.068	2.04	37.44	7.01	35.64
<i>Thymallus thymallus</i> from river Krušnica and a fish farm							
River Krušnica (A)	AVG	<b>69.21</b>	<b>0.477<sup>b</sup></b>	<b>1.561<sup>b</sup></b>	<b>306.92</b>	<b>44.43</b>	<b>145.40</b>
	STD	7.73	0.030	1.068	25.83	4.86	17.93
Farm Martin Brod (B)	AVG	<b>61.81</b>	<b>0.429<sup>a</sup></b>	<b>1.387<sup>a</sup></b>	<b>308.77</b>	<b>44.33</b>	<b>143.15</b>
	STD	14.40	0.067	1.636	31.71	8.46	20.54
<i>Oncorhynchus mykiss</i> from a fish farm and aquaria with two ambient temperatures							
Farm (A)	AVG	<b>41.20</b>	<b>0.334</b>	<b>0.894<sup>c</sup></b>	<b>364.58<sup>b, c</sup></b>	<b>45.66<sup>c</sup></b>	<b>125.24</b>
	STD	12.52	0.058	0.144	60.65	12.27	33.84
Aquarium 9°C (B)	AVG	<b>42.52</b>	<b>0.311<sup>c</sup></b>	<b>0.872</b>	<b>373.66<sup>a, c</sup></b>	<b>51.57</b>	<b>137.43</b>
	STD	4.91	0.044	0.177	96.56	16.13	18.04
Aquarium 14°C (C)	AVG	<b>44.11</b>	<b>0.344<sup>b</sup></b>	<b>0.823<sup>a</sup></b>	<b>431.67<sup>a, b</sup></b>	<b>55.24<sup>a</sup></b>	<b>129.35</b>
	STD	7.22	0.043	0.151	98.79	13.78	22.19
<i>Carassius gibelio</i> control fish and fish exposed to short term temperature increase for 10°C							
Aquarium 10°C	AVG	<b>74.66</b>	<b>0.450<sup>b</sup></b>	<b>1.046<sup>b</sup></b>	<b>438.60</b>	<b>77.16<sup>b</sup></b>	<b>172.79</b>
	STD	11.13	0.085	0.196	91.49	18.02	49.52
Aquarium 20°C	AVG	<b>76.73</b>	<b>0.545<sup>a</sup></b>	<b>1.234<sup>a</sup></b>	<b>448.16</b>	<b>63.31<sup>a</sup></b>	<b>144.35</b>
	STD	1.47	0.076	0.161	85.13	12.28	35.69
<i>Perca fluviatilis</i> from low (30 %) and high (90 %) O <sub>2</sub> saturated water							
High saturation (A)	AVG	<b>67.76<sup>b</sup></b>	<b>0.326</b>	<b>1.597</b>	<b>212.55</b>	<b>43.12</b>	<b>206.45</b>
	STD	12.64	0.034	0.347	39.70	5.03	25.76
Low saturation 30% (B)	AVG	<b>78.48<sup>a</sup></b>	<b>0.357</b>	<b>1.787</b>	<b>200.67</b>	<b>44.35</b>	<b>221.24</b>
	STD	6.79	0.040	0.207	15.77	5.08	22.10
<i>Cyprinus carpio</i> in water with normal (A) and low (B) oxygen concentration							
A	AVG	<b>49.08</b>	<b>0.234<sup>b</sup></b>	<b>1.040<sup>b</sup></b>	<b>237.61</b>	<b>46.99</b>	<b>201.94<sup>b</sup></b>
	STD	20.00	0.061	0.374	45.62	6.37	33.66
B	AVG	<b>56.62</b>	<b>0.329<sup>a</sup></b>	<b>1.314<sup>a</sup></b>	<b>251.38</b>	<b>42.91</b>	<b>173.34<sup>a</sup></b>
	STD	15.46	0.084	0.266	40.20	6.07	27.82
<i>Cyprinus carpio</i> from three cage fams with different environmental conditions							
Novi Becej (A)	AVG	<b>63.52</b>	<b>0.366</b>	<b>1.422</b>	<b>252.50</b>	<b>43.82</b>	<b>174.85<sup>b</sup></b>
	STD	4.66	0.039	0.066	28.02	2.68	13.20
Vrbas (B)	AVG	<b>63.40</b>	<b>0.335</b>	<b>1.353</b>	<b>246.80</b>	<b>46.72</b>	<b>189.65<sup>a</sup></b>
	STD	13.48	0.070	0.243	29.26	5.83	13.27
Kovilj (C)	AVG	<b>81.11<sup>b</sup></b>	<b>0.420<sup>a, b</sup></b>	<b>1.679<sup>a, b</sup></b>	<b>251.09</b>	<b>48.79<sup>a</sup></b>	<b>194.18<sup>a</sup></b>
	STD	11.21	0.050	0.206	24.41	7.85	23.56

Mean values (AVG) of one parameter in the same study are marked with different letters in superscript when they are significantly different (significance level at least 0.05).

So, in individuals which were exposed to temperature increase were recorded significantly higher values of hematocrit and erythrocyte number, while values of MCH in these fishes is significantly lower. Based on these results authors conclude that gradual temperature increase encouraged hematopoiesis, which resulted to higher proportion of young erythrocyte in which hemoglobin synthesis is not finished. Looking at parameters of erythrocyte line in total in control and heat-treated fishes it can be detected that in fishes that were exposed to long-term thermal stress values of erythrocyte number and hematocrit are increased. In the same time in this group of individuals are also recorded a slightly higher values of hemoglobin concentration and MCV, while in control fishes are recorded significantly higher values of MCH and slightly lower values of MCHC.

Changes of hematological status are also recorded in time of acclimation of carp to the water with low oxygen concentration (IVANCA et al., 1996). Researches were performed on fishes kept in cages in natural habitats for two months at three localities with different oxygen regime, and in experiment, after thirty days exposure to hypoxic environment. In carp blood are recorded changes common to both types of exposure (increase in RBC, Hb concentration and PCV), also changes characteristic for certain exposure type. After three days stay in water with low oxygen concentration occurs increase in MCV, and after two months of exposure to low oxygen concentration, increase of MCH and MCHC. Effort spent for additional erythropoiesis is probably one of the causes of poor growth in carp grown in water with the most unfavorable oxygen regime.

These physiologic adaptations are recorded also in fishes from other families. Researches of IVANCA et al., (1997) show that in perch, in conditions when the most part of the day in the water is decreased oxygen concentration, occurs changes in blood which improve oxygen transport efficiency. They go in two ways: by increasing the number of circulatory erythrocytes and by increasing the total hemoglobin concentration. These conditions do not cause increase of MCH and MCHC.

Same authors showed (IVANCA et al. 1994; 1995; 1997; 1997a) that in perch, also, chronic exposure to conditions of worse oxygen regime cause increase in MCV and MCHC values, which was also noticed in carp in similar ambient conditions.

Thereby it can be noticed that a short exposure to unfavorable conditions does not cause increase in MCH and MCHC, while longer exposure cause increase. SPECKNER et al (1989) founded that in carps mature erythrocytes also can synthesize hemoglobin. Results with short-term hypoxia show that primarily erythrocyte number increase, and then hemoglobin concentration. Certain increase of MCV shows, however, a possibility that synthesis of hemoglobin can be occurred in mature erythrocyte.

## CONCLUSIONS

Hematological status reflects good reaction of organism on changes in environmental conditions. They are manifested by increasing the number of circulatory erythrocytes, increasing total hemoglobin concentration in blood and mean corpuscular volume. In short-term exposition to unfavorable conditions MCH and MCHC is not increasing, while in long-term exposition they do increase.

## REFERENCES

- DEKIĆ, R. (2010): Cirkanualna istraživanja hematološkog statusa *Barbus peloponnesius* u funkciji staništa. Doktorska disertacija, Univerzitet u Banjoj Luci.
- DEKIĆ, R., IVANC, A., BAKRAČ-BEĆIRAJ AZRA, BOŠKOVIĆ JELENA (2009): Normalne hematološke vrijednosti gajenog lipljena, IV međunarodna konferencija i Sajam tehničkih i tehnoloških dostignuća “Ribarstvo” 27. – 29. Maj, 2009. Beograd. 358-364.
- DEKIĆ, R., IVANC, A., BAKRAČ-BEĆIRAJ AZRA, BOŠKOVIĆ JELENA, LOLIĆ SVJETLANA (2009): Hematološki parametri riba kao indikatori stanja životne sredine, IV međunarodna konferencija i Sajam tehničkih i tehnoloških dostignuća “Ribarstvo” 27. – 29. Maj, 2009. Beograd. 204-210.
- DEKIĆ, R., IVANC, A., MIROŠLJEVIĆ, D. (2010): Eritrogram kalifornijske pastrmke (*Oncorhynchus mykiss*) iz ribnjačkih i eksperimentalnih uslova. II simpozijum biologa Republike Srpske, 4-6. 11. 2010. Banja Luka.
- DJURDJEVIĆ SVJETLANA, DEKIĆ, R., VUKOVIĆ DRAGOJLA., IVANC, A. (2005): Kvalitet vode morfološke, merističke i hematološke karakteristike klena (*Leuciscus cephalus*), I Simpozijum biologa Republike Srpske, Zbornik radova, 231-244.
- HRUBEC, T.C., CARDINALE, J. L. AND SMITH, S. A.(2000): Hematology and Plasma Chemistry Reference Intervals for Cultured Tilapia (*Oreochromis Hybrid*). *Veterinary Clinical Pathology*, 29, 1: 7-12.
- ISHIKAWA, N.M., RANZANI-PAIVA, M.J.T. and LOMBARDI, J.V.(2008): Total leukocyte counts methods in fish, *Oreochromis niloticus*. *Archives of Vet. Science*, 13, 1, 54-63.
- IVANC, A., S. MALETIN, N. ĐUKIĆ, B. MILJANOVIĆ (1994): Ecophysiological interpretation of the hematology of different species of *Percidae* in the Tisa river. *Tiscia*, 28 : 53-57.
- IVANC, A., MALETIN, S., N. ĐUKIĆ, V. PUJIN, V. MILJANOVIĆ B. (1995): Haematology of *Percidae* from the Yugoslav section of the Danube river system. First International Symposium "The Ecology of Large Rivers", Abstracts: 49, Krems, Lower Austria.
- IVANC, A., MALETIN, S., DJUKIĆ, N., PUJIN, V., MILJANOVIĆ, B., BUGARSKI, R. (1996): Adaptation der Karpfen während periodischen Verschlechterungen der Sauerstoffverhältnisse auf dem Überschwemungsgebiet der Donau. I.A.D. Internationale Arbeitsgemeinschaft Donauforschung der Societas Internationalis Limnologiae S.I.L. *Limnologische Berichte Donau*, Band I, Wissenschaftliche Referate, 40 Jahre I.A.D. Göd/Vàcràtót. 31. Konferenz der IAD, Baja-Ungarn, 335-340.
- IVANC, A., ETINSKI, M., MALETIN, S., ĐUKIĆ, NADA., MILJANOVIĆ, B., PUJIN VLASTA (1997): Grgeč kao test organizam u proceni kvaliteta vode. *Zaštita voda*, 253-257.
- IVANC, A., MALETIN, S., DJUKIĆ, N., MILJANOVIĆ, B. (1997a): Haematology of fish species inhabiting running and stagnant waters in Danube river system. 32. Konferenz der Internationale Arbeitsgemeinschaft Donauforschung der S.I.L. *Limnologische Berichte Donau 1997*, Band I, Wissenschaftliche Referate, Wien, 377-380.
- IVANC, A., MILJANOVIĆ, B. (2001): Hematološki status u dijagnostici fiziološkog stanja riba i uslova staništa. Eko-konferencija 2001. Ekološki pokret grada Novog Sada.
- IVANC, A., HASKOVIC, E., JEREMIC, S., DEKIĆ, R. (2005): Hematological Evaluation of welfare and health of fish, *Praxis veterinaria* 53, 3: 191-202.
- MURAD, A., HOUSTON, A.H., AND SAMSON, L. (1990): Haematological response to reduced oxygen-carrying capacity, increased temperature and hypoxia in goldfish, *Carassius auratus* L. *Journal of Fish Biology*. 36: 289-305.

- ROWAN, M. W. (2007): Use of blood parameters as biomarkers in brown bullheads (*Ameiurus NEBULOSUS*) from lake erie tributaries and cape cod ponds. Dissertation. The Ohio State University 2007.
- SEKER, Y., KARATAS, M. AND SEZER, M. (2005): Determination of Biochemical Parameter Values of Chub (*Leuciscus cephalus*) Population in Almus Dam Lake, Turkey. *Journal of Animal Andveterinary Advanses* 4, 11: 927 – 929.
- TAVARES-DIAS, M., AFFONSO, G.E., OLIVEIRA, R.S., MARCON, L.J. AND EGAMI, I.M. (2008): Comparative study on hematological parameters of farmed matrinxa, *Brycon amazonicus* Spix and Agassiz, 1829 (Characidae: Bryconinae) with others Bryconinae species. *Acta amazonica*. 38, 4: 799-806.
- WILSON, R.W. AND TAYLOR, E.W.(1993). The physiological responses of freshwater rainbow trout, *Onchorynchus mykiss* , during acute exposure. *J. Co.. Phy.* 163b: 38- 47

## BIOLOGICAL PRESERVATIVE IN WHOLE CROP WHEAT ENSILAGE

SZŰCS PÉTER JUDIT – MÉSZÁROS A., - SÜLI ÁGNES – BODNÁR SKOBRÁK ERIKA –  
AVASI Z.

University of Szeged Faculty of Agriculture  
6800 Hódmezővásárhely, Andrassy street 15.  
szucsne@mgk.u-szeged.hu

### ABSTRACT – Biological preservative in whole crop wheat ensilage

Ensilage of whole crop wheat is popular in Europe and America for feeding of ruminant animals, but it is quite rare in Hungary. It can be introduced for replacement of shortage of silomaize silages in drought season. The quality of wheat silage could improve by biological inoculants.

Silage additives are expected to ensure a more efficient fermentation phase as well as reduce the risk of aerobic deterioration when silages are exposed to air. Many additives have been developed to improve the ensiling process and nutritive value of silage.

Nowadays the 3<sup>rd</sup> generation biological inoculants –containing lactic acid bacteria and enzymes – are used in order to coordinate the fermentation in such a way that they increase lactic acid production at the beginning of the fermentation and improve the quality and stability of silage during the fermentation and feeding. The quality of raw material (maturity of plant, chop length, spreading of inoculant uniformly) and the proper filling, compacting, covering and wrapping have a great influence on the effectiveness of the inoculant. The mycotoxin content of malfermented silages is an undesirable risk factor.

The objective of our research was to determine the effect of two silage inoculant strains *Lactobacillus buchneri* and *Pediococcus acidilactici* mixture combined with *amilase*-, *glucanase*-, *xylanase* and *galactomannase* enzymes on whole crop wheat silage fermentation characteristics, nutritive value and aerobic stability compare to untreated control.

Experimental ensilage procedure started with the basic whole crop raw material originated from waxen ripeness of wheat (hard cheddar stage of maturity of seeds) at the time of harvesting. The DM content of chopped raw material was 44%.

The LAB inoculants were applied to raw material at  $2.5 \times 10^5$  CFU/g fresh material (FM).

Because of quite good quality of untreated silages also, the priority of LAB treatment could not proven in the aerobic stability test. The biological preservative (LAB+enzymes) promoted better fermentation and forced back the undesirable butyric acid production in the silages.

**Keywords:** whole crop wheat silage, lactic acid bacteria, fermentation, aerobic stability

## INTRODUCTION

Wheat is used for bread-stuffs first of all, or for animal feed. Ensilage of whole crop wheat is popular in Europe and America (WOOLFORD ET AL., 1982), but very rare in Hungary until now. The reason of making whole crop wheat silage for ruminant animals is the following: The uncertainty of selling of over production could be avoided in the high yield years. The wheat harvesting is occurred 2-2,5 months earlier than for maize means: whole crop wheat silage is available the same time earlier, so it could be replace the shortage of other forages at that time. Early entry of reseed is possible. There is no environmental pollutant effluent. Lower clamp cost, eg. straw ball walls are sufficient.

Additives are expected to ensure a more efficient fermentation phase as well as reduce the risk of aerobic deterioration when silages are exposed to air (KEADY AND MURPHY, 1998,

SZUCS AND SINDOU, 2005). Many additives have been developed to improve the ensiling process and nutritive value of silages (NIA AND WITTEMBER, 1999, KUNG ET AL., 2003). *Acids*: under difficult ensiling conditions (rainy weather) acids are best choice as an aid to preservation. *Enzymes*: additives containing fibriolytic enzymes provide additional sugar through the breakdown of plant fibre. *Bacterial inoculants*: they can improve fermentation characteristics by speeding up the fall in pH and lowering ammonia levels into the silo. At present biological additives are preferred because they are non-toxic, non-corrosive to machinery, do not present environmental hazards and are regarded as natural products. *Mixtures of different types of additives*: they can improve the effect of usage them selves. Nowadays the *bacterial inoculants* with cell-wall degrading *enzymes* -so called 3<sup>rd</sup> generation biological inoculants- one of the most popular additives are used in order to coordinate the fermentation in such a way that they increase lactic acid production by leaps and bounds at the beginning of the fermentation and improve the quality and stability of silage during the fermentation and feeding (KUNG ET AL., 1991). There is an unsettled discussion around this issue: the circumstances provided in the silo do not always fit the optimal conditions which are necessary for the functioning of the enzymes. For example cellulase originating from *Trichoderma reesei* fungi, has an optimal activity between pH 4.8 and 5.2 while from *Trichoderma viride* is between 4 and 5. The optimal temperature for these cellulase enzymes: namely 55-65 °C and 40-50 °C respectively (KNABE, 1987). We need to make a compromise regarding the maturity and dry matter content of plant for ensiling as well. The suggested domain of dry matter content for ensiling of grass and lucerne is 28-33% (SCHMIDT ET AL., 2001) as the hard cheddar/ wax maturity of cereals (SZUCS AND AVASI, 2005), in which domain both lactic acid bacteria and cell wall degrading enzymes can work in a sufficient manner. Silage additives produce variable results on aerobic deterioration of silages. A high concentration of lactic acid cannot provide aerobic stability for sure SUCU AND FILYA (2006). Recently the heterofermentative *L. buchneri* is regarded to be the most promising lactic acid bacteria for increasing aerob stability (DREIHUIS ET AL., 1996, 1999, WEINBERG ET AL., 2002). Applied by itself it may show a negative effect by reducing the speed of fermentation, but its combination with homofermentative lactic acid bacteria does compensate this disadvantage (FILYA, 2003). According to RUSER AND KLEIMAN (2005) it takes effect on stability in the 2<sup>nd</sup> phase: during the 1st phase lactic acid originates from sugar and in the 2<sup>nd</sup> phase acetic acid and 1,2 propandiol are generated from lactic acid. OUDE ELFERINK ET AL. (1999) emphasize the role of propionic acid originating from 1,2 propandiol and 1 propanol in stability (1,2 propandiol and 1 propanol are not found in untreated silage). *L.buchneri* may produce other yet unidentified metabolites with antifungal activity BAX AND SINDOU (2005). Applying suitable biological preservatives may be an effective method for the promotion of lactic acid fermentation and preserving forage nutritive value during ensiling and on exposure to air at feed-out (WEDDEL, 2001). The quality of raw material for ensilage (maturity of plant, chop length, spreading of inoculant uniformly) and the proper filling, compacting, covering and wrapping have a great influence on the effectiveness of the inoculant. The mycotoxin content of malfermented silages is undesirable risk factor (NADEU, 2007, SZUCS –AVASI, 2005).

## MATERIAL AND METHODS

The certain amounts of inoculants (*Table 1.*) were diluted in 100ml of distilled water, and spread on 25 kg of raw materials as follows:

We evenly spread 25 kg/treatment of chopped whole crop wheat on micro-silo ensiling on plastic foil, then we vaporized the silage additive on the weighed portions, finally it was mixed.

**Table 1. Composition of applied biological (LAB+ enzymes) inoculant**

<i>Lactobacillus buchneri</i> NCIMB 40788	> 3.00 x 10 <sup>10</sup> CFU* /g
<i>Pediococcus acidilactici</i> MA 18/5M	> 2.00 x 10 <sup>10</sup> CFU /g
Beta-glucanase	> 6000 IU/**g
Alfa-amilase	> 2400 IU/g
Xylanase	> 2400 IU/g
Galactomannase	> 1200 IU/g

\*Colony Forming Unit

\*\*Activity Unit

### Treatments

- T1: Control (untreated) for 4 weeks storage
- T2: LAB inoculants 2.5x10<sup>5</sup> CFU/g fresh material (FM) for 4 weeks storage
- T3: Control (untreated) for 6 weeks storage
- T4: LAB inoculants 2.5x10<sup>5</sup> CFU/g fresh material (FM) for 6 weeks

### Micro-size ensiling process

Small size containers (4.2 l cubic capacity / each), which we used were closed by screwed cap. We filled 5 containers for each treatment, altogether 20 pieces. Storage took place on 20-22C° interior temperature. We stored the filled micro containers 4 or 6 weeks. We performed laboratory examinations on them. The examination focused primarily on the products of fermentation and the aerobic stability.

### Chemical analysis

*Dry matter* (MSZ ISO 6496; 2001)

*Crude protein* with Kjehl-Foss technique on Gerhard Vapodest 40 types of equipment (MSZ 6830-4; 1981)

*Crude fat*: Soxhlet system (MSZ 6830-6; 1981)

*Crude fiber*: Henneberg Stohmann system (MSZ EN ISO 6865; 2001)

*NDF, ADF, ADL*: Van Soest system (1967)

*Crude ash*: sample burning on 600 Celsius° (MSZ ISO 5984; 1992)

*Examination of pH*: used electric Digital pH Meter OP-211/1

*Examination of NH<sub>3</sub>*: We measured NH<sub>3</sub> from watery extract, with OP264/1 NH<sub>3</sub> measuring device

*Organic acids*: lactic acid and volatile fatty acids (acetic-, butyric-, propionic acid) with the type of Young Lin 6100 Acme 6100 gaschromatograph device, applied FID detection. The type of directing software Autochro 3000.

*Examination of ethanol*: We determined it from watery extract with K<sub>2</sub>Cr<sub>2</sub>O<sub>7</sub> solution and through titration with Mohr-salt-solution.

*Water soluble carbohydrates(WSC)system*:D.Hillegis-G.Pahlow, FAL Braunschweig, Germany

Determination of aerobic stability – System Völkenrode (Honig, 1990)

*Principle:* To determine aerobic stability of the silages a method by Honig (1990) was modified and implemented. It is based on monitoring temperature which rises due to increased microbial activity of samples exposed to air. The measurement was continued for 7 days. The registration of the temperature of the samples was realized in every hour by computer.

*Evaluation:* The time till that the silage is supposed to be stable is the registration unit shows a temperature rise of 3°C above ambient temperature (last at least 48 h).

*Statistical analyses:*

Full statistical analysis was using an internationally recognised statistical procedure. We processed data by means of IBM PC computer with the aid of Microsoft Excel program. As method of mathematical statistics, we used the method of comparison of calculated mean values and significance. Significance was declared for P<0.05.

## RESULTS

The most important characteristics of whole crop wheat and silages are shown in *table 2 and 3*.

**Table 2. Chemical composition and nutritive value of whole crop wheat and silages**

Parameters	Fresh raw material	Silages			
		4 weeks storage		6 weeks storage	
		Control T1	Treated T2	Control T3	Treated T4
	Mean n=5	Mean n=5	Mean n=5	Mean n=5	Mean n=5
Dry matter %	43.7	45.7	45.9	45.6	45.2
Crude protein g/kg DM	89	81	80	79	78
MPE g/kg DM	71	66	66	65	65
MPN g/kg DM	53	49	48	47	47
Crude fat g/kg DM	26	18	15	18	20
Crude fibre g/kg DM	392	314	321	324	327
Crude ash g/kg DM	69	61	59	67	65
NE(m) MJ/kg DM	5.56	5.31	5.27	5.23	5.27
NE(g) MJ/kg DM	3.14	2.92	2.89	2.85	2.89
NE(l) MJ/kg DM	5.22	5.19	5.17	5.13	5.15
WSC g/kg DM	72	26	23	26	29
NDF g/kg DM	743	615	611	633	620
ADF g/kg DM	408	319	334	336	338
ADL g/kg DM	68	68	73	66	61
Cellulose g/kg DM	340	251	261	270	277
Hemicellulose g/kg DM	335	296	276	297	282



**Table 3. Fermentation products in whole crop wheat silages**

Parameters	Fresh raw material	Silages			
		4 weeks storage		6 weeks storage	
		Control T1	Treated T2	Control T3	Treated T4
	Mean n=5	Mean n=5	Mean n=5	Mean n=5	Mean n=5
Dry matter %	43.7	45.7	45.9	45.6	45.2
Buffer capacity	15	--	--	--	--
Lactic acid % of DM	--	12.5	20.5	12.3	13.7
Acetic acid % of DM	--	3.3	9.5	3.0	9.0
Butyric acid % of DM	--	4.8	2.5	4.3	1.5
Propionic acid % of DM	--	0.0	0.3	0.0	0.6
Ethanol % of DM	--	1.2	1.1	0.9	1.5
Ammonia % of total N	--	8.3	7.2	8.1	7.4
pH	--	4.1	4.1	4.1	4.2

## CONCLUSIONS

The conclusion of whole crop wheat ensiling experiments-are the followings:

- The basic whole crop raw material originated from waxen ripeness of wheat (hard cheddar stage of maturity of seeds) at the time of harvesting. The DM content of chopped raw material was 44%.
- The average net weight of filled micro silo-containers was 1878-1882 g, the density of silos was 0,442-0,443 t/m<sup>3</sup> which corresponds to a density of 194 kg DM/m<sup>3</sup>.
- The statistical analyse confirmed the similar density of the microsilos. There was no significant difference (P>10%) among the density of different treated microsilos.
- The average pH at silo opening was 4,1-4,2 suggesting that the treated and also untreated silages were well fermented.
- There was no significant effect of treatments on water soluble carbohydrate, protein- and netto energy content of silages .
- Lactic acid and acetic acid were the main fermentation products. High concentrations of acetic acid were found in the treated silages, indicating a hetero fermentative pathway thanks to the activity of *Lactobacillus buchneri*.
- There were significant differences between higher lactic acid content of treated silages and the the control after 4 weeks of fermentation (P< 5%) but there were no significant differences on 6 weeks samples.
- Lactic acid and acetic acid ratio was better in treated silages, which results better palatability and consumption for ruminant animals.
- The inoculant-treated silages contained less undesirable butyric acid than that of control silages. The difference is significant (P< 5) after 6 weeks of storage. The butyric acid is an undesirable substance of silages, because it is dangerous for the health of ruminant animals.
- The protein degradation was higher in control silages which was showed by their higher NH<sub>3</sub> content.

- On aerobic condition neither treated nor control silages did not heat up more than 3 C° during 7 days of exposure to the air.
- DM losses in bacterial treated silages were lower compare to the control -both after 4 and 6 weeks storage silages- during aerobic stability experiment, but the difference was not significant.
- Because of the same good stability of untreated silages, the advantages of LAB treatment could not proven by the aerobic stability test.
- The applied dosage of biological preservative (LAB+enzymes) promoted better fermentation and forced back the undesirable butyric acid production in the silages.

## REFERENCES

- DREIHUIS, F - SPOELSTRA, S.F. - COLE, C.C.J. - MORGAN, R. (1996): Improving aerobic stability by inoculation with *Lactobacillus buchneri* Proc. XI<sup>th</sup> International Silage Conference. IGER Aberystwyth, Wales 106-107
- DREIHUIS, F. - OUDE ELFERINK S.J.W.H. - VAN WIKSELAAR, P.G. (1999): *Lactobacillus buchneri* improves aerobic stability of laboratory and farm scale whole crop maize silage but does not affect feed intake and milk production of dairy cows. Proc. XII<sup>th</sup> International Silage Conference. Uppsala, Sweden. 264-265
- FILYA, I. (2003): The effects of *Lactobacillus buchneri* with or without homofermentative lactic acid bacteria on the fermentation, aerobic stability and rumen degradable of wheat, sorghum and maize silages *Journal of Applied Microbiology* 95.5.1080-1086
- Keady, T. W. J., Murphy J.J. (1998) Effects of inoculant treatment on silage fermentation, digestibility, rumen fermentation, intake and performance of lactating dairy cattle. *Grass and Forage Sci.* 51:232-241
- KNABE, O. (1987): Ermittlung von Einflussfaktoren zur Dynamik der Kohlenhydratfraktion in Grünfütterstoffen und Erschließung biotechnologischer Prinzipien und von Silierhilfsmitteln zur Steuerung von Konservierungsprozessen. (Studie) Institut für Futterproduktion-Paulinaue
- KUNG, L. - TUNG, R.S. - YACIOROWSKI, K.O. - BUFFY, K. - KNUTSEN, K. - AIMUTIS, W.R. (1991): Effects of plant cell-wall-degrading enzymes and lactic acid bacteria on silage fermentation and composition. *Journal of Dairy Science*, 74. 4284-4296
- KUNG, L.- STOKES, M.R. - LIN, C.J. (2003): Silage additives In: Buxton, D.R.- Muck, R.E.- HARRISON, J.H. (eds.) *Agronomy series No.42. Silage Science and Technology*. Madison, Wisconsin, 305-360.
- NADEU, E. (2007): Effect of plant species, stage of maturity and additive on feeding value of whole crop cereal silage *Journal of the Science of Food and Agriculture*, 87. 5. 789-801
- NIA, S.A.M. - WITTENBERG, K.M. (1999): Use of forage inoculants with or without enzymes to improve preservation and quality of whole crop barley forage *Canadian Journal of Animal Science*, 79.4. 525-542
- OUDE ELFERINK S. J.W.H., DREIHUIS, F., KROONEMAN, J., GOTTSCHAL, J. C., SPOELSTRA, S.F. (1999): *Lactobacillus* can improve the aerobic stability of silage via a novel fermentation pathway: the anaerobic deterioration of lactic acid to acetic acid and 1,2 propanediol. Proc. XII<sup>th</sup> Int. Silage Conf., Uppsala, Sweden pp. 266-267.
- RUSER, B., KLEIMAN, J. (2005): The effect of acetic acid on the aerobic stability of silages and on intake Proc. XIV<sup>th</sup> International Silage Conference. Belfast Northern Ireland, pp. 231

- SCHMIDT, J., CSERMELY, J., SZÜCSNÉ PÉTER, J., BELLUS, Z. , SIPŐCZ, J. (2001): Conservation of green lucerne by biological conserves containing cell-wall degrading enzymes 52. Annual Meeting of EAAP Paper N6
- SUCU, E. - FILYA, I. (2006): The effects of bacterial inoculants on the fermentation, aerobic stability and rumen degradability characteristics of wheat silages *Turkish Journal of Veterinary Animal Science* 30.187-193
- SZUCS, J.P.-SINDOU J. (2005): New inoculant protects alfalfa's properties *Feed-Mix* 13.3.13-15
- SZUCS, J.P. - AVASI, Z. (2005): Amit a jó szilázs készítéséhez tudni kell. *Szoliter Nyomda Hódmezővásárhely*, 1-96
- WEDDELL, J.R. (2001): Silage Additive Approval Schemes in Europe – Aims, Developments and Benefits *Proceedings of X. International Forage Conservation, Brno*, 37-44
- WEINBERG, Z.G.-ASHBELL, G.-HEN, Y.AZRIELI, A.-SZAKACS, G.-FIYLA,I. (2002): Ensiling whole –crop wheat and corn in large containers with *Lactobacillus plantarum* and *Lactobacillus buchneri* *Journal of Industrial Microbiology and Biotechnology* 28.1.7-11
- WOOLFORD, M.K. – BOLSEN, K.K. – PEART, L.A. (1982): Studies on the aerobic deterioration of whole-crop cereal silages. *Journal of Agricultural Science*, 98. 529-533

## **HABITAT SELECTION OF THE EURASIAN BADGER IN VARIOUS AREAS OF HUNGARY**

**HELTAI MIKLÓS<sup>1</sup>, HORVÁTH ZSUZSANNA<sup>1</sup>, KISS ZSUZSANNA<sup>1</sup>, NAGY ANNA<sup>1</sup>, MARKOLT FERENC<sup>(1)</sup>, SZENTKIRÁLYI PETRA<sup>1</sup>, LANSZKI JÓZSEF<sup>2</sup>**

(1) Szent István University, Institute for Wildlife Conservation  
2103 Gödöllő, Páter Károly str. 1  
[heltai.miklos@gmail.com](mailto:heltai.miklos@gmail.com)

(2) Kaposvári University, Department for Nature Conservation  
7400 Kaposvár, Guba Sándor str. 40.

### **ABSTRACT – Habitat Selection of the Eurasian Badger in Various Areas of Hungary**

We examined the habitat use patterns of the Eurasian badger in one area among mountains, one among hills and one on the Great Plain of Hungary. These examinations were based on burrow estimation by striped transect, and they were carried out by categorising the habitat types in which badger burrows were detected.

We found that badgers prefer forested areas, predominantly pine-forests and mixed pine-forests, for digging their burrows. They seem to avoid areas of open fields, although occasionally they do dig burrows in such areas, especially if the percentage of forest cover is low.

**Keywords:** Eurasian badger, habitat selection, den

## **INTRODUCTION**

The distribution of the Eurasian badger extends from Ireland to Japan, spreads from Finland throughout Israel across Iran and Afghanistan even to China. It is only lacking from the Balearic Island in Europe. The occurrence ranges between 1600 and 1700 above mean sea level. The European badger may find its life conditions in deciduous and mixed forests but shrubby and agricultural areas, as well (MITCHELL-JONES ET AL., 1999). WOZENCRAFT (2005) in his last-edited summary particularly emphasizes the recently experienced significant increase of population size in the British Islands and Ukraine. According to HOLMALA AND KAUALA (2006) the population of badger is growing in whole Europe. The oral rabies vaccination program might stay in its background. The European badger in Hungary was protected between 1973 and 2001, since then became game species and hunted from 1<sup>st</sup> of June till 28<sup>th</sup> of February. However its population was still continuously growing and spreading. The area-occupation of European badger in Hungary can practically be considered to be finished and nowadays there is not any Hungarian landscape without the occurrence of this species (LANSZKI AND HELTAI 2010). The reason of the wideness of the European and Hungarian dispersal area, and increase in populations in several European countries and so in Hungary is the adaptability and flexibility of this species both to habitat and feeding conditions. During its habitat selection the aspects of equally the suitable sites for digging setts that are not threatened by falling down (NEAL AND CHEESEMAN 1996), and the proper sheltering (CRESSWELL ET AL., 1990) are important for the Eurasian badger. HELTAI AND KOZÁK (2004), and KOZÁK AND

HELTAI (2006) studied the species' selection of den sites, principally considering the aspects of vegetation and cover, during their badger-habitat-preference studies on the Hungarian Plain (Erdőspuszta next to Debrecen, and Hortobágy). Their data showed small preference of forested areas within the two sample sites where environmental factors (such as geological, hydrological, feeding source patterns) enable. At Erdőspuszta preference of the *Pinus sylvestris* plantations is showed. They suggest that the very low preference of opened areas on the Hortobágy sample site may be caused by geological and hydrological parameters. Based on the data of their samples the habitat-preference of European badger on plain only partly depends on the vegetation and cover. The geological and hydrological parameters, by chance the nutrient-supply situation are often more dominant. Beside this study that was done in Hajdú-Bihar country there are not any other data available from Hungary about the habitat use of this species. Hence our aim was to study the habitat use at the choosing burrows' location in case of the Eurasian badger in three different landscapes: in the Bakony that is considered to be mountainous area in the Hungarian context, in the Gödöllő Hills, and at a recently occupied habitat that is called Kiskunság. We investigated the preferred and avoided habitat type of the three different landscapes and we were searching for the habitat parameters that were decisive to the presence of the species.

## **MATERIALS AND METHODS**

### **Study areas**

#### ***Bakony***

The Bakony study area was a fenced, 3768.46 ha game preserve that is bordered by eight settlements (Veszprém, Márkó, Bánd, Szentgál, Nemesvámos, Tótvázsony, Nagyvázsony és Úrkút). The terrain within this area is mainly unstructured. The average valley density is between 2.5 – 2.6 km/km<sup>2</sup>, the average above mean sea level is 320 metres. The soil consists of low productive leptosols on limestone and dolomite bedrock. Forests of this area are supplemented with diverse size clearings, meadows, agricultural areas, and watercourses. Almost the entire game preserve – from Nagyvázsony to Bánd – is continuously forested. The together 400 ha ploughland is utilized as game field; alfalfa, triticale, wheat, sunchoke (*Helianthus tuberosus*), and partly grass is produced on this areas.

#### ***Gödöllő Hills***

The observations were done between Isaszeg and Pécel. The former bedrock of the Gödöllő Hills was loess that was covered by a thinner-thicker diluvial sand sediment layer. Beside the typical loess that covers large areas loessy sand and sandy loess are frequently found, as well. This landscape ranges between 130-344 a.m.s.l. The scale of soil-erosion is remarkable; the typical site condition is dry. Water reservoirs, fishponds can be found both within and out of the forests between Isaszeg and Pécel. The size of the observed area included into the burrow-estimation was 1430 ha.

#### ***Kiskunság***

We conducted the investigation on the borderline of Pest and Bács-Kiskun countries between Kunpeszér and Kunszentmiklós all together on 4060 ha. This area can be spited

into two parts. The first is a solonchack barren, saline meadow and pasture called Nagyrét (protected area) that is located at the lower elevations of the Danube's former floodplain. The groundwater level may be high in the early spring here, but till the beginning of the summer, due to the evaporation and the suction effect of the sewage system, that was implemented in the beginning of the XX<sup>th</sup> century to solve the groundwater problems, dries up and the saline marshes are only to find separately in small patches.

The soil of the Kiskunság-study area is mainly bad water balanced heavy soil, additionally with a few sandy back. The other part of the investigation area is surrounding the eastern part of the Nagyrét. It consists of mainly non protected agricultural areas that are complemented by small forest patches and settlement mosaics. Here we almost exclusively find only sandy soils. Between 95 and 102 a.m.s.l. without any steep or unexpected changes, that means evenly plain site.

### **Burrow estimation**

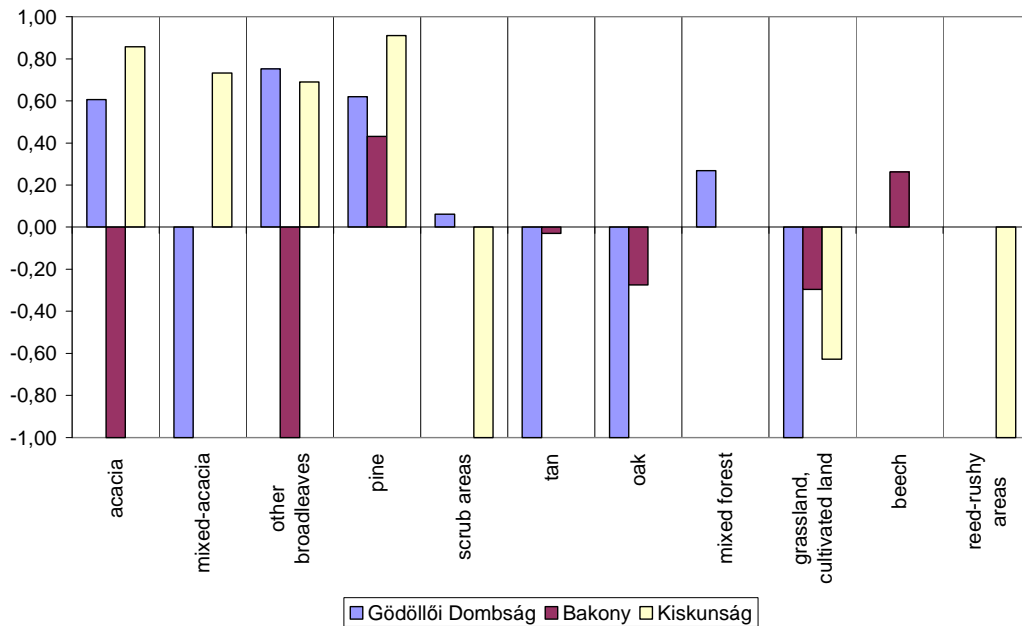
Burrows were estimated by parallel, North-South oriented stripped transects at all the three areas. The decision whether the found den is inhabited or not and whether the inhabiting species is Eurasian badger or red fox, was based on the surrounding indirect indices (footprint, latrine). The widths of the respective track-sections were continuously recorded. During the implementation, data recording, and evaluation of our field work we used the methods given by HELTAI AND KOZÁK (2004), and KOZÁK AND HELTAI (2006).

### **Calculation of habitat preference**

After determining the exact locations of badger-burrows that were found in the three different study landscapes the scales of preferences were counted according to the Ivlev's formula (Ivlev 1961):  $P_x = (A-B)/(A+B)$  where A is the rate of burrows in the respective habitat type compared to the total number of burrows within the respective landscape; B is the rate of the area of respective habitat type to the total area of the respective landscape;  $P_x$  is a value of preference/avoidance of the respective habitat type (range [-1;1]). (+1) means total preference whereas (-1) suggests overall avoidance. The significance of the preference values were calculated using Chi<sup>2</sup>-test, and Bonferroni Z-test after the necessary merges of the habitat-type categories. The same tests were used to compare the landscapes and to determine the most important habitat categories that are decisive at the habitat use of the European badger.

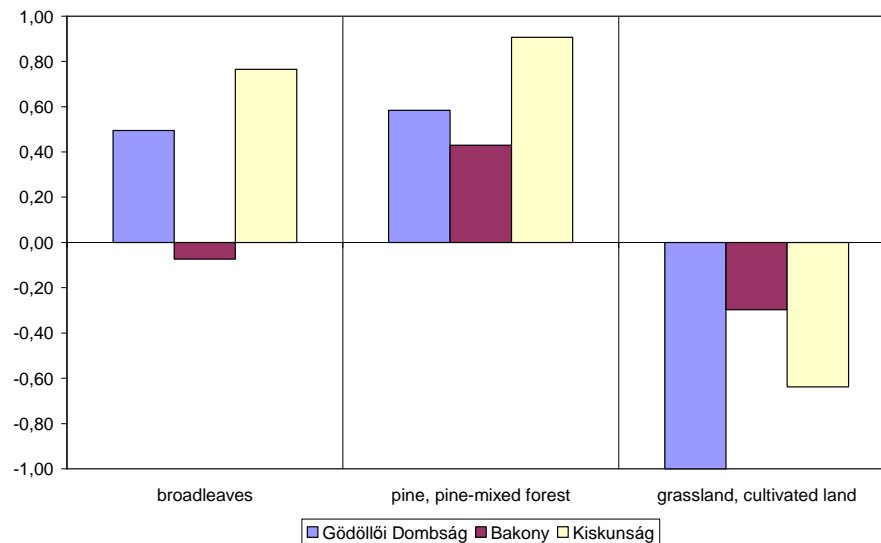
## **RESULTS**

The results of habitat use based on the spatial distribution of the burrows show overall preference of coniferous forests (Ivlev-index values per landscapes: Gödöllő Hills: 0.62; Bakony: 0.43; Kiskunság: 0.91) and general avoidance of opened sites such as meadows, pastures, ploughlands, however entire avoidance only were found in the Gödöllő Hills (Ivlev-index values per landscapes: Gödöllő Hills: -1.00; Bakony: -0.30; Kiskunság: -0.63) (*figure 1.*).



**Figure 1. Habitat preference values on the study area, estimated by European badger-burrows (Y-axis: Ivlev-index). Missing values mean absence of the respective habitat type at the certain landscape.**

Using Bonferroni Z-test the preference of *Robinia pseudoacacia* and coniferous forests were proven to be significant in the Gödöllő Hills, just like the avoidance of opened sites (Bonferroni Z (4) = 2.500;  $p < 0.05$ ). The other preferences and avoidances were not significant. In the Bakony neither of preference values were significant (Bonferroni Z (3) = 2.407) but in the Kiskunság landscape preference of deciduous forests and avoidance of opened sites were significant (Bonferroni Z (3) = 2.407;  $p < 0.05$ ). However it is important to underline, that the above mentioned habitat categories had to be merged into larger groups during the significance-analyses, because otherwise the area of certain habitat types often were not large enough compared to the total area size, which unable us to use the  $\chi^2$ -test.



**Figure 2. Comparison of the merged habitat uses of the three studied landscapes (Y-axis: Ivlev-index)**

To be able to compare the landscapes habitat categories first had to be merged. It had two main reasons: the above mentioned statistical criteria and the fact, that these landscapes are different, and some habitat types are not to find at either landscapes. This comparison confirms the results of the previous observations about the avoidance of opened sites and preference of coniferous forests. All of the preferences and avoidances of the three habitat types in the Gödöllő Hills were significant ( $p < 0.05$ ). In the Bakony were neither of the values significant, hence in the Kiskunság preference of deciduous forests and avoidance of opened sites are considered to be significant (Bonferroni  $Z(3) = 2.407$ ;  $p < 0.05$ ) (figure 2.).

## CONCLUSIONS-DISCUSSION

Our results prove our hypothesis that the European badger can widely adapt to the habitat conditions. However, taking in account the feeding habits and habitat use of this species, mainly based on research studies in the United Kingdom (NEAL AND CHEESEMAN, 1996; LANSZKI AND HELTAI 2010), the stronger preference of coniferous or partly coniferous forests than the preference of deciduous forests is surprising. Its reason is probably the fact that the coniferous plantations on the Hungarian Plain were mainly implemented on extensive, low productivity sand-soils that are suitable for digging burrows. The avoidance of the opened sites was also an expected result. However, the plasticity of the European badger is shown well by the fact, that in case of necessity it burrows on opened sites as well, especially at low forestation (e.g. Kiskunság).

## CITED LITERATURE

CRESSWELL, P., HARRIS, S., JEFFERIES, D.J. (1990): The history, distribution, status and habitat requirements of the badger in Britain. Nature Conservancy Council, Peterborough, pp. 1-42.



- HELTAI, M., KOZÁK, L. (2004): A borz kotoréksűrűségének felmérése két alföldi területen. *Vadbiológia*, 11: 83-91.
- HOLMALA, K., KAUALA, K. (2006): Ecology of wildlife rabies in Europe. *Mammal Review*, 36: 17–36.
- IVLEV, V.S. (1961): *Experimental ecology of the feeding of fishes*. Yale University Press, New Haven Conn.
- KOZÁK, L AND HELTAI, M. (2006): A borz (*Meles meles* Linnaeus, 1758) élőhelypreferenciája Hajdú-Bihar megyében. *Állattani Közlemények*, 91(1): 43-55.
- LANSZKI JÓZSEF AND HELTAI MIKLÓS (2010): Eurázsiai borz (*Meles meles* Linnaeus, 1758). 67-72 pp. In.: Heltai, M. (eds.) (2010): *Emlős ragadozók Magyarországon*. Mezőgazda Kiadó, Budapest. 240 pp.
- MITCHELL-JONES, A.J., AMORI, G., BOGDANOWICZ, W., KRYSZTUFK, B., REIJNDERS, P.J.H., SPITZENBERGER, F., STUBBE, M., THISSEN, J.B.M., VOHRALIK, V., ZIMA, J. (Eds.) (1999): *The Atlas of European Mammals*. Academic Press, London.
- NEAL, E., CHEESEMAN, C. (1996): *Badgers*. T and AD Poyser Ltd. London.
- WOZENCRAFT, W.C. (2005): Order Carnivora. In: *Mammal Species of the World*. (Eds.: Wilson, D.E., Reeder, D.M.) The Johns Hopkins University Press, Baltimore, pp. 532-628.

## **EFFECT OF DIFFERENT PROTEIN LEVELS ON, TESTICULAR PARAMETERS AND SEMEN QUALITY IN KIVIRCIK RAM LAMBS DURING PUBERTAL DEVELOPMENT**

**ÖZKAN ELMAZ<sup>1</sup>, ÜMIT CIRIT<sup>2</sup>, ONUR KESER<sup>3</sup>, CAN KUTAY<sup>3</sup>**

<sup>1</sup>Department of Animal Breeding, Faculty of Veterinary Medicine,  
Mehmet Akif Ersoy University, Örtülü Campus 15100, Burdur, Turkey

<sup>2</sup>Department of Reproduction and Artificial Insemination, Faculty of Veterinary Medicine,  
Dicle University, 21280, Diyarbakır, Turkey

<sup>3</sup>Department of Animal Nutrition and Nutritional Diseases, Faculty of Veterinary  
Medicine, Istanbul University, 34320, Avcılar, Istanbul, Turkey  
elmaz@mehmetakif.edu.tr

### **ABSTRACT – Effect of Different Protein Levels on, Testicular Parameters and Semen Quality in Kivircik Ram Lambs During Pubertal Development**

The aim of this study was to determine the effects of different protein levels on, testicular parameters and semen quality in Kivircik ram lambs during pubertal development. Two experimental groups were formed. Following weaning, crude protein (CP) were 12% CP in group I (low protein diet) and 18% CP in group II (high protein diet). Measurements of live weight and testicular characteristics were performed in 20 days intervals starting from 115 days up to 195 days of age. There was an increase in semen volume, spermatozoa concentration and the percentage of progressively motile sperm in both groups between 135 and 195 days of age. Group I had significantly higher semen volume on day 175 ( $P<0.05$ ). Furthermore, spermatozoa concentration were higher in group I than those in group II on days 155 and 175 ( $P<0.05$ ). Values of live weight, testicular diameter, testicular circumference, testicular length and testicular volume of ram lambs in group II (high protein diet) were higher than those in group I (low protein diet). Testicular length and testicular volume of group II were significantly higher than those of group I on day 195 ( $P<0.05$ ). Live weight and testicular characteristics of ram lambs fed with high protein diet were affected positively during pubertal development. However, it was observed that feeding with high protein diet had negative effect on semen characteristics by impaired thermoregulation mechanism and spermatogenesis in testicles because of excessive fat accumulation in scrotum.

**Keywords:** ram lambs, reproduction traits, feed, protein levels.

## **INTRODUCTION**

Nutrition plays a major role in many aspects of male reproduction, including attainment of sexual maturity, both in terms of spermatogenesis and libido (CARPENTER et al., 1997). The study of the reproductive function in different ruminant species has provided evidence for the effects of nutrition during the growing period on the development of the hypothalamic-pituitary gonadal axis and hence on the onset of puberty. It has been reported that low planes of nutrition during the prepubertal period in ruminants delay testicular growth and the onset of puberty by inhibiting the development of a mature reproductive endocrine system (PRUITT AND CORAH, 1985). There is now considerable evidence suggesting that the influence of nutrition on reproductive processes is mediated via effects of dietary constituents on the hypothalamic-pituitary axis, although there is some indication that dietary changes may affect the testis directly (BROWN, 1994). Undernutrition negatively

influences attainment of puberty (FOSTER et al., 1998). However, the mechanism by which nutrition influences reproduction is largely unknown. Nevertheless, it is noteworthy that there is some controversy about the effects of additional nutritive supply, above maintenance requirements, during the pre-pubertal period on testicular development and semen characteristics. Thus, it has been reported that the reproductive potential of young males may also be impaired by overfeeding. COULTER AND KOZUB (1984), observed a detrimental effect of high energy intake on 2-year-old Hereford bulls, as measured by epididymal sperm reserves and sperm motility and morphology. MORROW et al. (1981) evaluated the effects of low and high energy diets on the growth and reproductive development of Angus and Simmental bulls and found that the low energy group showed higher values of fertility and libido. In contrast to the above-mentioned results, several studies did not reveal any effect of the level of nutrient intake during the pre and postpubertal period of young bulls and rams on reproductive traits, such as testicular size, semen quality or serving capacity, attainment of puberty (BIELLI et al., 2001). It was reported that reproductive characteristics of ram lambs were effected by different feeding in early stage of their life, and these differences were compensated by improving of feeding (SUTAMA and EDEY, 1986).

This study was carried out in order to determine the effects of feeding the Kivircik ram lambs during the pubertal period with two diets that have same energy levels but different protein levels on growth performance, testicle morphology and semen quality.

## **MATERIAL AND METHODS**

This research was conducted in the boxes of Education and Research Hospital in Veterinary Faculty, University of Istanbul. Twenty single-born ram lambs were used for the research. Kivircik ram lambs were housed together with the other lambs starting from lambing until weaning. The lambs were weaned at three months age. During the suckling period, lambs were fed with lucerne and concentrate feed. Following weaning, lambs were transported to experimental pens. Ram lambs were randomly assigned into two groups (n=10). The experimental groups were designed according to the percentage of crude protein and source of protein of the diet. In addition, the energy levels of the diets in both groups were kept equal. Crude protein (CP) and metabolic energy (ME) levels were 12% CP, 2.54 Mcal/kg in group I (low protein diet) and 18% CP, 2.52 Mcal/kg in group II (high protein diet) (tab. 1). For fiber intake, only high quality lucerne was fed. At the beginning of the trial, lambs were fed with 600 g/head/day concentrate feed and 200 g/head/day lucerne on average. During the experiment, amounts of concentrate feed and lucerne were increased up to 1000 g/head/day and 400 g/head/day. Drinking water was available continuously during the experiment period. Data has been collected for the first time when the ram lambs were 115 days old. Measurements of live weight and testicular characteristics (testicular diameter, testicular length, scrotal circumference and testis volume) were taken every 20 days until the end of the experiment. Sperm was evaluated for each 20 days interval starting from 135 until 195 days of age.

**Table 1. Formulation and chemical composition of the experimental diets**

Ingredients	Group I (Low protein diet)	Group II (High protein diet)
Lucerne	15	15
Wheat bran	10	13
Barley grain	69.5	47.5
Soybean meal	2	21
Salt	1	1
Sodium bicarbonate	0.5	0.5
Limestone	1.5	1.5
Vitamins and mineral mix*	0.5	0.5
Total	100	100
<b>Calculated chemical composition (% DM basis)</b>		
Dry matter (%)	90.09	90.06
Crude protein (%)	12	18
ME (Mcal/kg)	2.54	2.52

Live weight was recorded in the morning before feeding. Testicular diameter was recorded with a caliper on the left and right testicles as the widest anteroposterior diameter. Testicular length was also measured with a caliper both on the left and right testicles as the distance between the top of the tail and the head of the epididymis. Scrotal circumference was measured with a flexible tape at the point of maximum circumference of paired testes. Paired testicular volume were calculated by  $0.0396 \times (\text{average testis length}) \times (\text{scrotal circumference})^2$  (GODFREY, 1998). Semen was collected from rams using a manually controlled electro-ejaculator (P-T Electronics, Model 304, USA) with a rectal probe that has three electrodes. The rectal probe was lubricated and gently inserted into rectum, and orientated so that the electrodes were positioned ventrally. Electric current was applied starting from 1 volt for 2 sec with 2-sec rest intervals between stimuli, increasing the voltage stimuli by one volt at a time. The penis was prolapsed beyond the prepuce, and semen was collected into a graduated collection vial attached to an artificial vagina at room temperature. Collected semen were immediately transported to the laboratory and immersed in a water bath at 30°C. Volume of ejaculates was read directly from a graduated collection container with 0.1 ml intervals. The spermatozoa concentration was determined by optical density with a spectrophotometer (Photometer SDM4, Minitüb, Germany) calibrated for ram species (1:1000 dilution rate). A small subsample of semen was diluted with physiological saline on a slide, covered with a cover slip and placed on a microscope stage at 37°C. The percentage of progressively motile sperm was estimated qualitatively by examining approximately eight fields at a magnification of 400x (MARCO-JIME'NEZ, 2005). To avoid variance, all semen measurements were analyzed by a single researcher in this study.

In the statistical analysis, all the related characteristics were investigated (live weight, testicular characteristics, testosterone concentrations and semen characteristics). Independent Samples t-test was used to observe whether any differences existed between groups (ZAR, 1996). Calculations have been made using the SPSS program pack (OZDAMAR, 1999).

## RESULTS

The effects of nutrition on live weight, testicular characteristics and semen quality during the pubertal development period of the ram lambs have been investigated in this study. The results for the semen characteristics are presented in Table 2. There were increases in semen quality values in both groups between 135 and 195 days of age. Although increases in these values were generally higher in group I (low protein diet), there were statistical differences ( $P < 0.05$ ) for semen volume on day only 175, and for spermatozoa concentration on days 155 and 175. No statistical difference was observed between the groups in terms of motile spermatozoa during the study. The measurements on the 195<sup>th</sup> day of the study coincided with the quality season. No difference between the groups in terms of semen quality was observed for this period.

**Table 2. Mean ( $\pm$  S.E) of semen characteristics (semen volume, spermatozoa concentration and motile spermatozoa) in ram lambs from 135 to 195 days**

Days	Groups	n	Semen volume (ml)	Spermatozoa concentration ( $\times 10^9$ /ml)	Motile spermatozoa (%)
135	I	5	$0.48 \pm 0.10$	$0.56 \pm 0.26$	$23.0 \pm 15.3$
	II	6	$0.48 \pm 0.12$	$0.27 \pm 0.14$	$14.2 \pm 12.3$
155	I	10	$0.99 \pm 0.07$	$0.97 \pm 0.10^a$	$63.5 \pm 2.9$
	II	10	$0.75 \pm 0.08$	$0.51 \pm 0.11^b$	$60.5 \pm 4.6$
175	I	9	$1.12 \pm 0.13^a$	$1.00 \pm 0.14^a$	$70.0 \pm 4.1$
	II	10	$0.88 \pm 0.15^b$	$0.58 \pm 0.14^b$	$65.0 \pm 6.4$
195	I	10	$1.14 \pm 0.11$	$1.42 \pm 0.21$	$72.0 \pm 3.1$
	II	10	$0.92 \pm 0.06$	$1.40 \pm 0.25$	$69.0 \pm 4.2$

<sup>a, b</sup> Means within a row with different superscripts are significantly different ( $P < 0.05$ ).

The developments of live weight and testicular characteristics are presented in Table 3. Values for live weight, testicular diameter, testicular circumference, testicular length and testicular volume of rams in group I were lower compared to those in group II for all observations (on days 115, 135, 155, 175 and 195). An increase was observed in all parameters from day 115 to day 195 in both groups. While statistically no significant difference was found between two groups on days 115, 135, 155 and 175 in all parameters, there was a statistical difference on day 195 for testicular length and volume between the two groups ( $P < 0.05$ ). The live weight and testicular parameters of the ram lambs in group II (high protein diet) were higher than the ram lambs in group I (low protein diet) for all the time intervals included in the study (at days 115, 135, 155, 175 and 195). While no statistical difference has been observed between the groups in terms of the above mentioned parameters, but only the differences at testicular length and testes volume on the 195<sup>th</sup> day between the two groups were statistically different ( $P < 0.05$ ).

**Table 3. Mean ( $\pm$  S.E) value of live weight and testicular characteristics at different times throughout the experiment for ram lambs**

Days	Groups	n	Live weight ( kg )	Scrotal circumference ( cm )	Testicular diameter ( cm )	Testicular length ( cm )	Testes volume ( cm <sup>3</sup> )
115	I	10	27.3 $\pm$ 1.2	18.6 $\pm$ 0.9	2.98 $\pm$ 0.2	6.28 $\pm$ 0.5	93 $\pm$ 17
	II	10	27.8 $\pm$ 0.9	18.7 $\pm$ 0.9	2.93 $\pm$ 0.2	6.76 $\pm$ 0.4	100 $\pm$ 16
135	I	10	28.9 $\pm$ 1.1	21.1 $\pm$ 1.3	3.69 $\pm$ 0.3	7.95 $\pm$ 0.4	152 $\pm$ 23
	II	10	30.6 $\pm$ 1.2	21.8 $\pm$ 1.2	3.79 $\pm$ 0.2	8.13 $\pm$ 0.4	164 $\pm$ 25
155	I	10	31.4 $\pm$ 1.3	24.8 $\pm$ 1.3	4.37 $\pm$ 0.3	9.12 $\pm$ 0.4	233 $\pm$ 27
	II	10	35.2 $\pm$ 1.7	27.7 $\pm$ 0.9	4.77 $\pm$ 0.2	9.90 $\pm$ 0.4	310 $\pm$ 34
175	I	10	36.1 $\pm$ 1.5	26.8 $\pm$ 1.3	4.56 $\pm$ 0.3	9.47 $\pm$ 0.4	282 $\pm$ 33
	II	10	39.8 $\pm$ 1.4	28.9 $\pm$ 0.9	5.10 $\pm$ 0.2	10.4 $\pm$ 0.4	354 $\pm$ 33
195	I	10	39.3 $\pm$ 1.5	28.3 $\pm$ 0.8	5.06 $\pm$ 0.2	10.7 $\pm$ 0.4 <sup>b</sup>	344 $\pm$ 27 <sup>b</sup>
	II	10	42.8 $\pm$ 1.2	30.5 $\pm$ 0.9	5.24 $\pm$ 0.2	11.7 $\pm$ 0.3 <sup>a</sup>	437 $\pm$ 30 <sup>a</sup>

<sup>a, b</sup> Means within a row with different superscripts are significantly different (P < 0.05).

Similarly, higher motility, density and semen volume value have been obtained from group I (low protein diet) compared to group II (high protein diet) during the entire research period. It is assumed that the results that have been obtained are a because of the fact that a high protein diet results in the excess fat to be stored in the scrotum, thus the thermoregulation mechanism in the testis and the spermatogenesis to collapse.

## CONCLUSIONS

The results show that diets with equal energy levels but different protein levels have different effects on the live weight, testicular parameters and sperm parameters of the Kivircik ram lambs. It has been determined that the live weight and testicular parameters of the ram lambs that were fed with high protein diets during the pubertal period have been affected positively.

In conclusion, feeding with high protein diet had negative effect on semen characteristics by collapsed thermoregulation mechanism and spermatogenesis in testicles because of excessive fat accumulation in scrotum. A research on the effects of diets with different energy and protein levels on the testicular and spermatogenesis parameters of the ram lambs will be beneficial and contribute to the existing literature.

## REFERENCES

- BIELLI A., KATZ G., PEDRANA G., GASTEL M.T., MORANA A., CASTRILLEJO A., NILS L., MATS F., HERIBERTO R.M. (2001): “Nutritional management during fetal and postnatal life and the influence on testicular stereology and sertoli cell number in Corriedale ram lambs”. *Small Rumin. Res.* 40, p. 63-71.
- BROWN B.W. (1994): “A review of nutritional influences on reproduction in boars, bulls and rams”. *Reprod. Nutr. Dev.*, 34, p. 89-114

- CAPRENTER D.B., HALLFORD D.M., SI-SHANG HUNG, HAWKINS D.E. (1997): “Semen traits and metabolic and gonadotropic hormone profiles in ram lambs treated with glucose”. *Theriogenology*, 48, p. 625-639.
- COULTER G. H. AND KOZUB G. C. (1984): “Testicular development, epididymal sperm reserves and seminal quality in two-year-old Hereford and Angus bulls: effects of two levels of dietary energy”. *J. Anim. Sci.*, 59, p. 432-440.
- FOSTER D.L., EBLING F.J.P., MICKA A.F., VANNERSON L.A., BUCHOLTZ D.C., WOOD R.I.: SUTTIE J.M., FENNER D.E (1989): “Metabolic interfaces between growth and reproduction. I. Nutritional modulation of gonadotropin, prolactin, and growth hormonesecretion in the growth-limited female lamb”. *Endocrinology*, 124, p. 342-350.
- GODFREY R.W., COLLINS J.R., GRAY M.L (1998): “Evaluation of sexual behavior of hair sheep rams in a tropical environment”. *J. Anim. Sci.*, 76, p. 714-717.
- MARCO-JIME’NEZ F., PUCHADES S., GADEA J., VICENTE J.S., VIUDES-DE-CASTRO M.P. (2005): “Effect of semen collection method on pre- and post-thaw Guirra ram spermatozoa”. *Theriogenology*, 64, p. 1756-1765.
- MOOROW R. E., ELMORE R. G., BROOKS A. L., LUEBKER J. P. AND BREUER D. J. (1981): “Growth and reproductive development of beef bulls tested on two levels of energy”. *J. Anim. Sci.*, 59, p. 432-440.
- ÖZDAMAR K. (1999): ”Paket Programlar ile İstatistiksel Veri Analizi”. I. Kaan Kitabevi, Eskişehir.
- PRUITT R.J., CORAH L.R. (1985): “Effect of energy intake after weaning on the sexual development of beef bulls I. semen characteristics and serving capacity”. *J. Anim. Sci.*, **61**, 1186-1193.
- SUTAMA K. I., EDEY T.N. (1986): “Postpubertal sexual development in Merino rams after differential feeding through puberty”. *Theriogenology*, 25, p. 601-607.
- ZAR J. H (1996): “Biostatistical Analysis”. Prentice-Hall International Inc., 3rd edition 1996.

## EFFECT OF THE STORAGE TIME AND SEVERAL SILAGE INOCULANTS ON THE AEROBIC STABILITY OF SORGHUM SILAGES

AVASI ZOLTÁN<sup>1</sup>–SÜLI AGNES<sup>1</sup>–KUCSERA JUDIT<sup>2</sup>

<sup>1</sup>University of Szeged, Faculty of Agriculture, Dep. of Animal Nutrition Sci. and Technology

<sup>2</sup> University of Szeged, Faculty of Sciences, Dep. of Microbiology  
Hódmezővásárhely, Andrassy Str. 15.  
H-6800 HUNGARY  
avasi@mgk.u-szeged.hu

### ABSTRACT - Effect of the storage time and several silage inoculants on the aerobic stability of sorghum silages

Aerobic stability of silages has great importance in practice. When the silo is opened, yeasts and moulds can grow due to exposure to the air. The process cause significant loss of nutrients and harmful silage will be produced. There are lot of published results on the fermentability, the nutritive value and digestibility of sorghum silages, but we have only limited knowledge about their aerobic stability. The aerobic stability is affected by several factors. As the sugar content is high one of the most important fact is the amount of easily fermented carbohydrate remaining after the fermentation – in case of sorghum silage.

In this paper we report the aerobic stability of sorghum silages changing in the function of storage time, using inoculants *Lactobacillus buchneri* (NCIMB 40788), *Propionibacterium acidipropionici* (MA 26/4U) and the preservative product Lalsil Fresh.

Four treatments were used (T1 untreated control, T2 treated with *Lactobacillus buchneri* 3x10<sup>5</sup> CFU/g FM, T3 treated with *Propionibacterium propionici* 3x10<sup>5</sup> CFU/g FM, T4 treated with 0.005 g/kg Lalsil Fresh). The Lallemand inoculant “Lalsil Fresh” contained selected strain of *Lactobacillus buchneri* (NCIMB 40788 6x10<sup>10</sup> CFU/g). Sorghum (Róna 1) was ensiled immediately after harvest, chopped to about 1-1.5 cm size, mixed with additives and ensiled in 4.2 L jars. The jars were incubated at 20+/-2 °C. Five jars per treatment were sampled on day 14, 28, 42, 56 and after 140 of storage. The aerobic stability, chemical and microbiological parameters were analysed from the silages.

Strong correlation was observed between the aerobic stability and the storage time of silages. At the beginning of fermentation the aerobic stability was still low but changed better with the progress of time. After complete fermentation, from the eight week of ensilaging stable silages could be observed. The aerobic stability of silages opened on the twentieth week was more than one week. Positive effect of the heterolactic bacteria was established. The aerobic stability was increased moderately by *Propionibacterium propionici*, and significantly *Lactobacillus buchneri*. Lalsil Fresh had the best effect on aerobic stability. All the treated silages opened on the twentieth week had better aerobic stability than the untreated.

**Keywords:** sorghum silages, aerobic stability, storage time, microbial inoculants

## INTRODUCTION

Due to the climate changes caused by global warming, the numbers of droughty years are increasing, and that is while the cultivation of xerotolerant plants becomes important. It is well known that sorghum (*Sorghum bicolor* L.) belongs to drought resistant plants. Sorghum – as a forage-plant – has numerous advantages and some disadvantages properties. The sorghum is able to produce (depending on the drought weather) 10-30% more yield than silo maize. Due to the high sugar content of sorghum fermentation starts more rapidly, the pH decreases and the interval of auto-oxidation shortens. These conditions are favourable to lactic acid bacteria for fermentation (AVASI ET AL., 1997,



2001). Aerobic stability of silages has great importance in practice. When the silo is opened, yeasts and moulds can grow due to exposure to the air. The process cause significant loss of nutrients and harmful silage is produced (URIARTE ET AL. 2001). The aerobic stability is affected by several factors (initial microbial populations, density of the silage, exposure to air, exposure time, stage of maturity, DM content, ambient temperature, residual water soluble carbohydrate) (OHYAMA ET AL., 1975; WOOLFORD, 1978). As the sugar content is high one of the most important fact is the amount of easily fermented carbohydrate remaining after the fermentation – in case of sorghum silage. The residual WSC content is also relatively high and because of this the silage can spoil easier (WOOLFORD, 1990). Due to the fairly high carbohydrate content the aerobic stability of sorghum silage has been intensively studied. Supplementation with lactic acid bacteria during ensiling sorghum improved the fermentation process, but reduced the aerobic stability of the silage (MEESKE ET AL., 1993). The effect of heterofermentative bacterium *L. buchneri* has been investigated on the aerobic stability of sorghum silage. The bacterium decreased the growth intensity of yeasts and moulds, and it was established the aerobic stability of silages improved (FROETSCHER ET AL., 1995; FITYA ET AL. 2002; WEINBERG ET AL., 2002).

## MATERIAL AND METHOD

Four treatments were used (**T1**= untreated control, **T2**= treated with *Lactobacillus buchneri*  $3 \times 10^5$  cfu/g FM, **T3**= treated with *Propionibacterium acidipropionici*  $3 \times 10^5$  cfu/g FM, **T4**= treated with Lalsil Fresh 0.005 g/kg  $\rightarrow 3 \times 10^5$  cfu/g FM). The Lallemand inoculant „Lalsil Fresh” contained selected strain of *L. buchneri* (NCIMB 40788,  $6 \times 10^{10}$  cfu/g).

The sorghum (varieties Róna 1 from the research station of the Cereal Research Ltd. Szeged) was harvested at the doughy stages of maturity, and was ensiled immediately after harvest, chopped to about 1-1.5 cm size, mixed with additives and ensiled in 4.2 L jars. Silage density was  $210 \text{ kg DM/m}^3 \pm 3\%$ . The jars were stored at ambient temperature  $20 \pm 2$  °C.

Five jars per treatment were sampled on day 14, 28, 42, 56 and after 140 of storage.

The chemical and microbiological parameters and the aerobic stability were analysed from the silages. Dry matter content and crude nutrients (crude protein, crude fibre, crude fat, ash, nitrogen-free extract) were measured according to the Hungarian National Standards. The WSC (water soluble carbohydrate) was determined according to Mac Donald and Henderson, using anthron reagent and sulphuric acid, applying spectrophotometer. The content of lactic acid and volatile fatty acids was examined with ACME Joung Lin 6100 gas chromatograph device. The ammonia content from watery extract was measured with OP246/1 NH<sub>3</sub> measuring device. The number of yeast and mould colonies was determined on the basis of the Hungarian standard (MSZ ISO 7954).

The silages were tested for aerobic stability by HONIG (1986) method. For this purpose, 500 g of silage was put into an isolating box, and stored at environmental temperature of 20-22 °C. The temperature was measured in every hour. The rise of silages temperature was measured through 10 days. Aerobic stability was defined as the time passed until the temperature increased 3 °C above ambient temperature.

## RESULTS AND DISCUSSION

The dry matter content of the fresh crops sorghum was 34.2 %. The chemical composition of sorghum on the basis of dry matter was: crude protein 64.3 g.kg<sup>-1</sup>, crude fat 31.1 g.kg<sup>-1</sup>, crude fibre 270.6 g.kg<sup>-1</sup>, ash 64.9 g.kg<sup>-1</sup>, WSC 424,8 g.kg<sup>-1</sup> (mean value, n=3).

The fermentation parameters of the silages after 2,4,6,8 and 20 week storage time are shown in *Table 1*.

**Table 1. Fermentation parameters of sorghum silages on fresh basis**

Storage time	Parameters		Treatments			
			T1	T2	T3	T4
2 weeks	Lactic acid	%	0.97	2.14	2.41	2.21
	Acetic acid	%	0.34	0.64	0.71	0.72
	Butyric acid	%	0.00	0.00	0.00	0.00
	Propionic acid	%	0.000	0.000	0.02	0.000
	pH		4.53	4.26	4.16	4.10
	NH <sub>3</sub> -N	% of TN	9.16	10.98	9.08	9.18
4 weeks	Lactic acid	%	1.13	1.89	2.26	2.00
	Acetic acid	%	0.55	1.24	0.83	1.36
	Butyric acid	%	0.04	0.00	0.00	0.00
	Propionic acid	%	0.004	0.000	0.01	0.000
	pH		4.66	4.17	4.15	4.10
	NH <sub>3</sub> -N	% of TN	10.37	9.68	8.15	8.23
6 weeks	Lactic acid	%	1.25	1.72	1.77	1.82
	Acetic acid	%	0.48	1.32	0.74	1.14
	Butyric acid	%	0.06	0.00	0.00	0.00
	Propionic acid	%	0.000	0.000	0.03	0.000
	pH		4.94	4.19	4.22	4.22
	NH <sub>3</sub> -N	% of TN	8.02	7.61	6.68	6.27
8 weeks	Lactic acid	%	1.06	1.75	1.33	1.98
	Acetic acid	%	0.43	1.21	0.87	1.33
	Butyric acid	%	0.04	0.00	0.00	0.00
	Propionic acid	%	0.000	0.000	0.03	0.000
	pH		5.29	4.20	4.35	4.46
	NH <sub>3</sub> -N	% of TN	11.64	8.94	8.28	8.77
20 weeks	Lactic acid	%	1.28	1.62	1.48	1.72
	Acetic acid	%	0.55	1.31	1.18	1.36
	Ratio LA:AA		2.33:1	1.24:1	1.25:1	1.26:1
	Butyric acid	%	0.06	0.00	0.00	0.00
	Propionic acid	%	0.000	0.000	0.06	0.000
	pH		5.29	4.35	4.44	4.47
	NH <sub>3</sub> -N	% of TN	13.94	10.24	10.15	9.75

It can be seen that intensive fermentation was going on in the treated silages (T2, T3, T4) already in the first two weeks, and the lactic acid, acetic acid content was higher, the pH was lower than in the untreated control silages (T1).

Further fermentation resulted in lower lactic acid but more acetic acid amount in the treated silages. After the 20 weeks storage time the ratio of lactic acid: acetic acid was about 1,25:1.

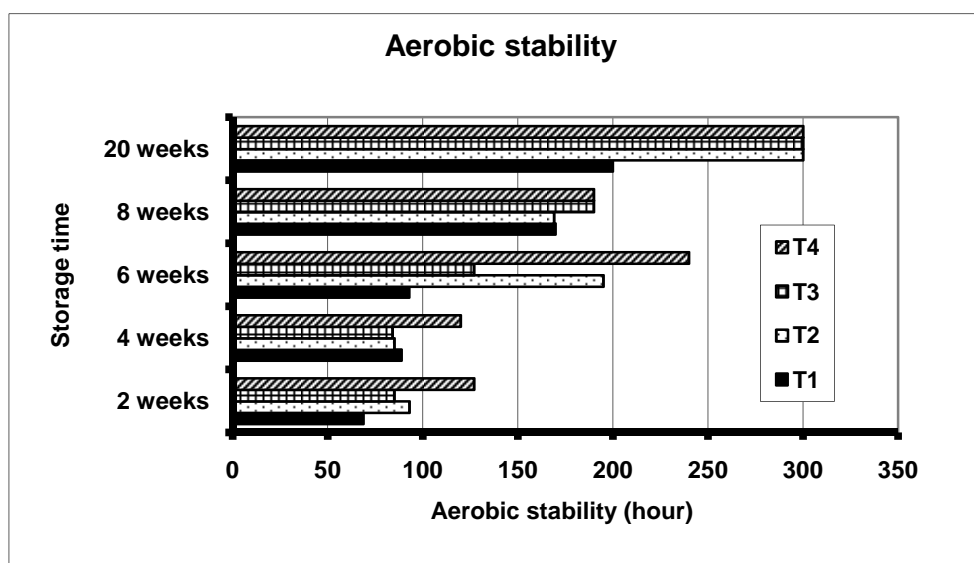
The pH and ammonium content of treated silages were significantly lower than in the control.

Data concerning the aerobic stability and dry matter loss are shown in *Table 2*.

Comparing the aerobic stability of the treated silages with the control the treated samples can be considered much better after 2 weeks storage time and the dry matter loss is much lower in these treated silages. That is positive correlation was observed between the storage time and the aerobic stability, and negative correlation between the storage time and the dry matter loss. After 20 weeks storage the aerobic stability of treated silages was more than 300 hours (*Fig.1*), and during exposition to air lasting 10 days resulted in less than 1% dry matter loss.

**Table 2. Aerobic stability of silages and dry matter loss after 10 day exposition to air**

Storage time	Parameters		Treatments			
			T1	T2	T3	T4
2 weeks	Aerobic stability	hour	69	93	85	127
	Dry matter loss	%	12.0	11.0	11.2	6.7
4 weeks	Aerobic stability	hour	89	85	84	120
	Dry matter loss	%	11.1	10.2	10.0	8.6
6 weeks	Aerobic stability	hour	93	195	127	>240
	Dry matter loss	%	6.2	3.0	6.9	<1
8 weeks	Aerobic stability	hour	170	169	>190	>190
	Dry matter loss	%	4.8	4.9	4.1	3.0
20 weeks	Aerobic stability	hour	200	>300	>300	>300
	Dry matter loss	%	6.6	<1	<1	<1



**Fig.1. Aerobic stability of the control and treated silages**

The results of microbiological experiments verified the positive effects of inoculant on the aerobic stability of silages (Table 3). In the presence of *L. buchneri* bacteria (T2, T4) the number of moulds was 1-2 order of magnitude lower than in the control after 10 days exposure to air.

**Table 3. Number of mould and yeast cells at opening of silos (after 20 weeks storage time) and after 10 days exposure to air**

Treatment	Number of cells (yeasts and moulds) log <sub>10</sub> cfu/ g fresh matter			
	At opening		After 10 days exposure to air	
	Yeasts	Moulds	Yeasts	Moulds
T1	<1	<1	<1	8.2
T2	<1	<1	<1	6.7
T3	<1	<1	<1	7.4
T4	<1	<1	<1	5.7

## REFERENCES

- AVASI, Z.-J. P. SZÚCSNÉ-K.I. MÁRKI-ZAYNÉ (2001): Advantages and disadvantages of the combination of maize and sorghum for silage. 52th Annual Meeting of European Ass. For Animal Production, Budapest, HUNGARY
- AVASI, Z.-P. J. SZÚCSNÉ-K.I. MÁRKI-ZAYNÉ (1997): Data for the fermentation and nutrition value of silage Sorghum. 8th Int. Symp. of Forage Conservation, Brno, 128-129 pp.
- FILYA, I.-SUCU, E. (2002): Effect of enzyme-lactic acid bacteria mixture silage inoculants on the fermentation, aerobic stability, cell-wall content and in situ rumen degradability of wheat, sorghum and maize silages in Turkey. 13th Int. Silage Conf., Auchincruive, 11-13. sept. SCOTLAND
- FROETSCHER, M.A.-NICHOLS, S.W.-ELY, L.O.-AMOS, H.E. (1995): Effect of silage inoculant on the fermentation and digestibility of tropical corn and sorghum silages. Dairy

Sci. 95. 203-211 pp.

HONIG, H. (1986): Evaluation of aerobic stability. Proceedings of the Eurobac Conference. Upsala, 76-81 pp.

MEESKE, R.-ASHBELL, G.-WEINBERG, Z.G.-KIPNIS, T. (1993): Ensiling forage sorghum at two stages of maturity with the addition of lactic acid bacteria inoculant. Anim. Feed Sci. Technol. 43. 165-175 pp.

OHYAMA, Y.-MASAKI, S.-HARA, S. (1975): Factors influencing aerobic deterioration of silages and changes in chemical composition after opening silos. Jour. Sci. Food Agric. 26: 1137-1147 pp.

URIARTE, M.E.-BOLSEN, K.K.-BRENT, B.E. (2001): Aerobic deterioration of silage. 10th Int. Symp. of Forage Conservation, Brno, 25-36 pp.

WEINBERG, Z.G.-ASHBELL, G.-HEN, Y. (2002): The aerobic stability of whole-crop wheat, corn and sorghum silages. 13th Int. Silage Conf. , Auchincruive, 11-13. sept. SCOTLAND

WOOLFORD, M.K. (1978): The aerobic deterioration of silage. ARC Research Review (4) 8-12 pp.

WOOLFORD, M.K. (1990): The detrimental effects of air on silage. Journ. Appl. Bact. 68. 101-116 pp.

## **BREEDING OF „AIKOL” STRAIN SHEEP**

**SMAILOV ERKINBEK – NAZARKULOV KUBAT**

Osh State University, Osh 41400. Lenin Street. 331  
meccd@mail.ru

### **ABSTRACT– Breeding of “Aikol” strain sheep**

Low-productive Kyrgyz fine-wool, fine- coarse-wool hybrids and local coarse-wool sheep have been interbred with Gissar breed sheep in Aikol cooperative. The Aikol meat-greasy pedigree group was created as a result of this work.

The lambs of “Aikol” strain grow faster than the local lambs. Their birth weight is 4,5-5,0 kg.

The weight of 4 months old lamb is 32-34 kg, an 18 months old young sheep is 76-78 kg, while the mature ram is 110-157 kg, and the weight of the ewe is 56-64 kg according to the age.

The breeding capacity of “Aikol” strain sheep is more productive in meat-fat and the ewe is better milker than the local sheep. They also possess good meat-grease quality and enable producing cheap and pollution-free mutton and fat-tailed bacon.

**Key words:** Aikol strain, meat-fat strain, fat tailed sheep

## **INTRODUCTION**

Sheep-breeding is the field which provides the people with meat, milk, wool, skin, clothes and others. And on the base of cattle-breeding the people in Central Asia keep the sheep and have their meat.

The eastern people had been using the meat of sheep in the traditional medicine, especially the fat of tailed-sheep. The Kyrgyz people cut the fat-tailed sheep for respectable guests for many years (LUSHIHIN,1959).

The demand for meat is increasing year by year, because of the visitors from different places and countries have resort to our sanatoriums.

The crossing of gissar sheep in the east and the sheep of “edilbai” genus with the local fine-fleece sheep was not successful for a long time (OSIPOV, 1969, NAZARKULOV, 1989).

The pedigree structure of sheep in Kyrgyzstan has changed during the last years in connection with transition to a market economy. Thus, in 1990 the share of fine wool production was 87%, semi-fine wool production was 7%, semi-coarse wool production was 3%, and coarse wool fat-tailed production was 3% of the total livestock. (AZHIBEKOV ET AL., 2001. MUKASHOV, 2001, NAZARKULOV, 2002). In the year of 2003 the share was 31.3% (fine wool), 6.2% (semi-fine), 0.6% (semi-course), and 61.9% (course). The reason of this pedigree ratio was the sharp reduction of the number of fine-fleece and semi-fine-fleece sheep due to fall of prices and demand for fine and semi-fine wool and also due to the increase of fat-tailed meat sheep, which has a niche in the domestic mutton market (MAMYTOV, 2003, AJIBEKO, 2005).

The crossing of Kyrgyz fine-fleece, Gissar raw sheep – Kyrgyz fine-fleece wool sheep and the local raw wool sheep was experimented for the first time in the condition of Kyrgyzstan, in Ton region, at the “Aikol” corporation. The aim of this experiment was to

improve the growth performance, to achieve better live weight of the sheep mainly in the meat-fat strain production.

### **MATERIAL AND METHOD**

The research work started in the southwest zone near Issyk-Kul. There were used the low-productive Kyrgyz fine-wool, fine- coarse-wool hybrids and local coarse-wool sheep have been interbred with Gissar breed sheep in Aikol cooperative. in Ton region.

First, the local raw wool sheep were mated with Kyrgyz fine-fleece breed sheep, than the given interbreed was crossed through “blood digestion” with gissar meat sheep. The research work was carried out by a breeding plan .

The economic situation of the corporation was good, the base of feed and veterinary conditions were satisfactory.

The sheep were kept mainly on the pasture by grazing but in winter they kept in sheep-fold and fed hay and food concentrates.

The constitution, live weight, and some parameters of the body were recorded, and the vitality of the animals was monitored.

The grazing fine-fleece wool sheep which participated in crossing grown badly, the achieved weight was only 46-48 kg, the wool was liquid, the length-width weren't flat, the lateral wool were short. The constitution of the sheep became tender; the living capacity was poor because of bad choosing and selection

Since 1994-95 the production of meat-fat strain sheep had began, and had been used the best way of crossing.

### **RESULTS**

In the result of annual selection and sorting, in 2008 the “Aikol” new meat-fat strain has produced and adopted. Nowadays the number of new race of sheep increased over 18 000. The constitution of such kind of sheep is strong, medium height is tall, the chest is broad and deep, legs are strong and long, the back is wide, the parts of body are straight, the fat is middle round.

The lambs grow and mature faster. The birth weight is 4,5 -5,0kg, 4 months old weight is 32-34kg.

The matured ram's weight is 110-157kg, 18 months old young ram's weight is 76-85kg, the ewe's weight is 56-64kg according to their age.

The main importance of farming of “Aikol” meat-fat strain is breeding capacity and feed the given breed with care. Usually the round fat sheep in meat-fat strain give less breed than fine-fleece and half fine-fleece sheep. The hard conditions of nature have been influence on breeding of the sheep for many centuries. And the poor feeding in winter and early spring season, the moving from one grassland to another, the stone sheep-folds instead of warm farm holdings, feeding the sheep in open-fields, all these influenced badly on breeding too.

The productivity of meat and wool of the sheep depend on their vital capacity of breed and without its decreases in sheep breeding. With the activity of breeding company, the ewe would give about 106-108 lambs / 100 ewe and the breeding depends on their age and the time of birth period The raw wool sheep of meat strain give little breed, but without

decrease. This breeding company is provided in cold winter season and beyond of Ton valley.

The breeding is start in December, and the yeap begins in May. The weather temperature in high mountains of Ton region (on 2800-3000m) is above -36-40C° cold in December-March. In such frosty days and nights young lambs spend winter under the fence pastures and in the sheep folders. It shows that the new race of the sheep is frost-resistant and they have high vital capacity. The one of the peculiarity of meat-fat strain round fat sheep is they live by the expense of their own fat and withstand different diseases.

The main particularity of “Aikol” strain sheep is their fast premature growth. Unfortunately, the lambs are put on weight for 2 month or till September and October. After the putting on weight the 6 months old lambs weight is about 36-40kg. The showing of meat-fat production of the sheep is characterized with cut weight, body meat, inside and tailed fat. The meaty body is that, the sheep of meat-fat strain. The weight of the sheep after cut is 20-22kg. The body composition of the sheep in high mountains such as Alp and Subalp, are more ecology pure, have the marble colour, delicate with aromatic smell and taste than the sheep in deserts. The muscle fat is plane and has thin nut shells. The meat-fat production of sheep is value with their round fat as a tasty food in Central Asia and it is the source of cheep meat production.

The 2,5-3,0 kg. weight of fat tail of the sheep is valued highly in Kyrgyz tradition and used for medicine.

The sheep milk contains much chemical substances and differs from the cattle milk. If the cow milk contains 3,3% protein average the sheep milk contains 5,9 %, so the output is 2,6 % higher. If the fat of cow milk is 3,7-3,8%, and the sheep milk contains 5,5-6,0% of fat the output is approximately 2,0% higher. The vitamin B1(thiamin), B2(riboflavin) content is two times more than in cow milk.

The lambs of “Aikol” meat-fat strain mature faster, because of their breeding properties and high chemical substance milk of the ewe. The milk-yield of matured ewe is about 142-167 kg / lactation and can feed the lambs with satisfaction.

The Kyrgyz people had been kept the lambs, and milk the sheep for many years. They made sour cream, butter, ayiran, whey-cheese or curds, kurut, suzmo and other special foods from sheep milk. And this way of methods, milking sheep and goats require more attention. Approximately, about 20-25 thousand ton of milked milk would be necessary to produce for a year. So, the income of sheep-breeding will increased.

The results of research work generated the development of Meat Sheep Breeding Plan in Kyrgyzstan: eg.a group of five members of the Akbeket community mated a total of 87 selected ewes to 4 purchased Aikol rams and,with help of scientists, recorded pedigree and performance of the progeny. These data will be used to select future male and female replacements and indicate parent’s genetic merit. It is recommended to pay maximum attention in the data recording process to avoid mistakes. It is also recommended to progressively involve farmers more in the recording and selection process.

Visual inspection of the Aikol progeny indicates superiority in conformation and weight when compared with local sheep progeny, it is recommended to objectively verify this impression (MUELLER, 2009).



## CONCLUSION

For the first time in the southwest zone near Issyk-Kul, low-productive Kyrgyz fine-wool, fine- coarse-wool hybrids and local coarse-wool sheep have been interbred with Gissar breed shee. The Aikol meat-greasy pedigree group was created as a result of this work.

Concluded and summary of the main results:

1. Kyrgyz fine-fleece, local raw and gissar raw in meat-fat strain sheep and the sheep which produced on “blood-digestion” of “Aikol” race have more biological and breeding qualities than the local sheep. The new race of the sheep is frost-resistant and they have high vital capacity  
The constitution of the sheep is strong; the body is middle long, the back is broad, the body parts are straight, the fat is middle round.
2. The lambs grow and mature fast. The birth weight is 4,5-5,0 kg; 4 months old weight is 32-34 kg; the weight of matured ram is 110-157 kg; and the weight of ewe is 56-64kg.
3. The average breeding capacity of ewe is 106-108 lambs /100 ewe.
4. The average milk yield of the ewe is 142-147 kg/ year.
5. Sheep of the new pedigree group are steady to extreme conditions of high mountains, dry-steppe and semi-desert zones of the country.
6. They also possess good meat-grease quality and enable producing cheap and pollution-free mutton and fat-tailed bacon
7. The results are enlarged to the other region of Kyrgyzstan as well.

## REFERENCES

- AJIBEKOV A. (2005) Animal husbandry in Kyrgyzstan. Strategies for Development and Food Security in Mountainous Areas of Central Asia. International Workshop Dushanbe, Tajikistan June 6-10, 2005
- AZHIBEKOV A., DUISHEEV A.D., ABDYKERIMOV K. (2001). Livestock breeding and veterinary science in the book entitled “Mountains of Kyrgyzstan” Bishkek “Technology”
- LUSHIHIN M.N. (1959) The Kyrgyz fine-fleece wool sheep. Kyrgyz state printing.
- MAMYTOV A. (2003) Kyrgyzstan in figures. Bishkek “Technology”.
- MUKASHOV Z. M. (2001) The fertility and vital capacity of different genotype of ewe Bishkek. “Technology”
- MUELLER J. (2009) Community Action in Integrated and Market Oriented Feed-Livestock Production in Central and South Asia.” Report on ICARDA Project
- NAZARKULOV K.A. (1989) To intensive wool and sheep meat production F. Kyrgyzstan.
- NAZARKULOV A.N.( 2002.) The Sheep-Breeding. B. Uchkun Bishkek “Technology”
- OSIPOV B. A. (1969) The milk production of Gissar sheep. Sheep Breeding F. №4. Bishkek.

## PARAMETERS OF NASAL BOTFLY INFESTATION OF ROE DEER IN PLAIN LOCATIONS

PINNYEY SZILÁRD

University of Szeged, Faculty of Agriculture, Institute of Animal Science and Wildlife Management 6880, Hódmezővásárhely, Andrassy u. 15.  
pinnyey@mgk.u-szeged.hu

### ABSTRACT - Parameters of nasal botfly infestation of roe deer in plain locations

I am investigating the occurrence of one of the diseases caused by parasites in plain roe deer populations, namely a botfly larvae, *Cephenemyia stimulator*, (CLARK, 1815) ranged among the Oestridae family. Nasal botfly larvae are common roe deer parasites and are generally spread nationwide. The subject of the present survey is the processing of the data gained about roe deer bucks of the year 2009 and their infestation indices. I investigated botfly larvae in 75 bucks' nasal and pharyngeal cavity. We have found botfly larva in 17,3% of the examined bucks (prevalence), this means 13 infected specimen. I collected 199 pieces of larvae from the samples, with a 15,3 pieces mean intensity. In our investigations prevalence was lower than in previous Hungarian researches. This was manifested both in our overall data, and in our examinations by the different age groups.

The rate of infestation was demonstrably higher in the old age group. This can be explained by the territorial behaviour of the roe deer, which can also be manifested by the older bucks' displacement to weaker habitats.

**Keywords:** Roe deer, botfly, *Cephenemyia stimulator*, parasitosis

## INTRODUCTION

The role of roe deer - especially bucks – in our wildlife management is really significant. One of the conditions of good quality roe deer populations is proper animal health state. It is therefore very important to know those diseases which mostly influence the roe deer's general health state. I am investigating one of the parasitic diseases, namely the occurrence of a botfly, *Cephenemyia stimulator* (CLARK, 1815) larvae, ranged among the Oestridae family.

Relying on domestic observation we can speak of the occurrence of a significant country-wide parasite infestation. Earlier examinations showed a 71,7% infestation level of roe deer, and the average intensity amount was 12 specimen (SUGÁR, 1978). Most recent research, on the contrary, has shown different results. KIRÁLY AND EGRI (2003, 2004, 2007) inform us in their works that the prevalence in roe deer was 34,8% in 2002, while it was 38,5% in 2003 considering Tolna county. Mean intensity amount was 8,7 in 2002 and 9,8 in 2003.

Opinion is split in respect to what degree parasite larvae damage the host organism. According to MINÁR (2000), in the young age group we can count on significant damage. SUGÁR (1978, 2000) in contrast does not consider the presence of larvae significant.

## MATERIAL AND METHODS

I collected the samples necessary for research in 2009 from the end of April till the end of September, in the lands of three wildlife management regions, primarily in the southern parts of the Great Plain. I examined 75 roe deer bucks altogether, in which I found 199

botfly larvae. The samples ready for examination were specimen cut into small skulls. The main aspect during larva collection was to find all infected individuals and each and every larvae. At the same time we noted the individuals identification data, the eviscerated body weight, later on the age, the condition, the weight of the trophy.

I defined the collected botfly larvae by stereomicroscope, in which the descriptions of Papp and SZAPPANOS (1992), as well as MINÁR (2000) oriented us. From the such gained data we calculated the characteristic botfly larva *indices*:

- prevalence %: infected/examined specimen
- mean intensity: number of larvae found/number of individuals carrying larvae.

Statistics were performed using SPSS for Windows 15.0.

I created three age groups for further analysis, on the basis of trophy judgement ages.

- young: 1-3 years
- middle-aged: 4-5 years
- old: 6 years and above.

## RESULTS

I found botfly larvae in 17,3% of the examined roe deer bucks, which meant 13 individuals carrying larvae. I summarized the detailed figures in *Table 1*.

**Table 1. Detailed figures of roe deer nasal bot fly infection**

<b>Indices</b>	<b>2009</b>
Number of examine specimen(n)	75
Larva carrier (n)	13
Prevalence%	17,3
All larvae (n)	199
Mean intensity (n)	15,3
Spread(n)	4,04
Variance	16,33
<b>Minimum</b>	<b>5</b>
<b>Maximum</b>	<b>48</b>

FUENTE AT AL. (1998) carried out investigations on where they found that mean intensity grows parallel with age. SUGÁR (1978) earlier investigated that there is no difference among the infestation indices of the different age groups. According to KIRÁLY AND EGRI (2003) among young and old ages the proportion of infestation is significantly higher than

among the middle-aged. Our own investigations proved the infestation indices of the older aged significantly different from the young and the middle-aged

**Table 2. Nasal botfly infestation of roe-bucks by age group**

<b>Indices</b>	<b>Young</b>	<b>Middle aged</b>	<b>Old</b>
Nu. (n)	21	49	6
Larva carrier (n)	4	6	3
Prevalence %	19,0	12,2	50,0
All larvae (n)	69	71	59
Mean intensity (n)	17,25	11,8	19,7

### **IMPLICATIONS**

In my investigations the prevalence was significantly lower, however mean intensity showed a higher rate than it has in earlier published investigations in Hungary. It manifested both in the overall data and the analysis according to age groups.

The infestation rate was demonstrably higher ( $P < 5\%$ ) in the old age group. This can be explained by the territorial behaviour of the roe deer, which can also be manifested by the older bucks' displacement to weaker habitats. The weaker habitat for the roe deer can be pleasant for the parasites, the possibility KIRÁLY AND EGRI (2003) calls attention too.

### **REFERENCES**

- KIRÁLY, I. ÉS EGRI, B. (2003): Az őz orr-garatbagócs fertőzöttségének 2003. évi Tolna megyei adatai. *Vadbiológia*, 10: 55-60
- KIRÁLY, I. ÉS EGRI, B. (2004): A Tolna megyei őzállomány orrgaratbagócs-fertőzöttségéről. *Magyar Állatorvosok Lapja*, 126: 433-438.
- KIRÁLY, I AND EGRI, B. (2007): Epidemiological characteristics of *Cephenemyia stimulator* (Clark, 1815) larval infestation in European Roe deer (*Capreolus capreolus*) in Hungary, *Acta Zoologica Academiae Scientiarum Hungaricae* 53 (3), pp. 271-279
- FUENTE, L.B., MORENO, P., PERÉZ, J.M. AND RUIZ-MARTINEZ, I. (1998): Oestrosis in red deer from Spain. *Journal of Wildlife Diseases*, 34: 820-824
- MINÁR, J. 2000. FAMILY OESTRIDAE (in: Papp L. and Darvas B. (eds.) (2000): Contributions to a Manual of Palaearctic Diptera. Appendix, Science Herald, Budapest p.467.
- PAPP, L. ÉS SZAPPANOS, A. (1992): Bagócslegyek: Gasterophilidae, Oestridae, Hypodermatidae. *Magyar Természettudományi Múzeum*, Budapest
- SUGÁR, L. (1978): A vadon élő kérődzők orr-garat(torok) bagócs-fertőzöttsége (oestridosis). In: Hónich, M., Sugár, L. és Kemenes, F. (1978): A vadon élő állatok betegségei. *Mezőgazdasági Kiadó*, Budapest. P. 156-158.
- SUGÁR, L. (2000) *Vadbetegségek*. Mezőgazda Kiadó, Budapest

## EXAMINATION OF FEEDING AND SOME POPULATION PARAMETERS OF ROE DEER (*CAPREOLUS CAPREOLUS*, L.) ON THE GREAT HUNGARIAN PLAIN

BARTA TAMÁS – MAJZINGER ISTVÁN

Szegedi Tudományegyetem Mezőgazdasági Kar  
Állattudományi és Vadgazdálkodási Intézet, Hódmezővásárhely  
[barta@mgk.u-szeged.hu](mailto:barta@mgk.u-szeged.hu)

### ABSTRACT - Examination of feeding and some population parameters of roe deer (*Capreolus capreolus*, L.) on the Great Hungarian Plain

It is known that roe deer are considered to be very choosy. It needs this sorting because the microorganisms, which help the digestion of high fibre plants, are missing in its stomach, that is why they are mostly called „concentrate selectors” (HOFFMANN, 1985; 1988; 1989).

These animals should mostly eat easily digestible plants with high nutrition level (pulses, buds, sprouts and flowers). Consequently they are able to do this sorting because of their small mouth size. At winter there is a lack of these plants, so the high selectivity occurs only when the feed is in abundance.

Examining the amount and quality of vegetation available on the habitat of roe deer we can identify the species which can satisfy their feed demand. It is known, that roe deer as other large ruminants, in case of plant abundance prefer certain plants and plant parts while others avoided. The identification of the eaten species and the rate of their occurrence in the feed is the first step to become acquainted with the interaction between animal and the surroundings simultaneously.

**Keywords:** roe deer, *Capreolus capreolus*, feed selection, food composition, body weight, kidney fat index

### INTRODUCTION

Gallery forest, wooded steppe and the scrubland are considered to be the ancient habitat of roe deer. They prefer leafy forests, forest edges and the bordering lawn or cultivated areas. On the enormous treeless plains they are not at all or only in limited numbers are found. The calmness offered by large scale field farming leading to area reservation of roe deer, this happened when they spread on the Great Hungarian Plain. This was also supported by the afforestation of the plain by forming forest belts and patches, namely the improvement of the habitat. The roe adapted to the agricultural environment very well. So in our days we separate the field and the forest roe ecotypes, which are different from each other in behaviour, social contacts and dietary habits (CSÁNYI, 1992).

Roe deer (*Capreolus capreolus*, L.) has the largest population within the big game population in Hungary. Their nourishment was examined in several countries of Europe, and the abundance of available nourishing plants was highly emphasized (MÁTRAI ET AL., 1986; FEHÉR ET AL., 1988). The key factor of food was not the quality but the accessibility. (TIXIER ÉS DUNCAN, 1996; DUNCAN ET AL., 1998; TIXIER ET AL., 1997; 1998).

During this examination we were keen to answer to what differences can be experienced between the composition of consumed food and the change in some population parameters. The plant combination consumed by roe deer is basically identified by the vegetation of the habitat. The quality of the natural vegetation seems to be the one of the most important factors which influences the density of the population, besides it determines the body- and

trophy weight and the reproductive performance. The autumn condition of the doe shows the quality of their habitat (MAJZINGER, 2004; 2007). During our examination have been looked for the answer to the underlisted questions:

1. What was the food combination consumed by roe in different hunting seasons on the examined territories?
2. How did the body weight, condition and trophy weight change by the examined roe on both territories?

## **MATERIAL AND METHOD**

The sampling was from 01.10.2006 to 28.02.2009 on agricultural, on forest and floodplain habitats, because of the different ecological conditions of the two hunting areas. It has been assumed that the roe populations living there have different feeding strategies and population parameters.

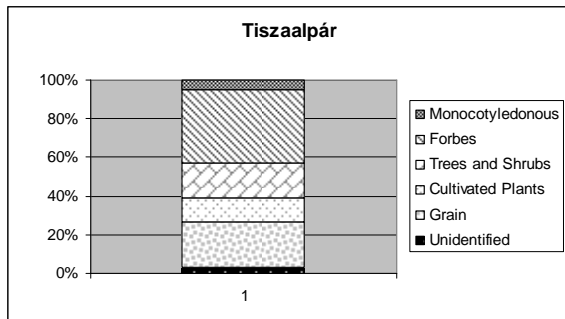
The samples were taken from the hunting area Tiszaalpári Tisza Vadásztársaság (game management unit) (9500 hectares, where the woody vegetation consists of the floodplain forest, the forest cover of the area involved in the examination is more than 30%); the Bársony István Agricultural Secondary School of Csongrád (3010 hectares of special function hunting area, the forest cover is 20%); the Petőfi Vadásztársaság (game management unit) of Nagyszénás (7096 hectares, forest cover less than 1%) and the Szakszervezeti Vadásztársaság (game management unit) of Hódmezővásárhely (12727 hectares, forest cover less than 1%). The estimated roe population of the territories involved in the examination is 1800-2000 animals.

At the examined hunting season on the four different territories the data of 633 does was processed. The samples (N<sup>o</sup>: 211) were investigated in the laboratory of the University of Szeged Faculty of Agriculture where the processing of data was done continually.

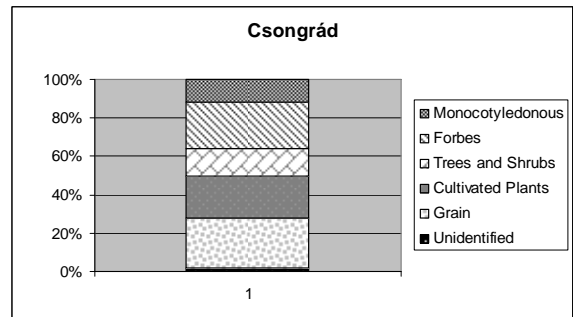
To examine the feed of roe we used the shedded microfibre method (MÁTRAI ET AL., 1986). To identify the plants forming the feed we put a histological collection together from the photographed epidermis of the plants which can be found in the growing season on the area. The epidermis is the most resistant fibre containing part of the plant, the structure of which stays almost the same after digestion. The sampled plant parts should be damaged with nitric acid than dyed and fixed. According to the specific features we put an adverbial key together to simplify the identification of the species which constitute the feed. The definition of the feed combination was made according to the examination of unique samples.

During the examination we determined the body weight (BW) of the eviscerated doe, the kidneys and the adipose tissue around the kidneys, to characterize their condition via the kidney fat index (KFI) (CAUGHLEY ÉS SINCLAIR, 1994). To determine the age of dropped doe we examined the tooth abrasion and we have counted the cement zones of the M<sub>1</sub> subsequent molar. For calculating the differences among the characteristics (BW, KFI, age) and years on the areas – after exclusion of the protruding values and the homogeneity examination – have been used single variable variance analysis, which was evaluated with the SPSS 14.0 program package.

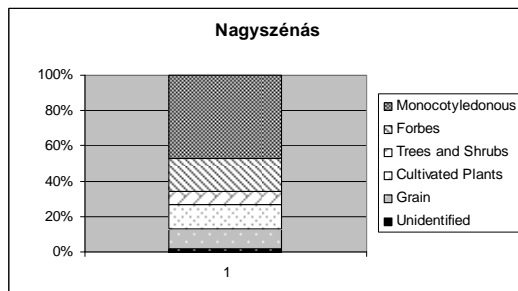
## RESULTS



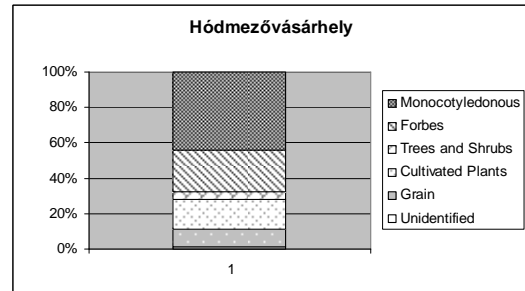
**Figure 1.** The feed composition of roe living on the territory of Tiszaalpári Tisza Vadásztársaság with high forest cover between 2006 and 2009 (n=48)



**Figure 2.** The feed composition of roe living on the territory of Bársony István Agricultural Secondary School of Csongrád on the field with forest cover between 2006 and 2009 (n=45)



**Figure 3.** The feed composition of roe living on the territory of Petőfi Vadásztársaság of Nagyszénás on field habitat between 2006 and 2009 (n=62)



**Figure 4.** The feed composition of roe living on the territory of the Szakszervezeti Vadásztársaság of Hódmezővásárhely on field habitat between 2006 and 2009 (n=52)

**Table 1.** The main statistical indicators of age, BW, KFI in Tiszaalpár

	2006			2007			2008		
	n	$\bar{x}$	$S_x$	n	$\bar{x}$	$S_x$	n	$\bar{x}$	$S_x$
Age	12	4,50	±2,06	15	4,53	±1,80	21	2,86	±1,65
BW	12	18,85	±1,54	15	19,56	±1,82	21	16,89	±2,42
KFI	12	0,50	±0,53	15	0,42	±0,28	21	0,62	±0,53

**Table 2. The yearly significance of the examined variables on Tiszaalpár**

	Age		BW		KFI	
	2007	2008	2007	2008	2007	2008
2006	0,962	0,016*	0,377	0,012*	0,670	0,473
2007	-	0,009*	-	0,000*	-	0,212

\*:  $P < 0,05$

On Tiszaalpár there was a significant difference ( $P < 0,05$ ) after completing the significance test between the BW of doe in year 2006 and 2008. After examining the KFI had been experienced the same result. Although there was no significant difference between the age of dropped doe in these years.

**Table 3. The main statistical indicators of age, BW, KFI in Csongrád**

	2006			2007			2008		
	n	$\bar{x}$	$S_x$	n	$\bar{x}$	$S_x$	n	$\bar{x}$	$S_x$
Age	14	4,71	$\pm 2,19$	16	4,44	$\pm 2,06$	15	4,53	$\pm 1,95$
BW	14	15,08	$\pm 2,21$	16	14,01	$\pm 3,48$	15	12,55	$\pm 2,27$
KFI	14	1,25	$\pm 0,55$	16	1,03	$\pm 0,39$	15	0,76	$\pm 0,28$

**Table 4. The yearly significance of the examined variables on Csongrád**

	Age		BW		KFI	
	2007	2008	2007	2008	2007	2008
2006	0,717	0,815	0,294	0,018*	0,159	0,004*
2007	-	0,898	-	0,149	-	0,090

\*:  $P < 0,05$

In Csongrád there was a significant difference ( $P < 0,05$ ) after completing the significance test between the BW of doe in year 2006 and 2008. After examining the KFI had been experienced the same result. Although there was no significant difference between the age of dropped doe in these years.

**Table 5. The main statistical indicators of age, BW, KFI in Nagyszénás**

	2006			2007			2008		
	n	$\bar{x}$	$S_x$	n	$\bar{x}$	$S_x$	n	$\bar{x}$	$S_x$
Age	21	5,10	$\pm 2,14$	16	3,44	$\pm 1,67$	25	5,00	$\pm 1,75$
BW	21	21,49	$\pm 1,40$	16	20,52	$\pm 1,90$	25	21,66	$\pm 1,00$
KFI	21	2,04	$\pm 0,56$	16	2,25	$\pm 0,81$	25	2,10	$\pm 0,53$

**Table 6. The yearly significance of the examined variables on Nagyszénás**

	Age		BW		KFI	
	2007	2008	2007	2008	2007	2008
2006	0,010*	0,864	0,043*	0,683	0,297	0,715
2007	-	0,012*	-	0,014*	-	0,456

\*:  $P < 0,05$



On Nagyszénás there was a significant difference ( $P < 0,05$ ) after completing the significancy test between the age of dropped doe in the year 2006 and 2007 and also in year 2007 and 2008. Examining the BW in year 2006 and 2007 and also year 2007 and 2008 ther was a significant difference ( $P < 0,05$ ) Although there was no significant difference between the KFI in these years.

**Table 7. The main statistical indicators of age, BW, KFI in Hódmezővásárhely.**

	2006			2007			2008		
	n (4)	$\bar{x}$	$S_x$	n	$\bar{x}$	$S_x$	n	$\bar{x}$	$S_x$
Age	20	4,25	$\pm 2,73$	16	3,50	$\pm 1,89$	20	4,20	$\pm 2,11$
BW	20	19,19	$\pm 1,95$	16	17,74	$\pm 1,75$	20	19,32	$\pm 1,57$
KFI	20	1,59	$\pm 0,59$	16	1,29	$\pm 0,91$	20	1,98	$\pm 0,98$

**Table 8. The yearly significance of the examined variables in Hódmezővásárhely.**

	Age		BW		KFI	
	2007	2008	2007	2008	2007	2008
2006	0,336	0,946	0,018*	0,824	0,295	0,153
2007	-	0,369	-	0,010*	-	0,019*

\*:  $P < 0,05$

After examining the population parameters in Hódmezővásárhely accoring to the significancy test in year 2006 and 2007 and year 2007 and 2008 there was a significant difference ( $P < 0,05$ ), regarding the KFI there was a significant difference ( $P < 0,05$ ) in year 2007 and 2008.

## CONCLUSIONS AND SUGGESTIONS

Experts in this field know very well, that game need feed and undisturbed lair. The game host who knows his territory well, knows the frequently visited and mostly liked places of roe. He also should know, which are those crucial plants which contribute to the qualitative improvement of the game stock (bigger trophy weight, good condition, high reproduction, healthy successors). Certain plant groups (monocotyledonous grasses) contribute to the satisfaction of feed claims of certain game races in an insignificant measure. There are other species which are sought for all the time, and there are others which are consumed only for a short period of time even if they are available all year long (MÁTRAI, 2000; 2006).

On the field, mostly on big broad areas with agricultural cultivation, in the examined year the dominant food components were of the cereals: the winter wheat, the autumn barley and corn, the consumption of dicotyledonous herbaceous plants were also considerable, primarily the alfalfa, red clover; the result were slightly different from those of HOLISOVA ET AL. (1982). We concluded that woody stem plants like the elderberry (*Sambucus nigra*), black locust (*Robinia pseudoacacia*) whip tree or the leaves and sprouts of willow were also consumed. On field habitat the examined population consumed in large quantities the cultivated plants, cereals and dicotyledonous plants (figure 3 and 4).

The combination of feed was more diverse in the examined period in Tiszaalpár and Csongrád on forest and floodplain habitat, the consumption of woody plants was present in a larger quantity. The dicotyledonous plants were also taken in large portions (mostly alfalfa (*Medicago sativa*), vetch (*Vicia sp.*), medical atrac (*Anchusa officinalis*), the cereals (winter wheat, autumn barley, other seeds and crops) the wooden stem plants (acacia, elder, blackberry and common pine) the results are similar to the results received on floodplain habitat by BARANCEKOVA (2004). The field population consumed cultivated plants, cereals and dicotyledonous plants in larger quantities (figure 1 and 2).

Generally have been concluded that as the forest cover decreases the consumption of wooden stem plants is reduced and the consumption of cereals is increased at the examined doe, and also they had smaller BW.

## REFERENCES

- BARANCEKOVA, M. (2004): The roe deer diet: Is floodplain forest optimal habitat? *Folia Zool.*, 53; 285-292.
- CAUGHLEY, G. – SINCLAIR, A.R.E. (1994): *Wildlife ecology and management*. Blackwell Science.
- CSÁNYI, S. (1992): A hazai őzpopuláció dinamikája, hasznosítása és a környezet változásai közötti kapcsolatok. Kandidátusi értekezés tézisei, Gödöllő.
- DUNCAN, P. – TIXIER, H. – HOFMANN, R. R. – LECHNER-DOLL, M. (1998): Feeding strategies and the physiology of digestion in roe deer. 97-117. p. in: Andersen R., Duncan P., és LINNELL J.D.C. (szerk.). *The Euroean roe deer: the biology of success*. Scandinavian University Press Oslo.
- HOFMANN, R.R. (1985): Digestive physiology of the deer (their morphophysiological specialisation and adaptation). *Biology of deer production*. Royal Soc. of New Zealand Bulletin. 22. 393-407.
- HOFMANN, R.R. (1988): Morphophysiological evolutionary adaptations of the ruminant digestive system. *Aspects of Digestive Physiology in Ruminants*, pp. 1-20. Cornell Univ. Press.
- HOFMANN, R.R. (1989): Evolutionary steps of ecophysiological adaptation and diversification of ruminants: a comparative view of their digestive system. *Oecologia*, 78: 443-457.
- HOLISOVA, V. – OBRTEL, R. – KOZENA, I. (1982): The winter diet of roe deer (*Capreolus capreolus*) in the southern Moravian agricultural landscape. *Folia Zoologica*, 31: 209-225.
- MAJZINGER, I. (2004): Az őz (*Capreolus capreolus*, L.) felnevelt szaporulatának vizsgálata (The examination of grown up offspring in Roe Deer (*Capreolus capreolus*, L.)). *Vadbiológia*, 11: 41-54, Gödöllő.
- MAJZINGER, I. (2007): Őzsuták kondíciójának változásai és kapcsolata a felnevelt szaporulattal. *Agrár- és Vidékfejlesztési Szemle* 2: 23-28.
- MÁTRAI, K. – KOLTAY, A. – TÓTH, S. – VIZI, GY. (1986): Az őz téli tápláléka és az élőhely növényzete közötti összefüggés. *Vadbiológia*. 1: 97-108.
- MÁTRAI, K. – FEHÉR, Z. – BURUCS, P. (1988): Az őz (*Capreolus capreolus* L.) téli tápláléka egy dombvidéki akácós (*Robinia pseudo-acacia*) és egy fenyves (*Pinus silvestris*) erdei élőhelyen. *Vadbiológia*, 2: 147-155.

MÁRTAI, K. (2000): Az ős téli tápláléka: élőhelytől függő azonosságok és különbségek. Vadbiológia. 7: 47-53.

MÁTRAI, K. (2006): Növényevő nagyvadfajok táplálkozási sajátosságai, a vadgazda tennivalói. In: Hivatásos vadászok kézikönyve. 208-219. Dénes Natur Műhely Kiadó.

TIXIER, H. – DUNCAN, P. (1996): Are European roe deer browsers? A review of variations in the composition of their diets. *Revue d'Ecologie (Terre Vie)*, 51 (1996) 3-17.

TIXIER, H. – DUNCAN, P. – SCEHOVIC, J. – YANI, A. – GLEIZES, M. – LILA, M. (1997): Food selection by European roe deer: effects of plant chemistry and consequences for the nutritional value of their diets. *Jurnal of Zoology, London*, 242 (1997) 229-245.

TIXIER, H. – MAIZERET, C. – DUNCAN, P. – BERTAND, R. (1998): Development of feeding selectivity in roe deer. *Behavioural Processes*, 43 (1998) 33-42.

***SECTION 3: FOOD SCIENCES AND FOOD SAFETY***

**Moderátorok/Moderators:**

Prof. Dr. Győri Zoltán

Prof. Dr. Ljupche Kochoski

**Secretary:**

Dr. Kocsisné Gráff Myrtil

## **THE FOOD SAFETY IMPACT ON FOOD PRODUCTS MERCHANTABILITY**

**IOAN BORLOVAN, LIVIU SÂMBOTIN, ADRIAN COROIAN**

University of Agricultural Sciences and Veterinary Medicine of the Banat, Faculty of  
Farm Management Timișoara, Romania  
adi\_21mar@yahoo.com

### **ABSTRACT – The food safety impact on food products merchantability**

On the whole food chain, food safety issues require a complex and extremely current approach. Traditionally, food safety aspects are analyzed at intermediate stages of the food chain and, to a lesser extent, during initial or final stages; however, certain diseases that have appeared in the livestock sector have revealed the necessity to discover the causes inside the food chain, namely inside its initial stages, but also a complete check of all the circuit a product follows to the final consumer. The common efforts of persons involved in the complex chain of food production, including agricultural production, processing and transport, and product traceability to consumer would lead to quality and safe items production.

**Key words:** food safety, food industry, food quality

## **INTRODUCTION**

Despite their vegetable, animal or mixed nature, food is essential for humans, since it provides energy and basic nutrients, very necessary for smooth operation of metabolic processes, growth and individual's development.

Nowadays, one can notice a phenomenon of extreme diversification of categories of complex and colorful wrapped food products that attract more consumers on a domestic or international market. However, we must say that food has a complex composition, sometimes indiscernible to consumers and that, associated with an improper diet, poor in nutrients necessary for the body, and combined with "dangerous" food, it could lead to increased risk of disease through ingested food and stress factors which man is subjected to every day. All these highlight the need to revise the outlook on human nutrition and to stress its character of health preventive factor, but also the great importance food security presents within a highly dynamic and complex trade. The nutritional value of products sold is emphasized more and more and the responsibility of food producer and trader regarding their state of safety increases.

## **MATERIAL AND METHOD**

### **Food safety-concepts and definitions**

Traditionally, food safety aspects are analyzed at intermediate stages of the food chain and, to a lesser extent, during initial or final stages; however, certain diseases that have appeared in the livestock sector have revealed the necessity to discover the causes inside the food chain, namely inside its initial stages, but also a complete check of all the circuit a product follows to the final consumer.

In recent years, a great number of consumers have been made aware about food safety problem, so they became more and more interested not only in quality but also in the origin of food products consumed. In these conditions, it is required that any deficiencies or weaknesses of the circuit map of foodstuffs are eliminated, from farm gate to consumer. Solving these problems includes, among others, a careful resources and factors management used in agricultural and food production, despite their nature. The issue of food safety receives new values, in terms of an unprecedentedly food trade development due to globalization. These aspects make us aware that it is becoming difficult to ensure food safety, which inevitably affects population health. A fair approach of food security requires, in fact, coresponsibility of all components of food chain.

In that context the following elements that concur to increasing food security should be taken into account:

1. the fundamental components of risk analysis that can be found in food and health security, namely assessment, management and communication, a distinction between scientific risk assessment and their management being required;
2. traceability, that should consider all actors involved in the full flow of food;
3. the harmonization of rules relating to various aspects of health security of food;
4. the existence of common elements in the systems to ensure health security of food, that make them equivalent;
5. prior risks elimination directly from source or their prevention.

The common efforts of persons involved in the complex chain of food production, including agricultural production, processing and transport, and product traceability to consumer would lead to quality and safe items production.

According to the European Union and World Health Organization – food safety is everyone’s responsibility, from their origin to final consumer. We must be aware of the particular role of trade in food safety given the fact that food is sometimes found during a significant period.

Requirements imposed by the legislation in force in Romania (Law 150/2004) to ensure food safety are:

- a) foods should not be put on the market if they are not safe;
- b) foods are considered unsafe if they are harmful to health or unfit for human consumption;
- c) to determine whether a food is safe or not, normal conditions of use of food should be taken into account by the consumer at every stage of production, processing and distribution, and consumer information provided, including label information or other general information
- d) available to consumers to avoid harmful effects on personal health, caused by a particular food or food category;
- e) to determine whether a food is harmful to health, probable immediate and / or short-term and / or long term effects of that food on the person consuming it should be considered, and the effects on future generations, the possible cumulative toxic effects, and sensitivity to the health of a certain class of consumers;
- f) to determine whether or not a food is proper for human consumption, one must consider if food is unacceptable for human consumption in accordance with its purpose, in terms of contamination, caused by external factors or not, by alteration, deterioration or decay;

g) if an insecure food is part of a batch or shipment of food from the same class or having the same description, it will mean that all food in that batch or shipment is unsafe unless, following a ailed assessment, no evidence, to indicate that the rest of the lot / batch or consignment is unsafe, is revealed;

h) the compliance of food with specific provisions applicable to that food will not prevent the competent authorities from taking all necessary steps to impose some restrictions on the market or to withdraw it from the market, hen there are reasons to prove food is ot safe, although apparently they are insistent.

## RESULTS

### **Trade and food security**

In market economy conditions, characterized by a very complex offer, including food, there is an intense competition among producers and traders n terms of meeting the highest level of consumer requirements, in a permanent change without which it is unlikely o achieve economic efficiency and, finally, profit. Therefore, in such competitive market consumers seek not only the general and particular characteristics of the existing product ix, but also the possibilities they have n relation to the choice of quality and safe consumption food. In other rds, they are concerned, in an increasingly higher measure, about the quality assurance issues and the responsibilities of those economic operators that are guilty of producing and trading products that can affect health or immediate and long term economic interests.

It should be recognized that economic agents do not always meet the ethical code and do not use the most honest practices, issues that necessitate he intervention of state bodies – through various regulations (laws, rules, standards, etc.) - in terms of imposing some specific requirements throughout he food chain, giving consumers' confidence that goods they purchase will ot affect the safety, health and their legitimate interests.

It can be said, without any fear, that a market driven by quality and safe food supply will have a significant potential in connection with the successful participation of economic operators which represent it in international trade, given that today, self-sufficient economic development is no longer conceivable.

In food trade field competitive authorities have mainly the following obligations:

a) to help develop technical standards for food and animal feed products and to develop sanitary and fitosanitary standards;

b) to coordinate activities related o implementation of specific food and animal feed, adopted by governmental and nongovernmental organizations;

c) to contribute, when appropriate, o agreements conclusion on recognition f equivalence of specific measures on food and animal feed;

d) to pay a particular attention to specific development, finance and trade problems, in developing countries, to ensure that international standards do not create obstacles in achieving exports of these countries;

e) to promote consistency between international technical standards and food aw, so hat the high level of protection as not diminished.

Both international and Romanian law regarding food industry stipulates the implementation of principles of a food safety management system based on risk assessment and prevention in all units involved in the whole food chain from primary producers to retailers production, transport, storage, serving and food trade), that is a HACCP system Hazard Analysis and Critical Control point).

ISO 22000 is a new international standard designed to ensure food safety. Developed with the participation of food specialists, ISO 22000 includes HACCP principles and integrates key requirements developed at global standards. A food safety management system certificate demonstrates the organization's commitment and ability to control food safety hazards in order to ensure that the food meets all quality standards during human consumption.

The quality of the food industry does not only refer to the finished product, but also to hygiene processes (not limited to technological flow).. In his context, quality is and will always be an important competition factor, if not the most important. HACCP principles are a means to guide the organization to comply with all rules related to achieving quality products and to continuously improve performance.

The benefits of implementing ACCP are: it is part of quality management system, it is a preventive method of self-control of food safety, it increases national and international competitiveness, it increases customers and employees confidence in its ability to consistently produce only safe products or consumption, it limits incidents involving legal responsibility of society, t demonstrates compliance with specific legislation in force, it improves the working conditions of employees.

### **The current situation of trade in food**

Since the fourth quarter of last year, the effects of global economic crisis began to manifest more intensely in Romania, the economic slowdown becoming a reality. The statistical results show a significant reduction of economic activities with direct impact on Romania's international trade relations, which have reduced.

In the first trimester of 2009, exports and imports of goods have reduced significantly compared to the first quarter of 2008 (by 19% and 34.5%), but also compared to the previous fourth trimester (by 14.7% and 33.5 %). In the first quarter of 2009 the important fall of

imports compared to exports of goods, increased the trade deficit by half, compared to fourth trimester of 2008.

Exports of food, beverages and tobacco, are the only component of manufacturing industry which registered positive trend during the first 6 months of 2009, namely 13.4%. This trend was given by increasing exports of tobacco products by 51.3% and a difference value of 55.2 million euros, compared to the a than their conventional counterpart.

Even if the quality products have a guaranteed safety by their ecological composition itself, a defining imprint on rate development of such products and beyond is given by the purchasing power of final consumers.

It is obvious that bio sector continues to grow, and farmers' interests to switch to organic farming are going up with the consumers' increasing interests in such products. In the first semester of the previous year and food exports about 2% and an increase of 5. million euro of nominal value.

Imports of food, beverages and tobacco were reduced by 6.2% compared to the first 6 months of 2008, while increasing this group contribution of 2.3 percentage points to achieve total imports. This evolution is based mainly on increasing the share of food imports in total imports structure, with 2.2 percentage points. From imports dynamics point of view, all three components of the group registered negative values, namely: food (-4%), beverages (-27.5%), tobacco products (- 5.1%)

Food, beverages and tobacco foreign trade has resulted in reducing the trade deficit with approx. 134 million euro compared to the same period of 2008. In this context, we may



emphasize that tobacco products have improved surplus with 57.2 million euro, while food and beverages decreased negative balances by 53 million euro, respectively 4.0 million euro, compared to January-June period of the reference year. (table no 1 and table no. 2)

**The evolution of food exports in Romania**

Table no. 1

Activity	2008 mil euro			2009 mil euro			Percent change 2009/2008-%-		
	1st trim	2nd trim	1st sem	1st trim	2nd trim	1st sem	1st trim	2nd trim	Sem I
<b>Food, beverages and tobacco products</b>	<b>159,8</b>	<b>212,2</b>	<b>372,0</b>	<b>186,4</b>	<b>235,3</b>	<b>421,7</b>	<b>16,6</b>	<b>10,9</b>	<b>13,4</b>
Food	110,6	121,9	222,5	100,9	126,9	227,8	0,3	4,1	2,4
Beverages	14,4	27,5	41,9	13,5	17,6	31,1	-6,2	-3,6	-25,8
Tabacco	44,8	62,8	107,6	72,0	90,8	162,8	60,7	44,6	51,3

Source: Statistical Yearbook of Romania, 2008 and www.cnp.ro

**The evolution of food imports in Romania**

Table no. 2

Activity	2008 mil euro			2009 mil euro			Percent change 2009/2008-%-		
	1st trim	2nd trim	1st sem	1st trim	2nd trim	1st sem	1st trim	2nd trim	Sem I
<b>Food, beverages and tobacco products</b>	<b>159,8</b>	<b>212,2</b>	<b>372,0</b>	<b>186,4</b>	<b>235,3</b>	<b>421,7</b>	<b>16,6</b>	<b>10,9</b>	<b>13,4</b>
Food	110,6	121,9	222,5	100,9	126,9	227,8	0,3	4,1	2,4
Beverages	14,4	27,5	41,9	13,5	17,6	31,1	-6,2	-3,6	-25,8
Tabacco	44,8	62,8	107,6	72,0	90,8	162,8	60,7	44,6	51,3

Source: Statistical Yearbook of Romania, 2008 and www.cnp.ro

A niche trade that clearly seeks product's harmlessness and food quality is represented by bio and premium organic products, which, because of the difficult economic situation, consumers are less willing to spend since their prices are high. In the EU, meat without chemicals costs double compared to conventional meat. Because of this difference, people either do not eat meat anymore, either they choose conventional version. Dairy and organic vegetables also tend to have 20% -30% higher prices than their conventional counterpart.

Even if the quality products have a guaranteed safety by their ecological composition itself, a defining imprint on rate development of such products and beyond is given by the purchasing power of final consumers.

It is obvious that bio sector continues to grow, and farmers' interests to switch to organic farming are going up with the consumers' increasing interests in such products

## CONCLUSIONS

Meanwhile, soaring food prices around the world alarmed.

Experts estimate that food prices in the next decade "will exceed the average levels over the last ten years" and will record "unprecedented prices for almost all agricultural products".

Compared to the average in the period 1998 - 2007, price projections for the period 2008 - 2017 suggests an increase of approximately 20% for beef and pork, with about 30% for brown sugar and white and between 40% and 60% wheat, maize and skimmed milk powder. For the same period, growth will be "more than 60% butter and oilseeds and vegetable oils over 80%".

European Development Commissioner Louis Michel said recently that "rising prices of basic foodstuffs could cause a global humanitarian disaster. Current food programs are subject to strong pressure, because there is less food available for people already at risk of hunger. Other millions, who managed to get by, are now threatened by famine.

Financial Times warns that the world is "dangerously close "to a new food crisis, while the UN biennial report points out: "The international community must remain vigilant to future food supply shocks".

The report gave the UN agency Food and Agricultural Organization (FAO) warns that this year will feel an increase in food prices, particularly the poorest people in the world. The report predicts a growth of 11% for the poorest countries and 20% for countries with food shortage because of low income. Currently, according to UN estimates, one billion people worldwide suffer from hunger. This is the highest number ever recorded in history.

It is estimated that imports of products worldwide will be 15% higher than in 2010 and reached 1,000 billion dollars. It would be the second time in history when that happens, while in 2008 the world food import was 1.031 billion dollars, an absolute record time. By comparison, in the period 1997-2007 was half the value of imports, not exceeding 500 million.

## REFERENCES

BOBOC DAN – “Managementul calității produselor agroalimentare”, Ed ASE, București, 2006;

BULGARU MIRCEA “Dreptul de a manca”, Editura Economică, Bucuresti, 1996

Ene Corina “Impactul Securității alimentare în elaborarea politicilor nutriționale și alimentare”, Teză de doctorat, 2005.

MANOLE VICTOR, STOIAN MIRELA, ION RALUCA-“Agromarketing Ediția a II- a”, Ed ASE, București, 2003

PELIN PETRUTA “Scenarii si tipologii privind securitatea alimentara a Romaniei”, Teza de doctorat, 2003.

PETRACHE, ADRIAN IONEL “Securitatea alimentara urbana intre restrictii si imperative”, Tribuna economica, v. 14, nr. 10, p. 49;

ZAHIU LETIȚIA “Politici agroalimentare comparate”, Editura Economica, București, 2001.

\*\*\* faostat.fao.org

\*\*\* www.gov.ro;

\*\*\* www.insse.ro;

\*\*\* www.madr.ro;

## ORGANIC ANIMAL BREEDING AND PRODUCTION, QUALITY ASSESSMENT OF RAW MATERIALS AND PRODUCTS

JÁNOS SEREGI

Szolnok University College  
H-5000 Szolnok, Tiszaligeti sétány, Hungary  
[seregij@szolf.hu](mailto:seregij@szolf.hu)

### **Abstract - Organic animal breeding and production; quality assessment of raw materials and products**

There is an increased need for the products of ecological/organic animal breeding origin (products from agro-units with ecological qualification or units to go organic). I present the analysing processes and the quality preferences concerning human nutrition. They are dealing with the protection of origin, prevention of adulteration and food safety questions. Furthermore they present examples for the advantages of indigenous, traditional breeds used in the organic production.

**Keywords:** organic animal breeding, traditional animal races, eco products, direct marketing, human nutrition

### INTRODUCTION

The statistical data of organic animal breeding shows an increased consumer need for safe and healthy food of animal original. In EU countries this is a general tendency; we will deal with the situation of Central-European countries. We will talk about the qualified farms and those which are under changing conditions, because their eco-production is also very important.

Claim for plant production, environment protection, sustainable agriculture, rural developing and ecological animal keeping are increasing in Hungary (PONGRÁCZNÉ AND MEZEI, 2008; PONGRÁCZNÉ 2008, PONGRÁCZNÉ ET AL., 2009, (PONGRÁCZNÉ AND CSURGÓ, 2010)), and National Park Directors show special ecological model picture for the members of green agriculture in Hungary. Generally national parks have native the standing animals. Generally animals in general national parks are keeping because of model for pasture feeding (ÁNGYÁN ET AL., 2002; ARADI, 1992; VERESS ET AL, 2000; VERESS, 1987).

### MATERIALS AND METHODS

The controlled eco production in Hungary has a past of more than ten years. *Table 1.* shows the data of animal farms considering the data of two control units. There are 134 farms under changing conditions (changing into eco production), with a number of 16.430 standard animals. The animal species involved in eco production are also presented in *Table 1.*

The present situation is not so hopeful; this can be seen from the data of BIOFACH 2008 exposition, Nürnberg, Germany where 2.740 exhibitors were present; 7% more

than in 2007, but only 27 from Hungary. One of them presented organic honey, and the Hortobágy Non-profit Company for Nature Conservation and Gene Preservation (shortly: Hortobágy Co.) presented several different raw materials and products with eco qualification. This company has a leading role on the Hungarian organic market (see: *table 2.*). The Hortobágy Co. has an adequate stock of products for a continuous market supply, too.

**Table 1. Number of standard animals of Hungarian farms in (2007)**

<b>Animal species</b>	<b>Nr. of standard animals</b>
Poultry	188,5
Buffalo	539,2
Sheep	1.256
Goat	304,3
Horse	229,9
Pig	830,5
Donkey	35,2
Cattle	13.046
<b>Total</b>	<b>16.430</b>

Source: Biokontroll Hungaria Kht.

**Table 2. Hortobágy Company's organic raw materials and products**

<b>Animal species</b>	<b>Raw materials</b>	<b>Products</b>
Gray cattle	Meat, pluck (liver, triple 12 different packaging)	Eco salami
Buffalo	Meat (in 8 different packages)	Spicy/Hot Buffalo salami
Mangalitzza pig	Meat, pluck (lungs, heart, fat in 14 different packages)	Organic sausage, smoked bacon, salted bacon
Racka sheep	Meat	Eco salami
Guinea fowl	Meat, eggs	-

The animal farms under changing conditions are also very important from ecological point of view. The two main farms from Hungary are: 1) Family Farm of Csöde, Western-Hungary and 2) Tiszaug Farm, Middle-Hungary. The first one has a territory of 220 hectares and the second one 15 hectares with a number of 18 standard animals (poultry: more than 3.000 hens, ducks, geese and mangalitzza pigs). The farms under changing conditions can also increase the contribution to the total national eco animal breeding. *Table 3.* shows the data regarding the organic animal breeding in some Central-European countries (Hungary, Romania, Austria, Germany).

The authors are in a good cooperation, regarding the production with some eco producer companies from the above mentioned countries: SANFER, LA DORNA and GORDON

PROD companies from Romania; Cattle Breeding Federation from Southern-Austria; Agrobiogen Ltd. and Animal Breeding Authority from Germany.

## RESULTS AND DISCUSSIONS

From *Table 3.* can be seen, that the data from Germany and Austria are examples to be followed by us. In Germany the direct (“ab Hof”) marketing data are also good examples to follow. The 21% directly marketed products might be a pulling force for our farms, too – if they would get some governmental support (see *table 4.*).

**Table 3. Some data of eco animal breeding in Central-Europe (Hungary, Romania, Austria and Germany)**

Country	Eco territory <i>ha</i>	Nr. of eco farms	Nr. of animal species	Nr. of animals ×1000	Nr. of control units	Products	Quantities
Hungary	160000	1600	5	na	2	meat, milk, egg, honey	na
Romania	200000	na	4	na	1	meat, milk, egg, honey	62000 (export 2006)
Austria	362000	20500	5	840 hen 45 cow 44 pig	1	meat, milk, egg, honey, chocolates	110mil. eggs 398mil.kg butter
Germany	800000	16500	5	na	8	meat, milk, egg, cheese, butter	40%-of the products

Source: no available data

**Table 4. The animal breeding capacity in Hungary**

Pasture methods	National ratio, %	Territory, <i>1000 ha</i>	Animal breeding capacity*	Output, meat equivalent	Employee <i>persons</i>	Degree of self subsistence %
Only pasture	15	216	75 600	321,7	3 340	40
Pasture + mechanical maintenance, care	80	960	768 000	3268,1	27 650	60
Only mechanical cultivation (forage: hay)	5	96	144 000	612,8	1 890	85

Source:\* standard animal/total territory (own data collection, 2007)

The organic performances of the Hortobágy Co. (see *table 2.*) are well known also on an international level. Their restaurant situated on the Hortobágy region (called “Hídi

Csárda” – restaurant) gives the whole range of eco products in their menu, the foods and drinks, too. They also plan to supply the capital’s restaurant: the Hotel Benczúr.

Some of the most important quality parameters of the Hungarian eco raw materials are shown in *Table 5.*, compared with some data originated from non organic production.

The organoleptic characteristics of the eco products are also very talkative. The sensory properties of almost every tested eco product were of higher quality than those of non eco products.

The human nutritional value of eco products is also superior. As an example their omega-3 fatty acid and CLA content can be shown, which are 15-20% higher in the extensively reared traditional cattle species.

The chemical composition of raw materials and products was analysed at the Hungarian Meat Research institute and at the University of Kaposvár, where also CT examination were performed using also standard methods.

For the protection of origin the Typi-Fix method was used (Agrobiogen Ltd., Germany). The protection of origin is usually assured by the food safety and quality control processes. We believe that the protection of origin is highly important for the indigenous species that are traditional in our countries. Central European countries possess a large scale of indigenous animals; their special qualities can be confirmed with DNA analyses. With DNA marker analyses special qualities of some indigenous (as grey cattle, mangalitza pig and racka sheep) animals were proven.

**Table 5. Comparison of chemical composition and some physical properties of Longissimus dorsi muscles of Holstein and grey cattle, and extensively and intensively reared mangalitza pigs**

Characteristics	Grey cattle (extensively)	Holstein (intensively)	Mangalitza (extensively)	Mangalitza (intensively)
Protein content (%)	22,5	22,25	23,9	23,6
Fat content (%)	1,2	1,9	5,67	5,45
Connective tissue (%)	0,7	1,3	0,52	0,49
Pigment content (mg/g)	6,2	4,5	1,46	1,43
Fatty acid composition (%)				
SFA	43,8	45,8	38,9	43,4
MUFA	56,2	54,2	52,1	53,9
PUFA	20,8	13,4	8,11	5,39
n-3	5,1	1,3	0,5	0,14
n-6	14,4	11,3	7,35	4,98
n-6/n-3	2,9	9,3	17,2	35,57
pH	5,53	5,78	5,72	5,76
Colour characteristics				
Intensity	17,8	13,7	10,03	9,13
Hue	10,1	8,1	20,20	17,47
Dripping loss (%)	0,8	1,8	1,92	1,79
Cooking loss (%)	25,6	18,1	26,32	20,24
Hardness (N)	27,3	38,5	15,4	14,3

## CONCLUSIONS

Summing up, we can state that the organic animal breeding and the products manufactured under organic conditions can promote the development of the whole animal breeding in a given region. Organic products can also contribute to the increase of healthy human nutrition. *Table 6.* shows some approach of the past and present conceptions about meats, with special regard to organic products.

The meat covers less than 20% of the calories from food, contains easily digestible proteins and high amounts of vitamins B<sub>1-12</sub> and iron. For all these reasons the production of traditional animals is beneficial. The increase of their production can contribute to the regional development, self subsistence and direct marketing, to the increase of the employee number in the agriculture and to the rural development. A more emphasized international collaboration in this field is also needed. We are ready to contribute to such of collaborations.

**Table 6. Preconception and truth about meat**

<b>Preconception</b>	<b>Truth</b>
The meat contains saturated fatty acids only.	The meat fat contains 55-65% unsaturated fatty acids.
Saturated fatty acids are unhealthy.	In heart attack LDL/HDL ratio is determinant
Consumption of fat meats increases the cholesterol level and loads the fat metabolism.	Saturated fatty acids from meat have slight cholesterol decreasing effect.
Meat consumption increases the risk of CVD.	The optimal n-6/n-3 ratio (2-3:1) decreases the risk of cardiovascular diseases (CVD).
Mediterranean nutrition with low meat content decreases the incidence of CVD.	At moderate meat consumption the vegetable consumption is high. The meat CLA content is anticarcinogenic.

## REFERENCES

- ARADI CS. (1992): Ökológiai szempontok megjelenése a táj- és természetvédelemben. A Kertészeti és Élelmiszeripari Egyetem Kiadványai A Lippay János tudományos ülészek előadásai és posztere, Budapest, 11-15.
- ÁNGYÁN J., PODMANICZKI L., ÓNODI G., SKUTAI J. (2002): A Nemzeti Agrárkörnyezetvédelmi Program. A Falu, Agroinform Kiadóház, Budapest. XVIII.2. 21-31. Kerekerdő: [www.kerekerdo.org](http://www.kerekerdo.org). 2009.12.22.
- PONGRÁCZNÉ B. Á., MEZEI Z. (2008): Környezetkímélő agrotechnikák alkalmazása a búzatermesztésben. XIV. Nemzetközi környezetvédelmi és vidékfejlesztési diákkonferencia, Szolnoki Főiskola, Mezőtúr. 95.
- PONGRÁCZNÉ B. Á. (2008): A minőségi őszi búza termesztés környezetkímélő agrotechnikai szintjei. Szolnoki Főiskola Műszaki és Mezőgazdasági Fakultás, Mezőtúr. VI. Alföldi Tudományos Tájégzdálkodási Napok. Mezőtúr, ISBN 978-963-87874-1-5, 364-368.
- PONGRÁCZNÉ B. Á., PASZTERNÁK F., VÉHA A., GYÓRI Z. (2009): Környezettudatos agrotechnikák alkalmazása az őszi búzatermesztésben. II. Nemzetközi Gazdaságtudományi Konferencia, Kaposvár, ISBN 978-963-9821-07-1. 6pp.

PONGRÁCZNÉ B. Á., CSURGÓ Z. (2010): Az éghajlat hatása a Mezőtúr környéki rizstermesztésre. Agrár-és vidékfejlesztési szemle. Hódmezővásárhely, V.1.657-663, 2010.

VERESS L. (1987): International trends in sheep and goat breeding. 66. FAO Anim. Prod. and Health paper. Rome, 249 - 253.

VERESS L., ARADI Cs., DUNKA B. (2000): A Hortobágy hasznosítása. Magyar Tudomány. Magyar Tudományos Akadémia Kiadója, Budapest.



## **EVALUATION OF THE EXISTING AND POTENTIAL LATVIAN CANNED FISH EXPORT MARKETS**

**JURIS HÄZNER, INGŪNA GULBE**

Latvian State Institute of Agrarian Economics  
Struktoru 14, LV-1039 Riga, Latvia  
juris@lvaei.lv

### **ABSTRACT - Evaluation of the existing and potential Latvian canned fish export markets**

Latvia traditionally has been a major canned fish exporter. About 90% of domestic canned fish output had been exported. The share of canned fish in total Latvian processed foods export value stands at 15%. Declining Baltic Sea fish population and reduced quotas for fish catch creates a shortage of raw material for canning industry, as products are almost entirely produced from Baltic Sea species. As consumers in the export markets are becoming more affluent, a demand for quality products from ocean fish species increases. A restructuring of the canning industry output is necessary to maintain the production and export volumes. Traditionally, bulk of exports is shipped to five major markets - Russia, Estonia, Lithuania, Ukraine and USA. These countries altogether account for nearly 70% of total canned fish exports. Exports to other, mainly landlocked, countries are marginal. Even in periods with depressed demand from major export destinations, efforts to diversify and increase export geography have failed. Therefore, only five major markets are worthwhile to provide exports strategy analysis. An evaluation of strategies in the export markets would be crucial in the restructuring process. The use of GE/McKinsey matrix would provide an appropriate mapping of the present and proposed future performance of Latvian canned fish products in the principal export markets. Albeit being a strategy management tool used for the assessment of the business unit's performance in the various markets, the GE/McKinsey matrix can be successfully applied for the estimation of the given country's industry sector's export performance in export regions or countries. To adapt the matrix for the sector mapping, business unit performance is replaced by product competitiveness. Factors that are selected for characterizing the competitive advantages of sector and market attractiveness are modified accordingly. After the evaluation of the competitiveness of the products in particular markets, portraying of the markets on the matrix would allow for the assessment of the possible future strategies in the export markets.

**Keywords:** canned fish, Latvia, exports, markets, GE/McKinsey matrix

## **INTRODUCTION**

Canned fish traditionally has been an important Latvian export product. While production volumes lately have been stable at about 63 thousand tons, domestic consumption of canned fish reaches mere 6 thousand tons. The most important products are smoked sprats in oil and sprats in tomato sauce. These products account for about 80% of total canned fish output. About 90% of canned fish output is exported. Latvian canned fish products are almost exclusively produced from Baltic sea catch, including sprats, herring and Baltic herring. As Baltic fish population declines, annual fishing quotas are continuously reduced by authorities. This, in turn, leads to a necessity to restructure production accordingly by increasing the share of canned ocean fish in total output. At the same time, consumers in export markets are increasingly becoming more affluent and health conscious. An evaluation of strategies in existing and potential export markets is crucial for maintaining the production and export volumes.

The main export markets for Latvian canned fish are Russia, Ukraine, USA, Estonia and Lithuania. The hypothesis of the study proposes to continue the operations in all these markets. The objective of the study is to identify the best possible export strategies in every market.

## **MATERIAL AND METHOD**

Latvian exports of canned fish lately has been stable at about 50 thousand tons. The most important market is Russia. Direct exports to Russia makes about 30-40% of total export volume. Moreover, almost all exports to Estonia are re-exported to Russia. Total annual export volumes to Russia can reach 25 thousand tons. Exports to the USA fluctuates from 4 thousand tons to 8 thousand tons. Exports to Lithuania usually stands below 3 thousand tons. Other export destinations (Czech Republic, Germany, Belarus, Kazakhstan) do not have important share in total exports. Exports to each of these countries does not exceed 1 thousand tons. Exports to these countries is unstable with volumes varying on year.

Total size of the global canned fish market is about 16 million tons. The annual growth rate of the global canned fish market is marked at 10-15% (MÖLLER, 2009).

The size of the Russian market of canned fish is about 300 thousand tons. Market size in terms of value stands at about US\$ 800 million (USDA, 2009). Traditionally, one third of supply in domestic market is covered by imports. The share of Baltic states (mainly Latvia and Estonia) reaches more than 60% in import structure by origin. The demand for canned fish in Russia gradually changes, and canned sardines, tuna and other ocean species gain market share at the expense of sprats and mackerel. The customs duties for canned fish is set at the 15% rate. Exports to Russia is restricted by Russian Federal Veterinary Office which sets rather high standards with respect to product quality and processing technologies. Latvian products have good customer awareness in the market. Nevertheless, sometimes product sales are hindered by negative social attitude caused by political aspects. Products predominantly are directed towards large Moscow and Saint-Petersburg metropolitan area markets.

The USA is the most important market for the processed fish. However, the share of fresh and frozen fish in the human consumption continuously slightly increases (NATIONAL INSTITUTE OF OCEANOGRAPHY AND ATMOSPHERE, 2008). The demand for dried and smoked fish is stable. At the same time, consumption of canned fish is on the decline. The size of the USA market of canned fish is about 545 thousand tons. Market size in terms of value stands at about US\$ 3 billion. Imports of canned fish increases. Imports covers more than 80% of total domestic demand. Of total canned fish consumption, tuna has about 70% share. However, the demand for canned tuna declines, while consumption of fresh tuna grows. The consumption of canned salmon having 8% share of total canned fish consumption slightly declines, too. The demand for canned crustaceans and molluscs is stable. These products have 10% share in total canned fish market. The consumption of canned sardines and other species slightly grows, reaching 13% of total consumption. Customs duties for canned tuna imports are set at 35% rate for the countries without preferential trade agreements with the USA. Customs duties for canned salmon and mackerel are set at 6% and 4% rate respectively. Canned sardines and sprats have zero import duties. Importing procedures are rather simple and requirements are easy to meet. The main consumers of Latvian canned fish are immigrants from CIS countries.

The Ukrainian market of canned fish grows at 3-5% annually. The size of the Ukrainian market of canned fish is about 150 thousand tons (USDA, 2009). Market size in terms of value stands at about US\$ 300 million. About 40% of domestic demand is met by imports. "Traditional" canned herring, sardines and sprats dominate in consumption structure having more than 70% share of total canned fish market. The increased output by domestic processors may lead to decline in imports, as domestic supply increases at the 4-7% annual rate. The demand for imports almost entirely is met by Baltic states and Russia. Latvian products have good customer awareness in the market. The distribution of imported products is provided by a few large-sized importers. The customs duties for canned fish are set at the 10% rate. Above that level, imported products are taxed with 20% VAT rate, currency conversion expenses, pension fund tax at the 1% rate and banking duty at the 0.7% rate. Ukraine is not a member of WTO and validity of product export certificates is not approved by State Veterinary Department. All product checks are provided by domestic veterinary labs. Costs of checks and lab tests vary upon the type of product and size of the product lot.

The size of the Estonian market of canned fish is about 2.5 thousand tons. Customer demand for canned fish is stable. As customers are becoming more affluent, canned ocean fish, crustaceans and molluscs imported from Scandinavian countries are gaining market share. Latvian products have 30% share in Estonian canned fish market.

The size of the Lithuanian market of canned fish is about 5 thousand tons. Canned surimi products supplied by domestic processors dominate in the consumption structure. Import volumes are relatively small. Latvian products have 20% share in Lithuanian canned fish market.

GE/McKinsey matrix is a strategic management tool developed in the 1970's by Mc Kinsey & Company in consulting engagements with General Electric. The matrix itself is a nine-cell portfolio matrix designed for screening large product portfolio performance of strategic business units (MCKINSEY & COMPANY, 2010). The matrix portrays strategic business units on a grid of the industry sector attractiveness and position of the strategic business unit in the industry sector. Industry attractiveness and business unit strength are calculated by first identifying criteria for each, assigning the value of each parameter in the criteria, and multiplying that value by a weighting factor. Industry attractiveness is determined by such factors as market growth rate, market size, customer demand, profitability, competition, macro-environmental factors. Factors that determine business strength include market share, growth in market share, distribution, brand awareness, quality, product adaptation. The result is a quantitative measure of industry sector's attractiveness and strategic business unit's strength relative to competitors within the industry sector. Each business unit is mapped as a circle plotted on the matrix. Market size is represented by the size of the circle. Market share is shown by using the circle as a pie chart. The expected future position of the circle is shown by the arrow.

GE/McKinsey matrix has proved to be an excellent framework for portfolio decisions in selected agroindustrial sectors. Export markets or regions can be investigated for products where the country has high competitiveness and favorable export markets can be chosen.

To evaluate the Latvian canned fish exports GE/McKinsey matrix is modified as follows: horizontal axis is used to indicate the position in selected markets and vertical axis is used to indicate the attractiveness of the region / market.

## RESULTS

At first, the competitive advantages of Latvian products in major export markets are assessed. The quantitative assessment of the competitive advantages is provided in *table 1*. Latvian canned fish has important share in the Russian market. In the Estonian market the share is rather high. In the Lithuanian market the share is somewhat lower. The share in the Ukrainian market is small. The share in the USA market is unimportant. In all export markets, bar Russia, the growth in the market share of the Latvian products is slow. Exporter knowledge of the Russian, Estonian and Lithuanian markets is the best. The knowledge of the Ukrainian market is somewhat lower. The knowledge of the USA market is insufficient. Latvian products are well adapted to Ukrainian and Estonian markets. As for the Russian and Lithuanian markets, product adaptation is sufficient. The price level of Latvian products is adequate to customer demand in Russia, USA and Estonia. In Lithuania, the price level of similar products is slightly lower. In Ukraine, Latvian products are priced at the upper end of the price spectrum. The financial benefits of exporting in all markets, bar Ukraine are below the desired level. As imports to the Ukrainian market are provided by domestic importers, problems with the settlement of the accounts are rare. Production costs are the lowest for the products designed for the Russian market. Distribution in the Russian, Estonian and Lithuanian markets is rather efficient. Sales in the USA and Ukrainian markets are less predictable, as importers are free to position imported products in the market. Marketing activities and sales promotion in Russian market are adequate. Promotion in Estonian and Lithuanian markets is satisfactory. Promotion in the USA market is insufficient.

**Table 1: The evaluation of the parameters for the Latvian canned fish competitiveness in selected export markets**

Competitive advantages	Weighting	RU	EE	LT	UA	US
Market share	13%	8	6	4	2	1
Market share growth	13%	4	2	2	2	2
Market knowledge	13%	8	8	7	6	3
Product adaptation	13%	6	8	6	8	4
Price level	13%	7	7	6	4	7
Quality	13%	6	7	7	8	4
Financial benefits	8%	3	3	3	5	3
Sales and promotion	8%	6	7	7	2	2
Marketing	4%	5	4	4	3	2
Production costs	4%	5	3	3	4	3
Total	100%	145	141	123	111	78
Mapping position		6.0	5.9	5.1	4.6	3.3

Source: own calculation

The attractiveness of the main canned fish export markets vary. The quantitative assessment of the competitive advantages is provided in *table 2*. The USA market has maximum size. Russia is the second largest single market. Ukrainian market size is large, too. Lithuanian and Estonian markets are rather small. Russian market growth is the fastest. Ukrainian market growth also is marked. The size of the USA, Lithuanian and Estonian markets is rather stagnant. As Lithuania and Estonia along with Latvia are

EU member states, no obstacles to entry and operate in these markets do exist. Russian and Ukrainian markets traditionally are protected in cases when imports create problems for domestic processors. Moreover, customs tariffs and other duties make entry to these markets more difficult. The entry in the USA market is rather convenient and customs duties are relatively low. The price awareness in Russian and Ukrainian markets is rather high. Lithuanian consumers, on the average, also prefer lower priced products. In the USA and Estonian markets price is not an important factor behind the consumers' choice. Thus, these markets are the most attractive with respect to possible returns. Customer attitude towards Latvian products in the USA, Ukrainian, Lithuanian and Estonian markets is rather positive. In Russia, consumer attitude frequently is influenced by political rows between two countries, enhanced by media. In Russia and Ukraine, consumers with lower purchasing power have less opportunities to substitute canned fish with other sources of protein. In other markets products can easily be substituted. The USA has the most developed infrastructure. In Lithuania and Estonia, infrastructure is sufficiently developed. In Russia, infrastructure is unsatisfactory. The underdevelopment of the infrastructure in Ukraine sometimes create problems for the product distribution. As the Ukrainian economics is unstable, sometimes export volumes and assortment are difficult to plan.

**Table 2: The evaluation of the parameters for the attractiveness of the selected export markets for Latvian canned fish**

Market attractiveness	Weighting	RU	US	EE	LT	UA
Market growth	14%	8	3	2	2	6
Competition	14%	7	3	3	3	7
Market size	14%	8	9	3	4	6
Market protection	14%	3	7	9	9	3
Price trends	9%	6	7	8	6	2
Possible returns	9%	5	7	7	5	3
Consumer attitude	9%	4	7	8	8	7
Substitution opportunities	9%	7	4	3	4	7
Infrastructure	5%	3	8	6	6	2
Demand fluctuations	5%	6	7	6	6	3
Total	100%	131	131	115	112	109
Mapping position		6.0	6.0	5.2	5.1	5.0

Source: own calculation

After the calculation of the parameter values for the competitive advantages and market attractiveness, circles with respective market sizes and market shares are mapped on the McKinsey matrix grid shown in *figure 1*.

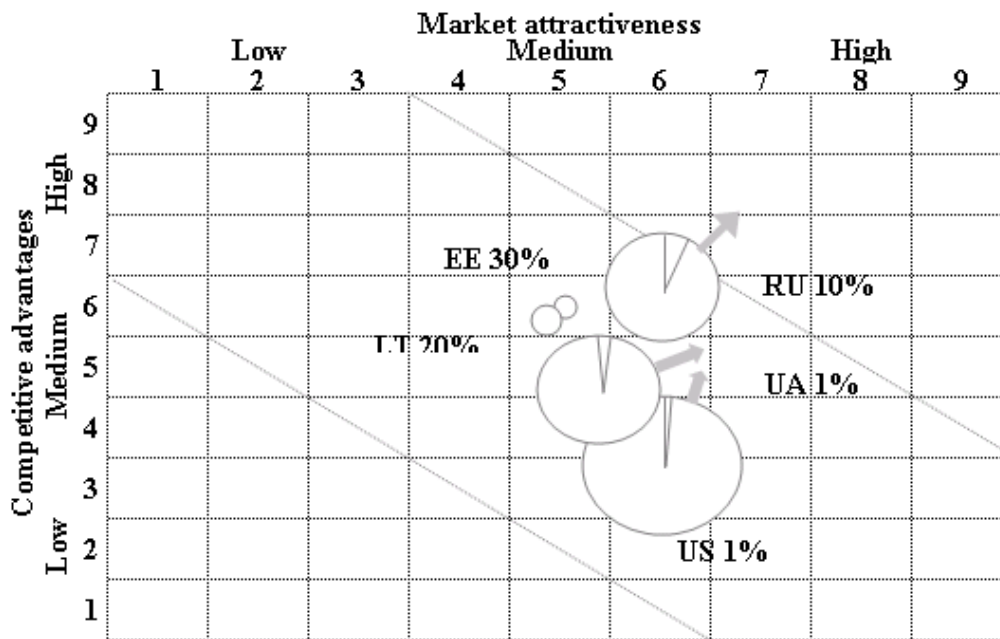


Figure 6: GE/McKinsey matrix for main Latvian canned fish export markets

Source: own calculation

## CONCLUSIONS

The positions of the all five major markets on the matrix grid are located in the medium segment. This indicates the opportunity to maintain or strengthen the presence in the market.

Russia is the most important single market with the highest attractiveness and Latvian products has the best competitiveness in this market. Considering the size of the market, market growth rate and share of the Latvian products, the proposed strategy in this market enclose the maintaining and increasing the share of the traditional products, as well as the increase in the supply of more expensive products from ocean fish species. The market will become even more attractive, and Latvian products should have increased competitiveness in the market.

USA is the largest single global market with the attractiveness only slightly lower than Russia has. However, Latvian products are not competitive in the market as the whole. Considering the size of the market and market growth rate, the proposed strategy in this market enclose the maintaining the share of the traditional products, as well as the increase in the supply of more expensive products from ocean fish species, especially salmon and tuna. The market attractiveness will remain the same, and Latvian products should have increased competitiveness in the market.

Ukraine is the third most important market. Market attractiveness lags the ratios of the USA and Russia. The competitiveness of Latvian products, albeit exceeding the ratio of the USA, is lower than in Russia. Market attractiveness will grow faster than the competitiveness of Latvian products in the market because of increasing competition by domestic processors. The proposed strategy in this market would be maintaining the existing positions of cheaper staple products, as well as the market entry of the more expensive products for the emerging segment of up-market consumers.

The competitiveness of Latvian products in small markets of neighboring Estonia and Lithuania with the unchanging attractiveness would not allow either the increase in product volumes or product diversification. The proposed strategy in these markets would be the maintaining of the existing positions for the same product range.

## REFERENCES

- MCKINSEY & COMPANY (2010): " Enduring Ideas: The GE–McKinsey nine-box matrix"  
[http://www.mckinseyquarterly.com/Enduring\\_ideas\\_The\\_GE-McKinsey\\_nine-box\\_matrix\\_2198](http://www.mckinseyquarterly.com/Enduring_ideas_The_GE-McKinsey_nine-box_matrix_2198), accessed 2010.12.02
- MÖLLER A. B. (2009): "Seafood processing. Opportunities and challenges of fisheries globalization - local sources, global markets"  
<http://www.oecd.org/dataoecd/20/25/38484834pdf>, accessed 2010.12.02
- NATIONAL INSTITUTE OF OCEANOGRAPHY AND ATMOSPHERE (2008): "Fisheries of the United States 2008"  
[http://www.st.nmfs.noaa.gov.st1/fus/fus08/08\\_perita2008.pdf](http://www.st.nmfs.noaa.gov.st1/fus/fus08/08_perita2008.pdf), accessed 2009.12.02
- USDA FOREIGN AGRICULTURAL SERVICE (2009): "Ukraine Fishery Products Robust Market Growth Continues to Boost US Exports 2009"  
<http://www.fas.usda.gov/gainfiles/200807/146291871.doc>, accessed 2010.11.06
- USDA FOREIGN AGRICULTURAL SERVICE (2009): "Russian Federation Fishery Products Fish and Seafood Market Update 2009".  
<http://www.fas.usda.gov/gainfiles/200808/146295389.doc>, accessed 2010.11.06

## **PRODUCTION AND COMPOSITION OF MILK FROM TSIGAI SHEEP BREED IN VOJVODINA**

**KÖNYVES T., VUKOSAV M., IVANC A., BOŠKOVIĆ J., MIŠĆEVIĆ B.**

Megatrend University Belgrade  
Faculty of Biofarming  
24300 Backa Topola, Marsala Tita 39. Serbia  
wiwat36@hotmail.com

### **ABSTRACT - Milk quality of Tsigai sheep breed in Vojvodina**

In this study the milk quality of Tsigai, like a most popular local sheep breed in northern part of Serbia are presented. The purpose of this paper is to review the several differences in physical-chemical quality aspects of sheep milk.. The average milk quantity are between 0,46 and 0,88 kg, and in 6 month milking period are up to 150 l. The milk is mostly processed into cheese and yoghurt. Compared results with other Tsigai breeds in Middle-East Europe area indicate that milk yield and composition are approximately the same, depending on pasture quality, keeping system and feeding.

**Keywords:** sheep, ewes milk, Tsigai breed, milk quality

### **INTRODUCTION**

The investigation on the sheep milk quality over the recent years has been focused on the ingredients of milk, (JANDAL, 1997), (ABOU-DAWOOD ET AL., 1980), (KANDARAKIS AND ANIFANTAKIS, 1986). Various sheep breeds have different milk quality. The composition and milk processing characteristics of the milk produced from different sheep breed reared in various regions have been subject of continuous researches, (RAICHEV ET AL. 1987), (SLAVOV ET AL. 1990), (GERCHEV, 1998), (PETROVA ET AL. 1998), (ODJAKOVA ET AL. 1992), (GENKOVSKI, 2002). GERCHEV ET AL. (2005), examined the amino acid composition in mixed sheep milk samples obtained from thoroughbred Tsigai and Karakachanska ewes reared in the Central Balkan Mountain region. CARIC (1973), reported on changes in the composition of cysteine in the milk casein of Tsigai breed over lactation period. On the other hand GERCHEV (2004), investigated the amino acid composition of sheep milk from the Tsigai breed. The origin, situation and future of Tsigai breed in central – south European region are described by KUKOVICS AND JÁVOR (2002). They also reported on milk production of Tsigai ewes and their types in different countries. CSANÁDI ET AL. (2006), described the Hungarian Tsigai milk production. Many different dairy sheep breeds are recognized, mainly in the Mediterranean and Middle-east Europe area, with different genetic milk yield merits, but all distinguished by higher milk fat and protein levels than in goat and cow milk. Some sheep milk protein polymorphisms and their relationships to different cheese making parameters have been identified. Sheep milk composition can also be influenced by different feeds, grazing systems and by subclinical mastitis conditions. The fatty acid composition in sheep milk is easily altered by different feed supplements. Average composition of milk from sheep, goats, cows and humans is comprehensively documented and compared relatively to the nutrient supply from human milk and to the



recommended human daily dietary allowances. The unique richness in short chain and medium chain fatty acids in sheep milk, sheep cheeses, sheep butter (so far very neglected commercially), and their special values in human health and as treatment for many disease conditions is discussed extensively, (HEINLEIN, 2002).

The purpose of this paper is to review the production and composition of milk from Tsigai sheep breed, like a most reared milky ewes in Vojvodina, and compare with other Tsigai breeds in Middle-East Europe.

## DISCUSSION

According to the sheep milk production in Vojvodina the most popular breed is Tsigai. They are also valuable for milk and meat production. The sheep milk production and processing are concentrating in east part (Banat) and in north-west part of Vojvodina near city Sombor. The semi-extensive system is widely use. Until March the animal were kept indoors, feeding with concentrate, forage and hay, from April they were grazed but milking ewes received some concentrate, (STATISTIČNI GODIŠNJAK, 2008). The length of the suckling period is cca. 50-55 days. After this the ewes are housed in large groups, and milked twice daily. Ewes are milked mostly by hand. The machine milking is used only for big flocks due to practical and economically reasons.

Sheep milk production in Vojvodina is usually seasonal, with average length of lactation of 60 days. Milk production per lactation period also varied. MITIĆ (1984), recorded production of 110 – 120 litre. In the other investigation the amount of milk in 6 month lactation period is between 50 – 150 liter, (KRAJNOVIĆ AND SAVIĆ, 1992). Most of sheep milk is made into cheese, and into products such like as a yoghurt and cream. From Tsigai sheep milk near city Sombor the famous Sombor cheese are produced. In Banat the Kashkaval cheese is widely made from sheep milk.

VULIĆ ET AL. (2000) examined the physical and chemical quality of ewe's milk (*table 1.*).

**Table 1. Quality of examined Tsigai sheep milk**

<b>Milk ingredients</b>	<b>Mean</b>	<b>Standard deviation</b>	<b>Min – max.</b>
Daily quantity of milk (g)	681,67	90,01	460 – 880
Total Solids (%)	17,86	1,74	13,15 – 20,7
Milk fat (%)	7,42	1,58	2,20 – 10
Non fat total solids (%)	10,44	1,69	5,54 – 17,71
Protein (%)	5,51	0,22	5,22 – 5,82

MASLOVARIĆ (1987) reported results of two year examination on Tsigai sheep milk in Vojvodina. According to this the value of total solids was: 17,73 %, milk fat 7%, total solids non fat 10,73%, milk protein 5,86% lactose 3,96% and ash 0,97%.

In spite of the fact that milk production of Tsigai ewes fall behind from the other milky sheep breeds, the milk level and composition even at the extensive system is still acceptable. CSANÁDI (2005) explain in Hungarian Tsigai population the average daily milk quantity of 0,78 l, and total milk in lactation of 102 litres. However the length of

the suckling period is differ, in Vojvodina are between 50-55 days, while in Hungary, in the examined stock it was 30 day. In the same time the composition of milk is nearly correspond in mentioned two Tsigai type, namely in Hungary was: total solids 18,16%, fat 6,97%, non fat total solids 11,19% and protein 5,44%. Taking into account the aviability on Tsigai milk components in some recorded flocks in Slovakia, ORAVCOVÁ ET AL. (2007), the values of milk fat and protein were 7,77 % and 5,94 % which are very common to sheep milk content in Vojvodina. In Bulgaria, as PETKOV AND NAKEV (1970) described, the local Tsigai ewes have a milk production between 76.8 and 81.4 litres, that is very similar to ewes milk production in Northern part of Serbia. The research, which has been done on individual milk samples, received from 8 sheep, crosses of Tsigai ewes and Black-head Pleven rams, MIHAYLOVA ET AL. (2005), showed different values of milk yield and composition. In three month experimental period (May, June, and July) on pasture, the average daily milk yield decreased as follows 1012,5 ml, 962,5 ml and 617,8 ml, but it was higher than in Tsigai milk in Vojvodina. The daily secretion of milk fat increased 7,09 %, 7,28 % and 8,01 % but the content of protein in the milk was almost equal throughout the pasture period 6,32 %, 6,38 % and 6,33 %. These results indicate that crossing with Black-head Pleven rams and factors such as a relief and climate with natural vegetation have positive effect on milk yield and composition. Concerning the average daily quantity of milk (g) 681,67 of Tsigai ewes in Vojvodina, ORAVCOVÁ ET AL. (2006), found in Slovakia 0,604 kg, which represent a lower milk yield, but in the same time the Improved Valachian breed had lower milk production, 0,595 kg. In the time of the same experiment Lacaune breed was included in the analyses, and showed higher milk yield 1,053 kg than Tsigai. In other experiment by OCHODNICKY (2000), two milk sheep breeds, which are mostly reared in Slovakia: Tsigai and Improved Valachian breed ewes, were tested for milk performance. Milk production varies considerably between the herds as well as between individuals. The average milk production was in the best Improved Valachian herd 139.19 L/ewe and in the best Tsigai herd 159.93 L/ewe. The top Tsigai ewe milked 291.22 L. These results indicate to genetic potential of Tsigai breed milk production in different intensive systems, as it was mentioned in case of Vojvodina Tsigai ewes.

## CONCLUSION

The observed Tsigai milk in Vojvodina according to physical and chemical properties are in the range of standard sheep milk quality. The average milk quantity are between 0,46 and 0,88 kg/day, and in 6 mounth milking period are up to 150 l. The sheep milk in Vojvodina mostly processed into cheese and yoghurt. Compared results with other Tsigai breeds in Midle-East Europe area indicate that milk yield and composition are approximately the same, depending on pasture quality, keeping system and feeding. At the same time the average milk production in top herds suggests that there are animals in the populations which give a guarantee for considerable growth of the milk production within the whole population by their genetic potential. Our opinion is based on suggests in literature namely the breeding and milking of Tsigai ewes may contribute to the development of the economical sheep breeding in Middle-East Europe regions.

## ACKNOWLEDGEMENT

This paper was supported by the Ministry of Science and Technology of the Republic of Serbia under project TR 31031 " Improvement sustainability and competitiveness in the organic crop and livestock production using new technologies and inputs.

## LITERATURE

- ABOU-DAWOOD, A.E., IBTISAM, I.G. AND SOOD, M. (1980): Major and minor components and trace elements of Egyptian ewe and goat milk. *Egypt. J. Dairy Sci.*, 8. p. 109-114.
- CARIĆ M., ĐORĐEVIĆ J. (1973): Amino Acid composition of Sheep Milk Casein, *Milchwissenschaft* 28. 3. p. 166-168.
- CSANÁDI JÓZSEF (2005): A juhtej termelése minősége és feldolgozása közötti összefüggések. Doktori értekezés. Debreceni Tudományegyetem, Mezőgazdaságtudományi Kar.
- CSANÁDI J., FENYVESSY J., BAJÚSZ I. (2006): Cigája anyajuhok tejtermelésének és a tej összetételének vizsgálata. X. Agrárökönómiai Tudományos Napok. Gyöngyös. Full text in Conference CD p. 1-6. ISBN 963 229 623 0
- GENKOVSKI D. ( 2002): Comparative assessment of sheep of different breeds and varieties reared under the condition of Central Balkan Mountain. PhD. Thesis Troyan.
- GERCHEV G., GYURGA MIHAILOVA, OUZOMOV G. (2004): Amino acid composition of sheep milk from Tsigai breeds. *Biotechnology in Animal Husbandry* 20. p. 1-2
- GERCHEV G., GYURGA MIHAILOVA, I., TSOICHEV (2005): Amino acid composition of milk from Tsigai and Karakachanska sheep breed reared in the Central Balkan Mountain. *Biotechnology in Animal Husbandry* 21. (5-6) p. 111-115.
- GERCHEV G. (1998): Productivity and composition of milk from Staroplaninski Tsigai ewes depending of the altitude and the pasture grassland. *Journal of Mountain Agriculture of the Balkans*, vol. 1. p. 220-232.
- GEORGE F. W. HAENLEIN (2002): *The Nutritional Value of Sheep Milk*. Department of Animal & Food Sciences University of Delaware, Newark, Delaware, 19717-1303 USA
- Jandal J.M. (1996) Comparative aspects of goat and sheep milk. *Small Ruminant Research* 22 (1996) p. 177-185
- KANDARAKIS, I.G. AND ANIFANTAKIS, G.M. (1986): Distribution of I-131, OS-134 and Cs-137 in ewe milk during processing into different products. Cited in *Dairy Sci. Abstr.*, 1987, 49. p. 582-586.
- KUKOVICS SÁNDOR, JÁVOR ANDRÁS (2002): A Cigája fajta és jövője In. Jávora A., Mihók S.: Génmegőrzés, kutatási eredmények régi háziállatfajok értékeiről. *Liceum-Art Kiadó Debrecen*.
- MASLOVARIĆ BOŽIDAR (1987): IX. Savetovanje na temu: Ovčije I kozije mlekarstvo. *Vlašić*: p. 69-75.
- MIHAYLOVA G., JAHREIS G., ODJAKOVA T., KAFEDJIEV V. (2005): Fatty acid profile of milk from sheep raised on mountain pastures. *Biotechnology in Animal Husbandry* 21 (5-6) p. 93-96.
- OCHODNICKY D. (2000): Interactions elements of intensification of sheep breeding. *Mendelova Zemedelska a Lesnicka Univ., Brno, Brno (Czech Republic)*

ODJAKOVA T., V. KAFEDJIEV, G. MIHAYLOVA (2002) Comparative study on the changes in some traits of milk from Tsigai breed sheep and their crossbreeds during the lactation period, *Animal Science* 3. p. 48-52.

ORAVCOVA M., MARGETIN M., PEŠKOVIČOVA D., DAŇO J., MILERSKI M., HETENYI L., POLAK P. (2006): Factors affecting milk yield and ewe's lactation curves estimated with test-day models. *Czech Journal of Animal Science – UZPI* (Nov).

ORAVCOVA M., MARGETIN M., PEŠKOVIČOVA D., DAŇO J., MILERSKI M., HETENYI L., POLAK P. (2007): Factors affecting ewe's milk fat and protein content and relationships between milk yield and milk components. *Czech J. Anim. Sci.*, 52, 2007 (7) p. 189–198 Original Paper.

PETKOV I. S., NAKEV S. (1970): Selection in purebred Tsigai sheep. *Zhivot-novudstvo* Vol. 24. No. 3 p.43-48.

PETROVA N., D. NEDELICHEV, D. TODOROVA (1998): Productivity and composition of milk from ewes Karakachanska breed. *Animal Science* 1. p. 86-92.

RAYCHEV S., I. PEYCHEVSKI, E. DIMITROV (1987): Comparative study on the milking capacity, composition and properties of milk from some sheep breeds. *Animal Science* 9. p. 15-20.

SLAVOV R., G. MIHAYLOVA, I. PEYCHEVSKI, E. RAYCHEV, T. DIMITROV (1990): Study on the composition, properties and processing characteristics of milk from mountain Corridale and Tsigaja breed. *Animal Science* 8. p. 43-49.

STATISTIČNI GODIŠNJAK AP VOJVODINE (2008): Aktuelno stanje i problemi u stočarskoj proizvodnji u AP Vojvodini. QG 731-01.

VULIĆ M. MIRJANA, ĆINKULOV M. MIRJANA, VUKOSAV M. MARIJA (2000): Kvalitet mleka ovaca cigaja rase. Zbornik Radova „Savremeni trendovi u mlekarstvu“ Zlatibor.

## ASSESSMENT OF FOOD SAFETY BY YOUNG PEOPLE

MAROSI TIBOR – GÁL ADRIENN

University of Szeged, Faculty of Engineering  
Mars tér 7, H-6724 Szeged, Hungary  
marosi@mk.u-szeged.hu

### **ABSTRACT - Assessment of food safety by young people**

The significance of food safety is indisputable. Every process that endangers health protection must be taken seriously. In this work an attempt has been made to understand familiarity with food safety of young adults. Answers have been searched how they are informed about food safety issues. Deceitful information or ignorance can easily cause distrust and sometimes panic between the consumers. Young adults are very active and conscious parts of the consumer society; furthermore they are flexible and open-minded which can be beneficially used in the future. With the applied questionnaire the demographic characteristics, food consumption behaviors, food safety beliefs, and exact knowledge in this area were assessed. Young adults (aged between 19 and 28) who participated were male and female in almost equal rate, the married status was in 1/3 rate, and 80% lived in cities. One of the most positive issues is that many of them are aware of the importance of food safety, and perceived the changes in comparison with the last years. They trusted in Hungarian food products, but unfortunately the connection with the traditional home products is not tight enough. Sadly the young consumers are not aware of their rights in the field of food safety, they are usually uncertain during shopping or consumption. On one hand the lack of direct communication from the market on the other the proper inquiry of them about food safety, young adults have insufficient and incomplete information.

**Keywords:** food safety, young people, questionnaire

*“If we know the truth, we will surely want to change things for the better!”<sup>1</sup>*

## INTRODUCTION

The share of food industry is significant from the world economy. This is the first sector of processing industry in the European Union, with 13,4% share and employees more than 4 million people. Consequently in food industry and in the connecting areas strong competition has been formed involving growers, producers and traders. Over and above making profit striving has been made to produce and distribute foodstuff in appropriate quantity, nutritive value and absolutely safety condition. It is well known that foodstuffs have an effect on human health condition. Three groups can be distinguished based on the effects (Lehoczkiné, 2006):

- Food safety problems in consequence of polluted foodstuffs.
- Damages in consequence of health condition and individual reactions of human body.
- Nutrition problems tracing back under or over consumption of certain food or food components.

---

<sup>1</sup> <http://freefromharm.org/understand-the-issues/food-and-public-opinion/>

These problems are not the result of the modern age, they had existed in the world from centuries. The main difference can be perceived in the quantity of occurrence as well as the detection and documentation of events. In the last 15 years the coordination and regulation of food safety had changed significantly in consequence of food borne illnesses and connecting events.

Food is more than something we eat, therefore the food choices we make have strong effect on state of health. The result of the unhealthy and unsatisfactory nutrition can be the obesity, heart disease, diabetes etc, but the choices we make can result in positive changes in our lives. In the last decade, public concern over the safety, quality, ethics and sustainability of our food system has been on the rise. Our purchasing decisions, and the messages we send to leaders in both the private and public sectors, will ultimately determine how this process plays out. But we need to better understand where our food comes from and learn to better evaluate facts from fiction.<sup>2</sup>

Health and well-being are highly valued in today's society and food is considered to play a major role. Food safety issues are complex and consumers vary greatly in their knowledge of the science of food safety. With the expansion of services and the marketing activities built on that the examination of consumer attitude has come to the front. Nowadays the food purchase and the consumer attitude is a separate topic of the food research, the trends are explored and results are utilized comprehensively. The consumer attitude is the sum activity of attaining and using products and services, where the aim is to gain positive customer satisfaction. (Kajári, 2006). Besides the customer habits these assessments highlight on the mechanisms of the customer decisions. Within the customer behavior the food consumption can be separated as a complex attitude. The attitude of food consumers has been affected by the biological, economical, demographical, psychological, social and cultural factors. Under the biological factors the sensory properties are the most important as well as the foodborne diseases e.g. food intolerances or allergies. Regarding the economical and demographical effect, it can be stated that the consumption of food stuffs slightly depends on the “price flexibility” of the product, rather than on the income, on the relative price of the replaceable products, on the price movements, and the change of the customer preferences. Beside the psychological effects it is understandable, that strong emotion results in strong motivation for purchasing attitude (Balla, Siró, 2007).

The object of this paper to know more about the behavior of young people aged between 19-28. The main characteristic of this age-group is the separation from the parents from the home, they have make own decisions, they have break away from the childhood. According to Erikson studying is a key factor in young people's life, they suit and form fraternities, start to develop their own life. Their personal evolution cannot be separated from the society, the choice of the workplace and the carrier is most important in this age. After marriage the situation is more complex, they get into conflict because of the irreconcilability of friends, family and workplace (Erikson, 2002)

In the course of survey of customer attitude the classification of society is important by age. Certain products and habits are connected to this age-group, and serve as symbol to articulate belonging to the effective or the desired level of society (Hofmeister, 2008)

---

<sup>2</sup> <http://freefromharm.org/understand-the-issues/food-and-public-opinion/>

## **MATERIAL AND METHOD**

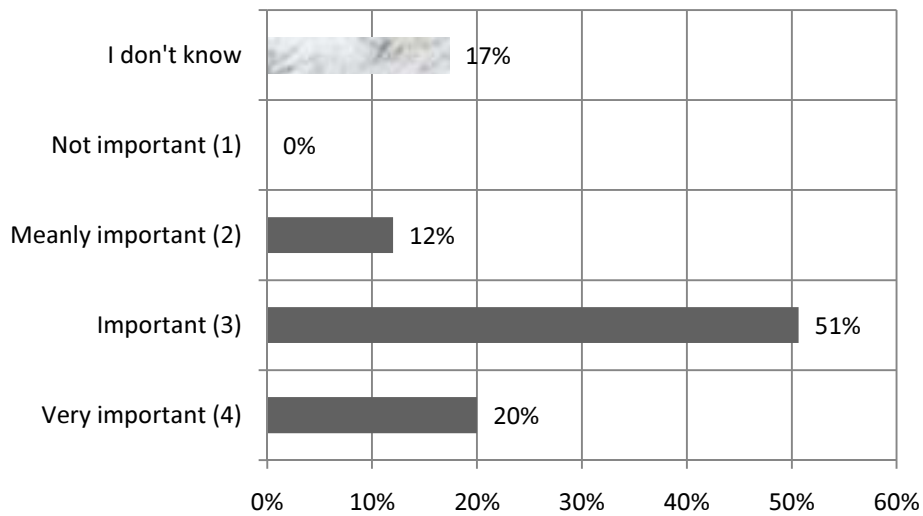
The attitude for food safety of young adults was surveyed using a questionnaire with 34 questions. For the sake of the better explanation the survey contained questions referring to food quality as well. The research was performed in summer 2010, big cities were selected where university can be found. The survey cannot be considered representative, rather than diagnostic, descriptive and illustrative (Scipione, 1997). Paper based data collection was applied and completed with personal assistance. Although this personal attendance limited the number of inquiry, gave a remarkable hand for the asked persons. The combination of open and closed format questions was applied, and the questionnaire was tested on a smaller sample before. The filling of a paper took up less than 10 minutes; finally 150 questionnaires were available for evaluation. The data were prepared and depicted in Excel program.

## **RESULTS**

The first group of questions refers to the asked persons, namely to the age, gender, marital status, qualification and residence. The rate of the male and female was around 50%, the single persons were in majority (60%), and the qualification was the following: skilled workers 8%, graduated 61% and higher graduated 31%. The 93% of asked persons live permanently in cities, from this 30% in county center, and 7% in the capital. To understand better the perception of food safety by young people additional information was collected about the purchase and consumption attitude. All respondents purchase food products; the majority not alone but typically with friends (22%) or with family (30%) and altering-wise 38%. It is surprising that 90% are conscious customer on their own admission, but the frequency of eating does not reflect this. Only 72% keep the daily three meals. The 10% who don't care about the healthy nutrition are almost men (8%). The next question refers to the determining factors of purchases, more answers were acceptable. The price sensitivity was expected ahead (93%), but the looks of the parlor (17%) and the characteristic of attendants (8%) were at the end.

The next three questions refer to the general knowledge about food safety. Firstly the people had to choose the appropriate definition of food safety. The 70% of them knew the concept correctly and 17% chose the answer about food security. Laboratory examinations (8%), own produced and bio foods (5%) were appointed in almost equal rate. It should be noted that finishing the questionnaire people came back to this question and wanted to change their opinion namely they was not aware of this idea.

Secondly young people were asked about the importance and changes of food safety. (see *Fig.1.*)



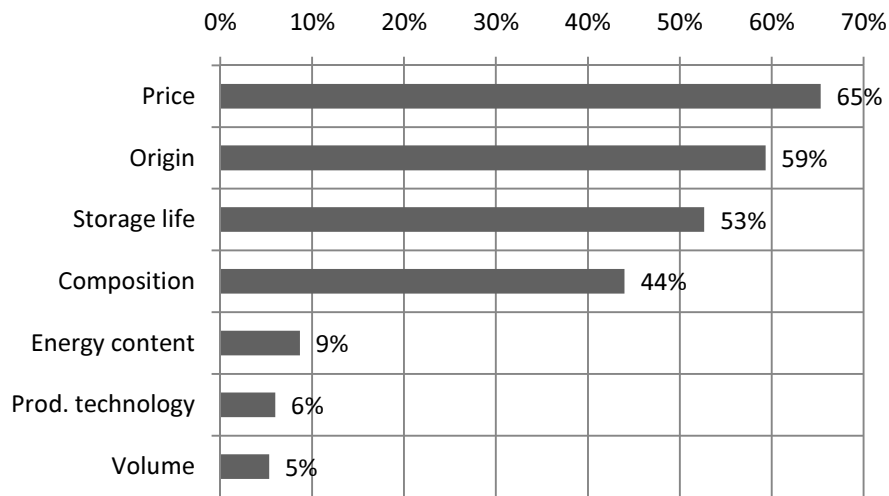
**Figure 1: The importance of food safety (average= 3.1; s<sub>N</sub>= 0.23)**

Two observations can be done, on one hand no people decided that food safety is not important, on the other 17% have no opinion or are not able to make a decision about the importance. The middling improvement of food safety was felt by 67%, distinct improvement by 14%, and according only 3% the change was not positive in the last decade. 16% did not feel any change.

In our survey we try to find a connection between the judgment of food safety and vendibility of Hungarian products. We asked the cause of selection of domestic food stuff, more answers were acceptable. 63% rely on Hungarian product better, 50% defend the domestic economy, and 27% are fond of Hungarian tastes. The results indicate that food products from other countries often generate distrust thus affects the inclination of purchasing. Perhaps the Hungarian products are overrated against the foreign gratuitously. The producers often take advantage of ethnocentrism, and emphasize the Hungarian origin of the product. This appears in advertisements as well on the package of the food stuff. This is fortified since 79% of asked young person every time or usually checks the customer information of the product, 19% only rarely and only 2% never.

We were curious what the people check on the label of food product. More answers were acceptable; the asked indicated 2 items on average. The results are in *Fig.2*.





**Figure 2: What do you check primarily on the label?**

Expectedly the price got into the first place, but the place of origin, the storage life or shelf life and the quality of component were in the range of interest. The energy content, the production technology and the volume or mass of the product were not in the focus of interest.

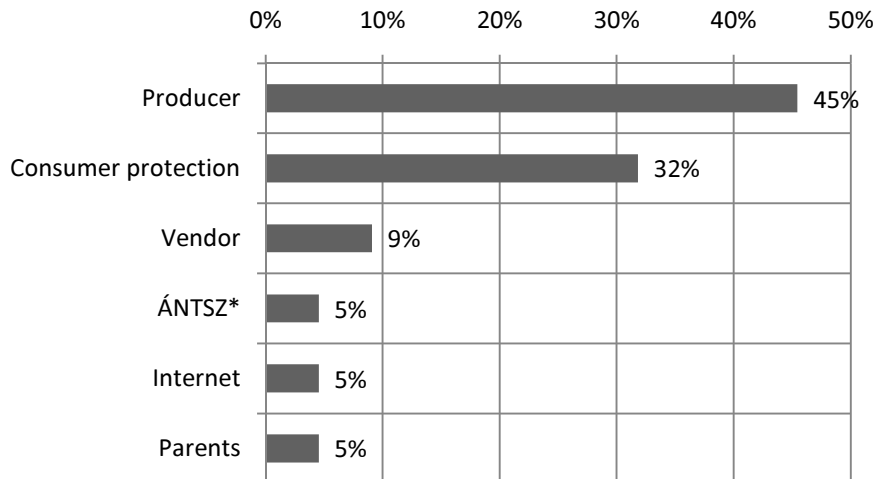
From the next question it was cleared that the quantity of food additives keeps back many people (74%) from the purchase, the high rate was surprising. 19% were not frightened away from purchase and 7% did not remember such a situation.

Connecting to the previous question the opinions about the modern production technology were tested. 17% of asked young people purchase these products often and certainly, 22% rarely, 4% don't buy them and 57% don't know (!) if they buy them or not. Investigating the reaction about preservative processes of food production the result is similar to the food additives. According to 3% of the youth the preservative processes strongly endanger the human health, 85% think there is less risk, 4% are not afraid at all and 8% don't know. Connecting to this we wanted to know with samples if trust was lost in food products. 36% of them had distrust one time at least, 30% had more bad experiences, 20% never met, and 14% did not remember such a situation. Not all people wrote examples in the first two cases, but we had 42 items at all. Among the products the followings are the most important: ice cream, tinned food, soft drinks, coffee, chocolate, dairy products, cold buffet products, pre-packed sandwiches, pastry, baker's products, honey, meat products, cake, rice, cereal, jam, dehydrated stock and sauce.

The importance of the place of production had no sense (66%) and 20% don't know the answer. 14% of people said the place had great importance, but what is very interesting the share between the large and small production places are almost equal, 48% and 52%.

The judgment of food safety authorities was absolutely positive, the 78% of asked young people are satisfied fully or generally, 21% did not know and only 1% was dissatisfied.

The young adults don't know who should have been applied for aid in the case of unsafe food. This was an open question, therefore only 29% of the asked people were answered, the detailed result can be seen in *Figure 3*.



**Figure 3: The possible sources of aid in the case of unsafe food stuff**  
 (\*ÁNTSZ: National Public Health and Medical Officer Service)

Next question refers to the check up of food stuff before the release. The result is very important, 77% of the asked people did not know if the food was checked up completely and according 23% the products are under control fully or partly. Nobody stated that products can be released without any control, namely people trust in foods.

40% of the asked people had foodborne disease one time; most of them had changed their consumption habits, they don't purchase the same product any more, or check the product must better. 32% have not had such a disease and 28% did not remember.

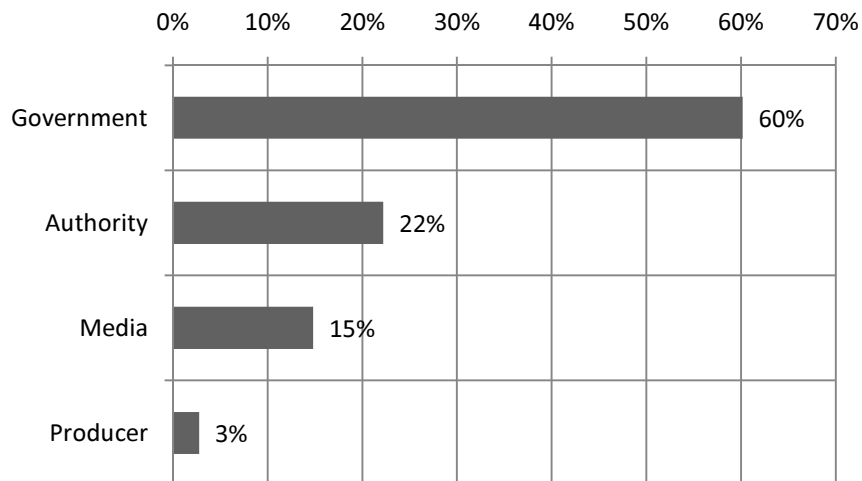
The young people are not informed sufficiently about the food safety questions. 78% could not mention any food safety system or food safety program, from the others who had any idea only HACCP system and ISO 9001 standard were mentioned in a few cases. Presumably mentioning HACCP system in a closed format question more people should have noted as a possible solution.

The most preferred source of the food safety is the customer information of a product (66%), then the television (26%), the written prospectus and press (6-6%) and internet (3%). Nobody indicated the family, friends and radio.

The most information about foodborne disease came from television (63%), from the press and the internet (13-13%), from family and friends (10%) and from written prospectus (7%). Nobody indicated the radio.

The asked people feel they got appropriate information about foodborne disease. 18% were totally and 72% on average satisfied, only 8% did not get enough information and 2% did not know the answer.

The last topic was the responsibility, namely who is responsible to warn against hazards or to give an instruction for this process. According to 47% people are interested in food safety and do everything to avoid hazards. 20% have an opposite opinion and 33% does not know. The asked people had to formulate their own opinion about the following questions: What is to be done in case of hazards? Who is responsible? 72% of the people answered for the first question, the result can be seen in Fig. 4. 82% said that the government and authorities are mainly liable for action, partly the media and the manufacturer. They did not name concrete authority.



**Figure 4: The responsibility of giving instruction about food safety**

75% of asked people have an opinion if the product can be hazardous. Most of them should withdraw the food from the circulation, or immediately destroy it.

## CONCLUSION

The young adults increasingly take into consideration food safety; they feel a positive change of the food treatment. This age-group come to a decision consciously and expect reliable foods with perfect quality. In the area of communication contradiction can be observed. On one hand they get sufficient information about foodborne disease, on the other they did not know food safety systems, or programs, furthermore they don't know where they get more information from. In the lack of knowledge they can rely upon the information of media. In general they are ambiguous, thus their knowledge must be increased by trainings and educations. Food safety is public health, affects everybody, in absence of knowledge of food safety risks distrust or panic can be evolved.

## REFERENCES

- BALLA Cs., SIRÓ I. (2007): *Élelmiszer-biztonság, és -minőség I.*, Mezőgazda Kiadó, Budapest, p. 10-15
- ERIKSON E.H. (2002): *Gyermekkor és társadalom*, Osiris Kiadó, Bp., p. 124
- HOFMEISTER-TÓTH Á. (2008): *Fogyasztói magatartás alapjai*, Aula Kiadó, Bp.
- KAJÁRI K. (2006): *Minőségügyi rendszermenedzsment az élelmiszer-gazdaságban*, In.: *Élelmiszer-biztonság és -minőség felnőtt fokon*, Mezőgazda Kiadó, Bp., p. 30-34
- LEHOCZKINÉ T. J. (2006): *Élelmiszer-mikrobiológiai minőségellenőrzés*, In.: *Élelmiszer- biztonság és minőség felsőfokon*, Mezőgazda Kiadó, Bp., p. 86
- SCIPIONE, P. A. (1997): *A piackutatás gyakorlata*, Springer Hungarica, Bp, p. 48

## **DRINKING WATER QUALITY IN RURAL REGIONS OF DIFFERENT HYDROGRAPHIC AREAS**

**IVANC, A.1, DEKIĆ, R.2, LOLIĆ SVJETLANA<sup>2</sup>, JANJIĆ NINA<sup>2</sup>, ERIĆ, Ž.2, TRBIĆ, G.2,  
GNJATO, R.2, ČETKOVIĆ DANIJELA<sup>2</sup>**

1Faculty of Biofarming, Marsala Tita 39, 24300 Backa Topola, Megatrend University  
Belgrade, Serbia

2Faculty of Natural Sciences and Mathematics, University of Banja Luka, Bosnia and  
Herzegovina

[aivanc@biofarming.edu.rs](mailto:aivanc@biofarming.edu.rs)

### **ABSTRACT: Drinking water quality in rural regions of different hydrographic areas**

Drinking water researches were conducted in rural regions of different hydrographic areas. In regions of Lijevče polje population mainly use for drinking water from the wells and water pumps, while in Eastern Herzegovina use water from springs and by capping groundwater. Water analysis from chosen locality was conducted four times during a year by season aspects on chosen springs. Results show that the water Vrijeka spring (Eastern Herzegovina) satisfies basic physicochemical and microbiological criteria for water that is used for drinking. Water from the well in village Berek (Lijevče) is not safe for the health because it is slightly acidic, muddy and has increased concentration of orthophosphates and suspended substances, while the water on the Trošeljci locality correspond to the drinking water, by monitored criteria.

**Key words:** water quality, physicochemical, microbiological

## **INTRODUCTION**

In rural regions of Lijevče polje is not installed water supply network so the local population mainly use for drinking water from the well and water pumps due to the existence of underground aquifers. Since it is a region where intensive agriculture is presented and where they use different fertilizers and pesticides, and the fact that there is not developed sewage system but beside the houses there are cesspools that gradually outflow in surrounding grounds, there is a real danger that undesirable substances, by surface waters, reach underground water that local population use for water supply. Population in rural areas in Eastern Herzegovina use for drinking water mainly from spring and by capping underground water, whose level significantly varies throughout the year. For this area is characteristic that in autumn and winter period heavy precipitation in significant rate raise water level causing flooding of entire fields, while in summer period appears drought, the water level is increasing and small springs and water flows dry up totally.

## MATERIAL AND METHODS

For analyzing drinking water in rural regions of Lijevo polje are chosen the well in Berek village and water pump in Trošeljci village. In the area of Eastern Herzegovina is conducted the analysis of water quality from the spring of the river Vrijeka which is used for water supply by local population. Taking the samples for physicochemical and microbiological analysis is conducted four times in a year. In area of Lijevo polje samples were collected once in April, June, September and November 2010., and in Eastern Herzegovina were collected in March, July and September 2010 and in January 2011. Water samples are collected in sterile dishes in aseptic terms by prescribed procedure (KARAKAŠEVIĆ, 1967; ŠKUNCA-MILANOVIĆ et al., 1990). On the spot were determined water and air temperature, pH values, electroconductivity, concentration of dissolved oxygen, oxygen saturation, turbidity i flow (Dalmacija, 2000). Through plankton net is filtered by 100 liters water for determining presence of algae. Then, samples are transported on ice on temperature of +4°C. Chemical analysis of water was conducted within 12 hours from the moment collecting, and seeding for microbiological analysis is conducted within 24 h. Using spectrophotometer HACH DR2800 concentrations of dissolved ammonia, nitrates, nitrites, orthophosphates, sulfates, iron and manganese are determined, so as total suspended substances. Concentration of ammonia was determined using Nessler reagent. Nitrites were determined using method with sulfanilic acid, nitrates by reduction of cadmium, and sulfates are determined using barium chromate reagent. For determination of orthophosphates is used method with ascorbic acid, for determination of manganese concentration is used PAN method, and for iron is used method with fenantrolin. Total suspended substances are determined photometrically. Number of individual group of bacteria is determined by indirect breeding methods (HRIBAR, 1978; MCKANE et al., 1996; PETROVIĆ et al., 1998; ŠKUNCA-MILANOVIĆ et al., 1990). Determination of total bacteria count is conducted on substrate for total count after 5 days incubation at temperature 22-26°C. Psychrophilic heterotrophs were determined on agar after 72 hours incubation at 22°C., while mesophilic heterotrophs were determined on the same substrate after 48 hours incubation at 37°C. Facultative oligotrophs were determined on ten times diluted agar after incubation at 26°C lasting 7 days. Total coliforms was determined using method of most likely number after 48 hour of incubation at temperature of 37°C on McConkey substrate. Confirmatory test for fecal coliforms was done on endo-agar substrate after incubation of 48 hour at 44°, as well as on McConkey substrate after 48 hours of incubation at 44°C. For determination of presence of *Pseudomonas aeruginosa* cetrimide agar is used. Presence of genus *Salmonella* i *Shigella* was determined on SS agar substrate, while for isolation of *Clostridium* species were used chromogenic substrate for clostridium isolation and TSN agar. Enterococcus species were isolated on Simons-citrate agar and azide dekstroze agar (APHA-AWWA-WPCF, 1998), and for Streptococcus species is used Slanetz-Bartley agar. For determination of algae presence in water microscope Leica DM1000 is used.

## RESULTS

Well in Berek village is located on 45°02'33" North, 17°13'76" East and it has an altitude of 114 m. The highest water temperature was measured in July and was 17.2° (Tab.1). In September in water was recorded a low concentration of dissolved oxygen,

only 5.15 mgO<sub>2</sub>/l which corresponds oxygen saturation of 54% and it is near lower limit that is recommended for drinking water. In all samples water was slightly acidic. Just in November pH value 6.8 was recorded which represents lower limit for drinking water, while in other samples pH values were under allowed limit. Acidic waters are often corrosive and can cause dissolution of copper and lead from water pipes which then reach drinking water and give it metal taste (Dalmacija et al., 2004). Values of electroconductivity were very high in every tested sample that indicates higher ion concentration in water which can be consequence of its low pH value. In April were recorded high values of turbidity (13.61 NTU) and concentration of suspended substances (6 mg/l), while in June, September and November values of both of these parameters were in normal range

**Table 1. Physicochemical characteristics of water from the Berek well**

	21.04.2010	9.6.2010	28.9.2010	16.11.2010
air temperature (°C)	18	25	18	15
water temperature (°C)	15.2	17.2	17.1	13.7
concentration of dissolved O <sub>2</sub> (mg/l)	-	6.83	5.15	6.28
saturation (%)	-	70.4	54.0	61.5
pH	6.45	6.53	6.75	6.80
electroconductivity (µS/cm)	695	709	745	702
turbidity (NTU)	13.61	1.01	0.56	0.47
ammonium nitrogen (mg/l)	0.01	0.07	0.02	0.02
nitrate nitrogen (mg/l)	3.2	0.5	2.1	2.7
nitrite nitrogen (mg/l)	0.003	0.002	0.005	0.000
sulfates (mg/l)	37	33	38	30
orthophosphates (mg/l)	0.17	0.27	0.12	0.06
suspended substances (mg/l)	6	0.5	0	1
iron (mg/l)	0.04	0.01	0.04	0.03
manganese (mg/l)	0.010	0.026	0.011	0.010

Suspended substances that cause turbidity can cause heavy metals, toxic organic components and pesticides, and also give water unpleasant look that gives negative impression to the consumers (DALMACIJA et al., 2004). Recorded concentrations of ammonium, nitrates, nitrites, sulfates, iron and manganese in water were in the prescribed range by the Rulebook. However, orthophosphates were above the permitted limit, in two of four samples, and in June was recorded 0.27 mg/l which was almost two times higher than permitted value. Number of aerobic psychrophilic heterotrophs was in every sample lower than maximum permitted 300 col/ml. The highest number of bacteria in water was recorded in September (347 col/ml) and the lowest in November (60 col/ml). Potential pathogenic mesophilic bacteria in April were not even recorded, and in June there was 80 col/ml which was in the prescribed range by the Rulebook (SLUŽBENI GLASNIK REPUBLIKE SRPSKE, 40/03). However, in June, September and November in water were recorded total number of coliphorms, among them in June and September were isolated fecal coliphorms. *Escherichia coli*, fecal *Streptococcus* and *Enterococcus* were isolated, which has high resistance and can resist negative conditions so their presence in water is used as indicator of older fecal pollution (ŠKUNCA-MILOVANOVIĆ et al., 1990).

**Table 2. Microbiological characteristics of water from the Berek well**

	21.04.2010	9.6.2010	28.9.2010	16.11.2010
total bacteria count (kol/ml)	100	285	347	60
aerobic heterotrophic psihrophilic	40	66	170	60
facultative oligotrophic bacteria (col/ml)	61	195	330	57
aerobic mesophilic bacteria (col/ml)	0	80	30	30
total coliphorm bacteria count (col/ml)	0	10	23	9
fecal coliphorm bacteria (col/ml)	0	4	5	0
<i>Escherichia col</i> (col/ml)	0	2	5	0
<i>Proteus</i> species (col/ml)	0	0	0	0
<i>Salmonella</i> and <i>Shigella</i> (col/ml)	0	0	0	0
sulfite-reducing <i>Clostridium</i> in 100 ml	0	0	0	0
<i>Pseudomonas aeruginosa</i> (col/ml)	0	0	0	0
fecal Streptococcus and Enterococcus	0	present	present	0
Algae	0	0	0	0

Based on these results it can be concluded that water from the well in Berek locality beside that it is slightly acidic and contains orthophosphates and suspended substances, comes in contact with waste fecal substances and it is not health safe.

Water pump in Trošelj village is located on 45°03'49" North and 17°21'12" East. Results of physicochemical water analysis are presented in *Table 3*.

**Table 3. Physicochemical characteristics of water from Trošelj locality**

	21.04.2010	9.6.2010.	28.9.2010	16.11.2010.
air temperature (°C)	18	25	19	17
water temperature (°C)	12.7	12.0	17.8	15.1
concentration of dissolved O <sub>2</sub> (mg/l)	-	14.62	8.17	8.11
saturation (%)	-	135.4	86.9	81.8
pH	6.65	7.32	7.32	7.74
electroconductivity (µS/cm)	623	612	717	733
turbidity (NTU)	1.29	0.77	0.42	0.76
ammonium nitrogen (mg/l)	0.06	0.00	0.02	0.05
nitrate nitrogen (mg/l)	1.0	4.9	4.2	4.1
nitrite nitrogen (mg/l)	0.001	0.001	0.004	0.010
sulfates (mg/l)	14	13	15	18
orthophosphates (mg/l)	0.01	0.14	0.10	0.15
suspended substances (mg/l)	2	0	0	1
iron (mg/l)	0.00	0.00	0.03	0.02
manganese (mg/l)	0.006	0.010	0.004	0.009

Water is rich with dissolved oxygen and in June was recorded oversaturation of 135.4%. In April is recorded slightly lower pH value (6.65) than it is predicted for drinking water, but in the next three months pH values were in the normal range. The highest value of turbidity is recorded in April what it was 1.29 NTU which corresponds to water that can be used for water supply to 5000 inhabitants. In the same sample suspended substances were present with 2 mg/l, while in June and September they were not even recorded. Total bacteria count on this locality did not go beyond 300 col/ml which was registered in September (*Table 4*). Then, the highest psihrophilic heterotrophic count was registered 150 col/ml, which is in the prescribed range for drinking water. Aerobic mesophilic bacteria was isolated in April, June and November, but their count was in the range prescribed by the Rulebook (SLUŽBENI GLASNIK REPUBLIKE SRPSKE, 40/03) and among them are not isolated total or fecal coliphorms.

**Table 4. Microbiological characteristics of water from Trošelj locality**

	21.04.2010	9.6.2010	28.9.10	16.11.2010
total bacteria count (kol/ml)	52	65	300	15
aerobic heterotrophic psihrophilic bacteria	15	30	150	13
facultative oligotrophic bacteria (col/ml)	32	80	55	30
aerobic mesophilic bacteria (col/ml)	13	10	0	9
total coliphorm bacteria count (col/ml)	0	0	0	0
fecal coliphorm bacteria (col/ml)	0	0	0	0
<i>Escherichia coli</i> (col/ml)	0	0	0	0
Proteus species (col/ml)	0	0	0	0
<i>Salmonella</i> and <i>Shigella</i> (col/ml)	0	0	0	0
sulfite-reducing Clostridium in 100 ml	0	0	0	0
<i>Pseudomonas aeruginosa</i> (col/ml)	0	0	0	0
fecal Streptococcus and Enterococcus	0	0	0	0
<b>Algae</b>	0	0	0	0

Based on all observed physicochemical and microbiological parameters it can be concluded that water from the water pump from Trošelj locality satisfies basic hygienic and sanitary conditions and can be used for drinking.

The highest recorded water temperature from the spring of the river Vrijeka was 11.2° (Table 5) and since it is not significantly increased during warm summer months it can be concluded that temperature of this spring correspond to drinking water. Water is slightly alkaline without significant variation in pH values during the year. The lowest values of concentration of dissolved electrolytes was recorded in January (398 µS/cm) when the spring has much water, while in summer period in time of drought recorded the highest concentration of electrolytes in water (550 µS/cm).

**Table 5. Physicochemical characteristics of water from the spring of river Vrijeka**

	23.03.2010	04.07.2010	01.09.2010	19.01.2011
air temperature (°C)	14.0	21.0	17.1	10
water temperature (°C)	11.0	10.5	11.2	9.9
concentration of dissolved O <sub>2</sub> (mg/l)	-	8.73	9.15	10.19
saturation (%)	-	82.3	88.4	94.5
pH	7.60	7.65	7.71	7.68
electroconductivity (µS/cm)	438	484	550	398
turbidity (NTU)	0.89	0.81	1.99	1.41
ammonium nitrogen (mg/l)	0.00	0.01	0.00	0
nitrate nitrogen (mg/l)	0.6	0.6	0.4	0.5
nitrite nitrogen (mg/l)	0.000	0.001	0.000	0.011
sulfates (mg/l)	0	0	0	0
orthophosphates (mg/l)	0.35	0.15	0.00	0.15
suspended substances (mg/l)	2	1	0	1

In September and in January were recorded slightly increases values of water turbiditz, but they were in allowed range to use as water supply to 5000 inhabitants. Recorded concentrations of ammonium, nitrate and nitrite were far below maximum allowed concentrations, and sulfates were not even recorded. In March is recorded increased concentration of orthophosphates (0.35 mg/l), also in water was recorded slightly more suspended substances and before taking the samples the weather was rainy, probably because of the washing away the surrounding soil caused slightly muddy water and bringing orthophosphates. Considering that in June concentration of orthophosphates was significantly decreased, and in September they were not even recorded and as all other parameters during the whole year were in allowed range for drinking water



(SLUŽBENI GLASNIK REPUBLIKE SRPSKE, 40/03), it can be concluded that in physicochemical aspect water from spring of river Vrijeka can be used for drinking. As regards to bacteriological analysis total bacteria count correspond the count of facultative oligotrophs which are adapted to survive in areas with very low concentration of organic substances (Table 6).

**Table 6. Microbiological characteristics of water from the spring of river Vrijeka**

	23.03.201	04.07.2010	01.09.20	19.01.20101
total bacteria count (kol/ml)	195	100	244	20
aerobic heterotrophic psihrophilic bacteria (col/ml)	24	100	215	20
facultative oligotrophic bacteria (col/ml)	130	100	250	66
aerobic mesophilic bacteria (col/ml)	0	2	95	0
total coliphorm bacteria count (col/ml)	0	0	0	0
fecal coliphorm bacteria (col/ml)	0	0	0	0
<i>Escherichia coli</i> (col/ml)	0	0	0	0
<i>Proteus</i> species (col/ml)	0	0	0	0
<i>Salmonella</i> and <i>Shigella</i> (col/ml)	0	0	0	0
sulfite-reducing <i>Clostridium</i> in 100 ml	0	0	0	0
<i>Pseudomonas aeruginos</i> (col/ml)	0	0	0	0
fecal <i>Streptococcus</i> and <i>Enterococcus</i> (col/ml)	0	0	0	0
<b>Algae</b>	0	0	0	0

Their count, also the count of psihrophilic aerobic bacteria in every analysis do not pass 300 col/ml which is the upper limit for drinking water. Potentially patogenic aerobic mesophilic bacteria in January and in March were not ever recorded, and in July were present with just 2 col/ml. Their count in September significantly increased (95 col/ml), but they were still in the range prescribed by Rulebook (SLUŽBENI GLASNIK REPUBLIKE SRPSKE, 40/03). Total coliphorm bacteria were recorded only in March, but their count were in allowed range. Among present total coliphorms fecal bacteria were not found. Based on monitored physicochemical and microbiological characteristics it can be concluded that water from the spring of the river Vrijeka satisfies conditions prescribed by the Rulebook (Službeni glasnik Republike Srpske, 40/03) for the water that can be used as water supply to 5000 inhabitants.

## CONCLUSION

By monitornig physicochemical characteristics of chosen springs in the area of Lijevo polje and Eastern Herzegovina, it is noticed that springs in Eastern Herzegovina contain very low concentration of dissolved sulfates. Vrijeka did not even have sulfates. Monitored springs in Eastern Herzegovina have also slightly lower concentrations of nitrate nitrogen. Also, it is evident that water from chosen springs have slightly lower pH values and significantly higher values of electroconductivity. Water from the well in Berek village is not health safe because it is slightly acidic, turbid and has increased concentration of orthophosphates and suspended substances. Presence of total and fecal coliphorms, *Escherichia*, fecal *Streptococcus* and *Enterococcus* shows that water from the well comes in contact with waste fecal substances and as such can not be used for drinking. Water on Trošeljci locality and from spring of river Vrijeka satisfy basic physicochemical and microbiological criteria set for drinking water.

## ACKNOWLEDGEMENTS

This work represents the result of scientific research project named „Condition of the shallow water resources in rural areas and measurements for their improvement“ co-financed by Ministry of science and technology in Republic of Srpska Government

## REFERENCES

- APHA-AWWA-WPCF (1998): Standard methods for the Examination of Water and Wastewater. 20th Edition. Washington: American Public Health Association.
- DALMACIJA, B. (2000): Kontrola kvaliteta voda u okviru upravljanja kvalitetom. Institut za hemiju, Prirodno matematički fakultet Univerziteta u Novom Sadu.
- DALMACIJA B., IVANČEV-TUMBAS, I. (2004): Analiza vode - kontrola kvaliteta, tumačenje rezultata. Prirodno-matematički fakultet Univerziteta u Novom Sadu, Budućnost, Novi Sad.
- HRIBAR, F.(1978): Uputstvo za biološko istraživanje voda. Savezni hidrometeorološki zavod, Beograd.
- KARAKAŠEVIĆ, B.(1967): Priručnik standardnih metoda za mikrobiološki rutinski rad. Medicinska knjiga, Beograd-Zagreb.
- MCKANE, L., KANDEL, J. (1996): Microbiology, essentials and applications. McGraw-Hill, New York.
- PETROVIĆ, O., GAJIN, S., MATAVULJ, M., RADNOVIĆ, D., SVIRČEV, Z. (1998): Mikrobiološka ispitivanje kvaliteta površinskih voda. Institut za biologiju, Prirodno-matematički fakultet Univerziteta u Novom Sadu.
- PRAVILNIK O HIGIJENSKOJ ISPRAVNOSTI VODE ZA PIĆE. Službeni glasnik Republike Srpske, br. 40, 2003.
- ŠKUNCA-MILOVANOVIĆ, S., FELIKS, R., ĐUROVIĆ, B. (1990): Voda za piće, standardne metode za ispitivanje higijenske ispravnosti. Savezni zavod za zdravstvenu zaštitu, NIP „Privredni pregled“, Beograd

***SECTION 4: INNOVATION AND SUSTAINABLE DEVELOPMENT***

**Moderátorok/Moderators:**

Dr. Margherita Mori

Dr. Skúli Skulason

**Secretary:**

Dr. Benkó Kiss Árpád

## TRADITIONAL AND MODERN FOODS

**BALOGH SÁNDOR, SNELCER BETTI**

University of Szeged, Faculty of Engineering  
Mars tér 7, H-6724 Szeged, Hungary  
[basa@mk.u-szeged.hu](mailto:basa@mk.u-szeged.hu)

### **ABSTRACT – Traditional and modern foods**

The lecture aims to present the “family tree” which shows the “phylogeny” of foods and which demonstrates that the process of product development in food industry shows a certain, largely predictable regularity.

### **Traditional foods**

These were prepared exclusively from natural raw materials, in the beginning with the oldest preservation methods. The essence of the “processing technology” was the use of some natural preservation method. The aim was to provide sufficient food and non-seasonal supply. These aims were achieved with high calorie content and with the use of preservation methods.

Their current availability is given in national lists [e.g. Traditions – Tastes – Regions program (Hungarian abbreviation: HÍR)]. Their consumption is still regular in certain populations otherwise it is occasional or even exceptional.

### **Produced foods**

The raw materials are the same but the development of science results in the use of up-to-date conservation methods, e.g. heat treatment. Canning is started, initiated by Appert. This is the beginning of the industrial revolution (steam power!) and machine engineering in food industry is also started. The primary mechanization of production processes in Hungarian food industry was realized between the 1830s and 1890s. Certain industries became like manufacturing industry in character.

### **Convenience foods** (a special group of produced food)

The *first* convenience products were meant to facilitate women’s housework (for instance, production of condensed tomato, pasta, tinned vegetables, soup concentrates and soup powders) and to replace household work (e.g. jams, bottled fruits). These are the so called ready to cook products.

The *second* generation of convenience products is constituted by products which facilitate not only preparation (that is the kitchen phase) but also consumption. These are the so called ready to eat products.

*Third* generation convenience products are fast to prepare and convenient to consume, yet healthy too. Functional foods all belong to this category. New packaging materials, new ways of packaging also has been appeared.

### **Special functional foods**

(for example, weight control and beauty food products, medical foods)

Properties: new or traditional raw materials, partly new technology: essentially it is fortification.

**New foods aimed at personalized nutrition**

Nanotechnology, microencapsulation.

Condition: genomics.

The lecture points out the joint occurrence of foods in the present supply, corresponding to the phases of development listed here, and outlines the different possibilities of innovation.

## **THE IMPACT OF EUROPEAN ECONOMIC RECOVERY PLAN (EERP) ON ROMANIAN RURAL AREA**

**ANDREA FEHER, VASILE GOȘA, TABITA HURMUZACHE, SORIN STANCIU**

Banat's University of Agricultural Sciences and Veterinary Medicine from Timisoara  
Calea Aradului, no.119, 300645, Timisoara, Romania  
feherandrea.usab@gmail.com

### **ABSTRACT – The Impact of European Economic Recovery Plan (EERP) on Romanian Rural rea**

As a response to the global financial crisis, the European Commission elaborated a European Economic Recovery Plan, which aims at the increase of the demand, generation of economic growth and creation of new jobs. Among the solutions proposed to recover the economies, investments in rural development, especially in the fields of biodiversity, water management, milk and dairy products sector refreshment may be reminded, support for application of renewable energy and development of internet infrastructure in rural areas.

By recovering economy with the help of investments in infrastructure, ecologic technologies, energetic efficiency and innovation, the package proposed by the European Commission intends to accelerate the transition to a knowledge-based society with reduced carbon dioxide emissions and environmentally-friendly agricultural practices.

**Keywords:** financial crisis, EERP, Health Check, rural development

## **INTRODUCTION**

The global financial crisis, appeared in the U.S.A. in 2007-2008, got quickly spread in the entire world. Alan Greenspan, the former president of the U.S.A. Federal Reserve, said that the current financial crisis is „the most severe crisis since the Second World War”. (GREENSPAN, 2007)

Although the European Union recorded, in 2008, a positive increase (due to a favourable beginning of the year), respectively 0.9% on the whole and 0.7% in the euro-region, in the fourth semester of 2008 it officially entered the recession (according to economists, the recession is defined as the existence of two consecutive trimesters of economic activity contraction). As a reaction, the European Commission proposed a plan of economic recovery, approved then by the European Council in the reunion from 11-12 December 2008. (DRAGAN, 2010)

## **MATERIAL AND METHOD**

At the moment, at the European Union level, the CAP Health Check and the EERP also contribute to new funds in order to solve the priority problems generated by rural development. In this viewpoint, this work deals with the impact exerted by these funds on the development of investments in the Romanian rural area.

## RESULTS

**The European Economic Recovery Plan (EERP)** attempts to offer a coordinated answer to crisis effects, by conferring priority to those measure protecting jobs and short-term purchase power. EERP is relied on an effort equivalent with a total value of approximately 1.5 % of the European Union's GDP, totalizing about 200 billion Euros, and it is covered from the national budgets (about 170 billions or 1.2% of GDP) and from the EU and European Investment Bank's budgets (about 30 billions or 0.3% of GDP). (COUNCIL REGULATION No 473/2009)

According to the European Commission's President, J. M. Barroso, the package proposed „must be big enough and bold enough to work in the short-term, yet strategic and sustainable enough to turn the crisis into an opportunity in the long-term. We also must pay attention to direct the support to those who need it most”. (EUROPEAN COMMISSION, 2008)

The President Obama classified the European plan as being too much „timid”. In comparison, the measures included by the American Recovery and Reinvestment Act in the United States involve the expenditure of about 800 billion \$ that should stimulate the American economy. (DRAGAN, 2010)

Of the EERP budget, 1.02 billion Euros are made available for the member states with the help of the European Agricultural Fund for Rural Development (EAFRD), in order to solve problems like the economic crisis, the dairy sector crisis, the climatic changes and the internet infrastructure from rural regions. To this sum, we should also add a supplementary budget of 3.9 billion Euros, as a consequence of some transfers from CAP and from CAP Health Check.

During the period October 2009 – January 2011, all the rural development programs have been modified, and the supplementary funds in a value of about 5.3 billion Euros are made available for investments in agriculture, environmental protection and wide-band infrastructure in rural regions. Most funds are concentrated in the fields of biodiversity (31.2% of total funds, respectively 1.5 billion Euros) and water management (26.9%, respectively 1.3 billion Euros). In order to refresh the sector of milk and dairy products, a percentage of 14.5% was allocated from the total budget (0.7 billion Euros), while the measures fighting against the climatic changes benefit by 14.2% (0.7 billion Euros) and the measures supporting the renewable energy represent 5.6% of the total supplementary budget (0.3 billion Euros). The development of wide-band infrastructure remains an important policy aspect for rural areas. So the member states have decided to invest in internet 35% of the EU funds for economic recovery, representing 360.4 million Euros of the available sum of 1 billion Euros.

Table 1 presents the situation of supplementary fund distribution for rural development, for each country separately.

**Table 1. Final sums allocated to EU member states to finance the rural development measures, during 2007-2013 (million euros, current prices)**

	<b>Sums allocated initially</b>	<b>Supplementary sums from EERP etc.</b>	<b>Final sums</b>	<b>% EERP</b>
Poland	13230.0	168.9	13398.9	3.2
Italy	8292.0	693.8	8985.8	13.2
Germany	8112.5	967.2	9079.7	18.4
<b>Romania</b>	<b>8022.5</b>	<b>101.7</b>	<b>8124.2</b>	<b>1.9</b>
Spain	7213.9	839.2	8053.1	16.0
France	6442.0	1142.5	7584.5	21.7
United Kingdom	4598.7	13.4	4612.1	0.2
Portugal	3929.3	129.7	4059.0	2.5
Austria	3911.5	114.1	4025.6	2.2
Hungary	3805.8	54.3	3860.1	1.0
Greece	3707.3	198.9	3906.2	3.8
Czech Republic	2815.5	42.0	2857.5	0.8
Bulgaria	2609.1	33.1	2642.2	0.6
Ireland	2339.9	154.6	2494.5	2.9
Finland	2079.9	75.1	2155.0	1.4
Slovakia	1969.4	27.5	1996.9	0.5
Sweden	1825.6	127.5	1953.1	2.4
Lithuania	1743.4	22.4	1765.8	0.4
Latvia	1041.1	13.3	1054.4	0.2
Slovenia	900.3	15.7	916.0	0.3
Estonia	714.7	9.0	723.7	0.2
The Netherlands	486.5	106.7	593.2	2.0
Denmark	444.7	133.2	577.9	2.5
Belgium	418.6	68.9	487.5	1.3
Cyprus	162.5	2.1	164.6	0.03
Luxembourg	90.0	5.0	95.0	0.1
Malta	76.6	1.1	77.7	0.02
<b>Technical assistance</b>	<b>196.2</b>	<b>0</b>	<b>196.2</b>	<b>0</b>
<b>Total</b>	<b>91179.6</b>	<b>5260.7</b>	<b>96440.3</b>	<b>100.0</b>

Source: Calculated according to the European Commission „EU support for Rural development 2007-2013”

In concordance with the distribution of funds originating in the CAP Health Check and EERP, Romania will benefit by 102 million Euros, of which 36 millions for renewable energy, 22 millions for water management and 18 millions for climatic changes. For biodiversity, Romania will benefit by 14 million Euros; for dairy sector Romania will benefit by 12 million Euros. These financings are separately budgeted from NRDP allocations. The money available may be accessed only together with the financial support offered through NRDP for an investment project, but the beneficiary has to allocate a separate budget for what he wants to be financed within this opportunity.

The measures benefiting by the supplementation offered through EERP are:

- **Measure 121 „Farm modernisation”**



Within this measure, the operations financed through EERP are related to the improvement of Nitrogen-based fertilizers efficiency, to investments in the field of dairy production, residual water treatments, and also perennial energetic crops.

• **Measure 123 „Adding value to agricultural and forestry products”**

The applicants for non-reimbursable funds who access the Measure 123 for agricultural and forestry products processing may obtain EERP-based financing for biomass processing for the achievement of renewable energy, production techniques for water savings, and also for improvement in milk processing and capitalization.

• **Measure 125 „Improving and developing infrastructure related to the development and adaptation of agriculture and forestry”**

The EERP funds afferent to this measure are designated to the investments in water savings technologies, namely efficient irrigation systems (pumping stations, water counters, etc.)

• **Measure 214 „Agri-environmental payments”**

The EERP funds attempt to supplement the agri-environmental payments offered to farmers as direct payments for the performance of an environmentally- friendly agriculture, to extend the livestock and extensively use the pastures, to not apply fertilizers and pesticides on the land of great value, to create and preserve the hayfields.

• **Measure 312 „Support for the creation and development of micro-enterprises”**

The money available successive to EERP supplementation may represent a non-reimbursable financial support for the purchase of equipment for energy production from renewable sources, other than the biofuels.

• **Measure 322 „Villages renewal and development, improving basic services for rural economy and population and upgrading of rural heritage”**

The supplementary funds are designated for financings in investments in production and supply of renewable energy.

## CONCLUSIONS

The recent evolutions of the European financing system, through the Common Agricultural Policy (CAP) confirm the increasing trend of the complementarity of the financing process of agricultural and rural area with the financing through other policies (especially the regional one), with the essential objective of promoting a general process of economic, social and territorial cohesion.

The global financial crisis, felt in the EU since 2008, has determined an action of supplementary financial support for the member states, materialized in the European Economic Recovery Plan.

In the field of EERP-based rural development, and also through the Health Check of CAP from 2009, Romania obtained a supplementation of rural development funds with 102 million Euros, reaching the sum of 8124 million Euros for the current program period. The sums will be used in concordance with the directives set by the European Commission for investments in agriculture, environmental protection and internet network development in rural area. (FEHER, 2009)

## REFERENCES

1. GREENSPAN A. (2007): “The Age of Turbulence: Adventures in a New World”, The Penguin Press
2. FEHER ANDREA (2009): “Financing of agriculture and rural development. Community Policies”, Orizonturi Universitare Publishing House, Timisoara
3. PAUL ANDREEA (2011): “European investments for sustainable rural development”, Tribuna economica, No. 4
4. DRAGAN GABRIELA, “European Recovery Plan, or the increased risks of lack of coordination and reform in the EU”  
[http://www.encyclopedia-economica.ro/upload/files/AT\\_3\\_MATERIALE\\_CRIZAECON2\\_Dragan-Gabriela-Planuleuropeandereadresareeconomica.pdf](http://www.encyclopedia-economica.ro/upload/files/AT_3_MATERIALE_CRIZAECON2_Dragan-Gabriela-Planuleuropeandereadresareeconomica.pdf)
5. LARCH M., VAN DEN NOORD P., JONUNG L. (2010): “The Stability and Growth Pact: Lessons from the Great Recession”, European Commission Directorate-General for Economic and Financial Affairs, Economic Papers 429
6. OTIMAN P. I. coordinator (2006): “Dezvoltarea rurală durabilă în România” - Sustainable rural development in Romania, Publishing House of Romanian Academy, Bucuresti
7. Council Regulation (EC) No 1698/2005 on support for rural development by the European Agricultural Fund for Rural Development (EAFRD), Official Journal of the European Union, L. 277/21.10.2005
8. Council Regulation (EC) No 473/2009 amending Regulation (EC) No 1698/2005 on support for rural development by the European Agricultural Fund for Rural Development (EAFRD) and Regulation (EC) No 1290/2005 on the financing of the common agricultural policy, Official Journal of the European Union, L. 144/09.06.2009
9. European Commission: “EU support for Rural development 2007-2013”  
[http://ec.europa.eu/budget/library/documents/multiannual\\_framework/2007\\_2013/tab\\_rural\\_devt\\_2007-2013.pdf](http://ec.europa.eu/budget/library/documents/multiannual_framework/2007_2013/tab_rural_devt_2007-2013.pdf)
10. The Ministry of Agriculture and Rural Development of Romania (2010): “The National Programme for Agriculture and Rural Development (NPARD) 2007 – 2013, enhanced version June 2010
11. The Payment Agency for Rural Development and Fisheries from Romania: “Types of operations which target the new challenges and are financed from EERP budget”
12. Communication from the Commission to the European Council (2008): “A European Economic Recovery Plan”, Brussels  
[http://ec.europa.eu/economy\\_finance/publications/publication13504\\_en.pdf](http://ec.europa.eu/economy_finance/publications/publication13504_en.pdf)
13. European Commission (2008): “Kick-starting the economy”  
[http://ec.europa.eu/news/economy/081127\\_1\\_ro.htm](http://ec.europa.eu/news/economy/081127_1_ro.htm)

## **STAGE OF IMPLEMENTATION OF THE NATIONAL RURAL DEVELOPMENT PROGRAMME IN ROMANIA THREE YEARS AFTER THE ADHESION**

**FEHER ANDREA, VASILE GOȘA, SORIN STANCIU, TABITA HURMUZACHE, COSMINA TOADER**

Banat's University of Agricultural Sciences and Veterinary Medicine from Timisoara  
Calea Aradului, no.119, 300645, Timisoara, Romania  
feherandrea.usab@gmail.com

### **ABSTRACT – Stage of implementation of the National Rural Development Programme in Romania three years after the adhesion**

The financing mechanism of CAP pillar II – Rural development has suffered, along time, significant changes, determined by the need for improvement and also by the experience achieved in this field by the European organisms and the member countries. The attaining of a rate as big as possible of the capacity of absorbing European funds represents a real „challenge”, especially for the new member states. Three years after the adhesion, unfortunately Romania has not succeeded in carrying out adequate fund absorption for rural development; at the end of 2010, the absorption degree recorded was only 17.7% and the contracting degree was only 34%.

**Keywords:** National Rural Development Programme (NRDP), pillar II, public funds, projects

## **INTRODUCTION**

The rural development policy fills out and accompanies the market policy and aims at the consolidation and diversification of rural economy. This policy relies on the integrated multi-sectorial approach of the rural area.

The financing mechanism of the common rural development program has suffered, during time, significant changes, culminating with the Cap reform from 2003, with references for the programming period 2007-2013.

The European Commission stipulations that reform the rural development policies for 2007-2013 include, beside several other aspects, the reorganization of financing, by dividing the **European Agricultural Guidance and Guarantee Fund (EAGGF)** into **European Agricultural Guarantee Fund (EAGF)**, for measures supporting the common market organizations, and **European Agricultural Fund for Rural Development (EAFRD)**, for rural development measures. This was an attempt to solve the essential problem of individualization of the financing resources for the two CAP pillars: **agriculture** and **rural development**. At the same time, three main objectives in the field of rural development were reformulated, namely:

- competitiveness improvement in the agricultural and forestry sectors;
- environmental protection and rural landscape improvement;
- life quality improvement, by diversifying the economic activities in the rural area.

These desiderata have become foreground axes of the rural development programs.

The new rural development policy, according to the EU commissioner for agriculture and rural development, Mariann Fischer-Boel, is „*more extended, simpler and better, because it answers the requirements of the European citizens*”.

The defining elements of the rural policy future are:

- 1) a single programming and financing instrument – European Agricultural Fund for Rural Development;
- 2) a new strategic approach for rural development, with clear concentration on the EU priorities;
- 3) refreshment of control, assessment and communication and a more accurate responsibility division between the member states and the Commission;
- 4) a stronger „bottom-up” approach. Member states, regions and the local groups of action will have the opportunity to express their opinions regarding the relationship between these programs and their local needs

## **MATERIAL AND METHOD**

The analysis of the NRDP implementation in Romania relies on the analysis of the projects applied for financing until the end of 2010, of the projects declared to be eligible, of the ones selected for financing and of the projects contracted or even completed. Projects analysis was performed from the viewpoint of their value, as well. These data were provided by the Minister of Agriculture and Rural Development and processed by the authors of this work in order to draw conclusions.

To admit one project for financing, it must pass several examinations for:

- a) conformity;
- b) eligibility;
- c) selection.

**The conformity step** supposes the checking of the application for financing, if it was correctly filled in, if it includes all the correct technical and managerial annexes, in two copies and if the application is presented in electronic and printed format. The projects applied and declared to be corresponding will enter the step of eligibility assessment.

The assessment, more exactly the **checking of project eligibility**, involves the checking of applicant's eligibility, of the eligibility and selection criteria specific to the investment type, of the project budget, of the study of feasibility and of all the documents attached.

Successive to this step, the projects declared eligible will be submitted to a **selection system**, and each project will be qualified in concordance with the selection criteria presented in the Applicant's Guide, afferent to each type of investment separately. Only the projects obtaining points over the minimal stipulated limit will be admitted for financing. The next step is represented by the signing of the financing contract.

## **RESULTS**

In the new CAP reform stage, the improvement of the rural development policy has become a priority of maximal importance for European Union. Under the conditions provided by EU extension to 27 member states, the rural development policy as part of the regional integration policy play an important role in the strengthening of the economic and social cohesion.

The rural development policy for 2007-2013 is synthesized in three axes, plus the axe LEADER; each axe includes a set of measures conceived to provide the accomplishment of the objectives proposed.

Once admitted the National Program for Rural Development 2007-2013 by the European Commission (February 2008), the first session of applications for projects belonging to the measures 121 „Farm modernisation”, 123 „Adding value to agricultural and forestry products”, 322 „Village renewal and development” was opened in March.

The session of May opened financing for two governmental support schemes, for IMMs processing agricultural products, afferent to the measure 123 – *Governmental Support Scheme XS 13/123 A/2008*, for agricultural products processing and *XS 28/123 B/2008*, for forestry products processing.

The session of September-October opened financing for the measures 312 „Support for the creation and development of micro-enterprises” and 313 „Encouragement of tourism activities”.

Other three new measures have been implemented since 3 December 2008, with the opening of the first application session for the measures 112 „Setting up young farmers”, 141 „Supporting semi-subsistence farms undergoing restructuring” and 142 „Setting up of producer groups”.

During the session from 15 September-22 October 2009, the measure 431 „Running the local action group, skills acquisition, animation” was launched, with the submeasure 431.1 „Building of public-private partnerships”, phase 3 „Financial support for the preparation of LAGs”.

**Table 1. Measures of rural development with opened financing (31.12.2010)**

Measure	Financial participation, public funds (mil. Euro)			Beginning of implementation
	Total	EU	RO	
121 – Farm modernisation	991,8	793,4	198,4	March 2008
123 – Adding value to agricultural and forestry products	1071,1	856,9	214,2	March 2008
322 – Village renewal and development	1546,1	1236,9	309,2	March 2008
Governmental support scheme XS 13/123	118,1	94,5	23,6	May 2008
Governmental support scheme XS 28/123	110,0	88,0	22,0	May 2008
312 – Support for the creation and development of micro-enterprises	383,4	306,7	76,7	September 2008
313 – Encouragement of tourism activities	544,2	435,4	108,8	September 2008
112 – Setting up young farmers	337,2	269,8	67,4	December 2008
141 – Supporting semi-subsistence farms undergoing restructuring	476,1	380,9	95,2	December 2008
142 – Setting up of producer groups	138,8	111,0	27,8	December 2008
431.1 – Building of public-private partnerships, Phase 3	9,8	7,8	2,0	September 2009
125 – Improving and developing infrastructure related to the development and adaptation of agriculture and forestry	483,2	386,6	96,6	March 2010
Governmental support scheme N578/123	200,0	160,0	40,0	July 2010
221 – First afforestation of agricultural land	229,3	183,4	45,9	October 2010

The measure 125 „*Improving and developing infrastructure related to development and adaptation of agriculture and forestry*” was opened for financing beginning with the session of projects from March 2010; the implementation of the State aid scheme N578 „*Stimulation of Regional Development by Investments for Agricultural and Forestry Products Processing in order to Obtain Non-Agricultural Products*”, afferent to the measure 123, is supposed to be applied in July.

Another measure for rural development was implemented in Romania in February 2011, namely the measure 221 „*First afforestation of agricultural land*”.

Of the 27 measures for rural development selected by Romania from the common environment, the country implemented 14 measures until the end of 2010 (table 1).

**Table 2. Situation of projects applied within NRDP until 31.12.2010**

**- Thousand euro -**

Measure	Projects applied		Projects selected		Financing contracts/decisions completed		Payments done	
	No.	Public value	No.	Public value	No.	Public value	Public value	
112	6572	136720	4567	95840	2799	58979	35542	
121	5545	2121051	1845	725476	1585	568567	228186	
123	913	972257	556	580960	369	362031	72173	
Scheme XS 13/M123	247	113706	215	101626	179	78404	28829	
Scheme XS 28/M123	177	78897	157	67451	134	59285	18118	
Scheme N578/M123	167	125825	-	-	-	-	-	
125	870	922897	141	165674	123	141434	-	
141	31757	238177	18413	138097	15686	117645	24476	
142	NRDP	17	2440	15	2235	14	2215	217
	Transferred from SAPARD	-	-	-	-	3	30	-
312	3980	543861	1382	204327	1338	196677	41503	
313	1401	238968	634	115517	583	102731	6809	
322	3039	7429244	610	1620540	602	1522969	155483	
431.1	Phase 3	112	4920	111	4827	104	4340	3134
	Phases 1+2					8	1704	1657
511					24	8428	5188	
Guarantee schemes					2	220000	220000	
211							146691	
212							78853	
214	NRDP						326552	
	Transferred from SAPARD					1	5	-
221	NRDP	6	1787	-	-	-	-	-
	Transferred from SAPARD					3	7	-
611							395714	
<b>TOTAL</b>	<b>54803</b>	<b>12930750</b>	<b>28646</b>	<b>3822570</b>	<b>23557</b>	<b>3445451</b>	<b>1789126</b>	

Source: The Ministry of Agriculture and Rural Development

[http://www.madr.ro/pages/dezvoltare\\_rurala/situatia-proiectelor-depuse-31.12.2010.pdf](http://www.madr.ro/pages/dezvoltare_rurala/situatia-proiectelor-depuse-31.12.2010.pdf)

During the 27 project sessions organized until the end of 2010, a total number of 54,803 projects were applied in the whole country, afferent to 14 measures; of these, 28,646

projects obtained the required points and were selected for financing, and 23,557 were completed with financing contracts or decisions.

The most of the projects were applied for the measure 141 „*Support of semi-subsistence agricultural farms*”. This measure aims at the increase of the volume of the production to be sold, in order to turn the semi-subsistence farms into economically-viable ones, respectively at the diversification of production according to market requirements and to the introduction of new products. The non-reimbursable public support is of 1500 euro/year/farm, for a 5-year period, if the farmer proves that the agricultural production obtained after three years, destined for sale, increases with 20%, and that farm’s economic dimension increases with minimum 3 ESU (Economic Size Unit).

The most of the biggest, important projects were applied for the measure 121 „*Modernization of the agricultural holdings*”; this situation was expected because of the big number of projects applied for the similar measure of the SAPARD programme.

We should mention the fact the measures belonging to AXE 2, namely M 211 „*Support for the disfavoured mountain area*”, M 212 „*Support for disfavoured areas, others than the mountain area*” and M 214 „*Agri-environment payments*” are measured administrated by the Agency of Payments and Intervention in Agriculture (APIA) and do not require the application of projects because the support is offered as direct payments to farmers.

The measure 511 „*Technical assistance*” includes funds allocated for the Agency of Payments for Rural Development and Fishery (APDRP), for projects of technical assistance that should support the process of technical and financial implementation of the National Rural Development Programme.

The measure 611 „*Direct complementary payments*” represents the sums transferred from rural development to Pillar I Agriculture, to complete the national sources of financing of the direct complementary payments offered the farmers.

The public financial allocation for NRDP 2007-2013 attains the sum of 10097 million euro, of which FEADR’s contribution represents about 8124 million euro and the national contribution from the state budget represents 1973 million euro. Within this programme, 54,803 projects were applied until the 31st of December 2010, in total public value of approximately 13 milliard euro. Of these, 28,646 contracts were selected, in value of 3.8 milliard euros, and only 23,557 projects were contracted, representing about 3.4 milliard euros, meaning 1/3 of the total allocated. The absorption degree of rural development funds, calculated as report between the payments performed and the sum allocated, was of 17.7% at the end of 2010.

In 2008 (the first year of implementation of NRDP), the payment rate was rather reduced, and the effective implementation of projects started in the second half of the year; the first contracts were completed at the beginning of September 2008. In this viewpoint, the absorption degree of the financial allocation in 2008 was 1.36%.

In 2009, the absorption degree of the financial allocation was 6.77%, and at the end of 2010 it was 17.7%.

After the first two years of effective implementation (in 2008, the main activity was consisted of the application of projects and their evaluation), the contracting rate is approximately 34%.

Considering that the beneficiaries of this Programme, according to measure, must participate with their private co-financing part, and some of them present difficulties in the achievement of the necessary credits, there have also been several contract cancellations (about 230 projects).

## CONCLUSIONS

The application of Common Agricultural Policy for Romania is supported by important financial resources, allocated from the common budget and from the national budget. The allocations for rural development measures from the EU budget attain the sum of 8124 million euro, much over the financial support level of the National Rural Development Programmes from other countries, and Romania's participation is 19.54%, respectively 1973 million euro. The public contribution (EU + Romania) for the support of rural development during 2007-2013 totals 10097 million euro, and if we also add the private contribution of beneficiaries in the case of measures that require co-financing, we obtain the total sum of 13574 million euro. We should also mention that 625 million euro of this sum are designated for direct agricultural support and not for rural development, representing a fund transfer from Pillar 2 to Pillar 1, in order to complete the direct payments offered the farmers, with financing from the national budget.

The sum designated to rural area financing is a significant one; however an important problem we should insist on is related to the capacity of common fund absorption, doubled by the capacity of co-financing. The lack of transparency, reduced experience, insufficient information, bad project management, reduced possibility of providing the financial advance or the private contribution – all of these are aspects that might exert negative influence on the process of absorption of the funds destined for rural development.

## REFERENCES

1. CATANĂ, AIDA (coord), 2007, Development of projects financed from Structural Funds for SMEs 2007-2013, Contaplus Publishing House, Ploiesti
2. FEHER, ANDREA, 2009, Financing of agriculture and rural development. Community Policies, Orizonturi Universitare Publishing House, Timisioara
3. OTIMAN, P.I. (coord.), 2006, Sustainable rural development in Romania, Publishing House of Romanian Academy, Bucuresti
4. Implementation and vision of Common Agricultural Policy. CAP in the 27 EU Member States, Council for the Rural Area, The Netherlands, 2008
5. Rural Development in the European Union, Statistical and Economic Information, Directorate-General for Agriculture and Rural Development, Report 2009 [http://ec.europa.eu/agriculture/agrista/rurdev2009/RD\\_Report\\_2009.pdf](http://ec.europa.eu/agriculture/agrista/rurdev2009/RD_Report_2009.pdf)
6. Council Regulation (EC) No 1698/2005 on support for rural development by the European Agricultural Fund for Rural Development (EAFRD), Official Journal of the European Union, L. 277/21.10.2005
7. Council Regulation (EC) No 473/2009, Official Journal of the European Union, L. 144/09.06.2009
8. [http://ec.europa.eu/budget/library/documents/multiannual\\_framework/2007\\_2013/tab\\_rural\\_devt\\_2007-2013.pdf](http://ec.europa.eu/budget/library/documents/multiannual_framework/2007_2013/tab_rural_devt_2007-2013.pdf) - „EU support for Rural development 2007-2013”
9. [http://www.madr.ro/pages/dezvoltare\\_rurala/situatia-proiectelor-depuse-31.12.2010.pdf](http://www.madr.ro/pages/dezvoltare_rurala/situatia-proiectelor-depuse-31.12.2010.pdf) - „The situation of the NRDP projects 31.12.2010”, The Ministry of Agriculture and Rural Development of Romania
10. The National Rural Development Programme 2007-2013, enhanced version June 2010, The Ministry of Agriculture and Rural Development of Romania



## WAY TO SUSTAINABLE DEVELOPMENT: SUSTAINABLE SOCIETY

**SZEKERESNÉ KÖTELES RITA**

**University of Szeged, Faculty of Agriculture**  
**6800 Hódmezővásárhely, Andrásy str. 15.**  
e-mail: [szkrita@gmail.com](mailto:szkrita@gmail.com)

### **ABSTRACT – WAY TO SUSTAINABLE DEVELOPMENT: SUSTAINABLE SOCIETY**

Based on the results of a questionnaire survey sent to the LEADER LAGs in 2010 March, this study presents some social aspects of sustainability of rural areas. In this study I deal with some forms of participation as a basis and one of the main characteristic of social sustainability. Cooperation or willingness to cooperate, interest, ability to innovate, confidence, existence of key people, information flow, as well as commitment can be considered as forms of participation and a basis for sustainable society of rural areas. The results of the survey indicates that social participation as a tool for the so called social pillar of sustainability must be a subject for development in order to achieve sustainable development in general.

**Keywords: rural areas, sustainable development, sustainable society, participation**

### **INTRODUCTION**

The definition of sustainability, and to ensure its views are quite different from scientists, politicians, business, or even in everyday life. We can find many differing opinions about the level of sustainability, the progress, or even about how much should be the rate of change according to the given approach. The most widely cited explanation and the most general approach as well, is that sustainable development - more broadly – is equal to the economic – environmental (ecological) and social development. In the narrow, but quite outdated!- sense sustainable development is focusing on natural resources, promotes the protection, conservation and quality of them. The economic systems are generally tested in the sense that, as a result of the economic activities, the environment is under- or overloaded. The Gothenburg strategy had recognized that in the long term, economic growth, social cohesion and environmental protection must go hand in hand. (EC, 2001). In 2004 the European Commission introduced the review of the Gothenburg strategy and defined new approaches to the new challenges. The review stated that strengthening identification and responsibility as well as *improvement of collaboration* between public and private sector at all levels is an important tool to sustainable development (BULLA ET AL, 2006). In recent years social sustainability has been gaining increased recognition as a fundamental pillar of sustainable development. Previous research on sustainability has been limited to environmental and economic concerns, however, social sustainability has begun to receive political and institutional endorsement, becoming entwined with the sustainable communities agenda and the notions of governance, social capital and corporate social responsibility (COLANTONIO, 2007).

Unfortunately in most cases, the socio-political and environmental debates and arguments are still rarely linked. However sustainability cannot be achieved without the

society: the active involvement and willingness to act are all essential. This is particularly important in rural areas, as significant part of the society live in rural areas, the most of the country's geographical area is rural and also the most of the gross national product is created on these areas. The active participation of stakeholders is indispensable feature of the implementation of sustainable development strategies, because governments alone can not determine and fit together economic, social and environmental objectives (GÁTHY ET AL, 2006). Nevertheless everyone has the right to participate in decisions shaping their lives, and to be recognized and appreciated contribution to the family, the development of community and society (EC, 2001). Development of rural areas can only be successful if people, organizations living and operating there, do cooperate, and coordination of activities takes place as well. It requires the active participation of individuals, enterprises, non governmental and governmental organizations as well.

### **MATERIAL AND METHOD**

The survey serving as a basis for this study was conducted in March 2010. The questionnaire including 70 questions was sent to each community with the title LEADER LAGs, assisted by the staff of the Rural Development Division of the Ministry of Rural Development (Ministry of Agriculture and Rural Development at the time of the research). The rate of response (94%) was highly favourable: 90 out of the 96 questionnaires sent out were returned. Our survey primarily focussed on the establishment of LAGs, their operations, tasks, and the features of the area covered by them.

This study, focusing on sustainability, involves only some part of the questionnaire survey and answers are sought for the followings:

- Level of cooperation/collaboration skills of the local communities.
- Local /regional needs and practices of public participation.
- If the LAG's activities contribute to the cooperation of regional actors.
- The most important aspects of the development of the surveyed areas, regarding economical, ecological and social pillars of sustainability.
- The main obstacles to the development of the surveyed areas, focusing on social factors.

### **RESULTS**

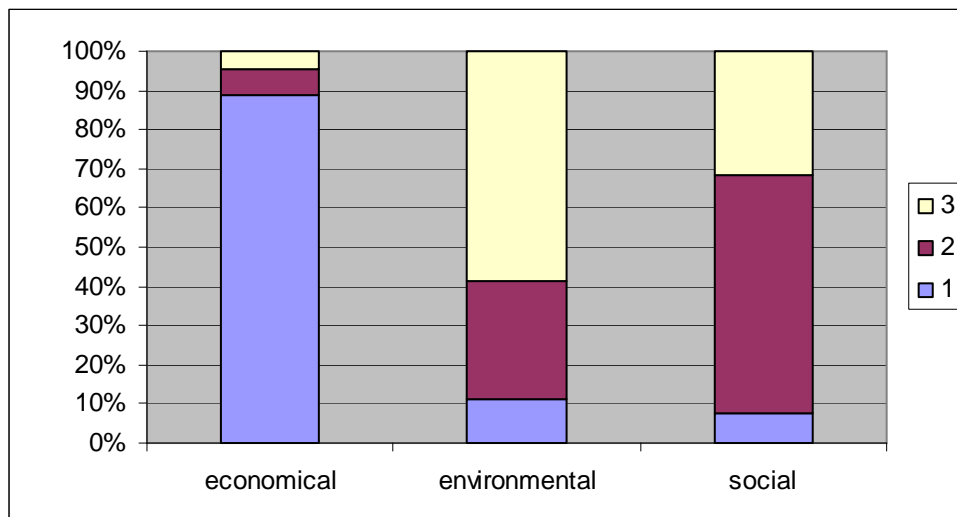
Cooperation and willingness to cooperate play a significant role in the development of rural areas. People's ability to cooperate depends on attitudes and coupled with the generation of social capital. Social capital is generated when people's relationships change in a way to facilitate action. Social capital is a resource for communities and partnerships, as well as an indicator of relations and cooperations established in the society and the economy (KIS 2006). Social capital has also emerged as an important element of social sustainability (COLANTONIO, 2007). Cooperation can be considered as a system of "working" relations between people: individuals as well as organizations with the purpose of realizing mutual benefits and advantages.

According to the result of the survey, - where respondents were asked to mark the level of cooperation on the scale 1-5 (1 weak, 5 strong)-, cooperation or collaboration skills of the local communities is moderate (average 3,41), as well as the needs and practices of public participation (average 3,25).

Playing a key role in the development of rural areas it is expected that LAG’s activities contribute to the cooperation of local or regional actors. According to their answers, 50% of the LAG’s answered that partially, and 50% of them think that totally promote and contribute to the cooperation of local actors, as a result of their coordinating activities. For instance in case of the Hódmezővásárhely micro- region, the LAG organizes trainings, consultation days or conferences and forums in different topics (eg. development of tourism, cooperation of NGO’s).

We also asked the LAG’s to define the most important aspects of the development of the area and got the following results: as the diagram (Figure 1.) demonstrates, the most important aspect is the economical development but social aspect is the second most important for 50% of the respondents. Regarding social development the following topics – as subject of the improvement were mentioned: employment, health, education, culture etc. There were 4 action groups who could not differentiate and considered all the three factors (economical, environmental and social) equally important.

**Figure 1. Importance of the three pillars of sustainability considering rural development among respondents**



Source: own data collected

In order to identify the factors mostly hindering the development of the surveyed areas the LAGs were asked to rank the factors relevant for their region in order of importance, choosing from 16 defined options (with 1 indicating the most important factor to hinder the development of a given region). Table 1. shows the results of the survey.

**Table 1. Order of importance of the social factors hindering the development of areas covered by LAGs**

Hindering factors	Average score
<i>Lack of willingness to cooperate</i>	3.4
Lack of knowledge	3.6
<i>Lack of interest</i>	4.2
Lack of the ability to innovate	4.3
Lack of confidence	4.7
Lack of key people	4.7
Lack of information	5.0
Lack of commitment	6.4

Source: Kis-Szekeresné Köteles, 2011

Cooperation can be defined as a working relation between people. The essence of cooperation lies in that it can lead to mutual advantages and benefits for both individuals and the society (Kis, 2008). Cooperation and confidence constitute a closely related system as cooperation is based on confidence. Accordingly, the main obstacle to the establishment and development of cooperations is the lack of confidence. Obviously it is traced back to various reasons as disappointment, lack of knowledge or information.

The success of the adaptation of rural areas highly depends on the preparedness of stakeholders. In this respect knowledge and information must be highlighted. Information influences the decisions and actions of people and organizations, thereby influences the functioning of the economy and society, and consequently sustainable development. Therefore, information – its presence or absence is a considerable differentiating factor, at the level of both local players and different areas as well. Thus, information flow and communication play a really important part in improving the level of preparedness on individuals and their communities. Accordingly, knowledge, skills and abilities have a greater impact on the development than earlier.

People's lack of interest as well as lack of attitudes in bottom-up rural development as a so called community issue can be traced back to several reasons, including disappointment, lack of confidence, and lack of knowledge and information. A lack of interest in public affairs affects civic activity and social inclusion, which is not favourable to the establishment and development of cooperations, specially significant for this topic. This sets back social competitiveness and social sustainability is questioned in the shorter or longer term. Acceptance of community values and interests and identification with them plays an important role, requiring dialogue, communication, proper information flow, increasing knowledge, acceptance of others, confidence, mutuality, and willingness to act, in order to be able to improve and develop the ability of the community to take initiatives, take action, and assert interests. It serves as a basis for enabling people and their communities to define their future and take action to make it come true.

Social and economic changes require the society to adapt on an on-going basis, which is only ensured by invention and renewal. And the basis for renewal is innovation, that is, the ability and sensitivity to innovate. Innovation can concern products and activities, but not only in the economy but in the social and political sector as well. There is no sustainable development without innovation. Innovation on the other hand - if not

distorted, or wants to be self-destructive - must be complied with the requirements of sustainability. (LIPPÉNYI 2005)

Existence of key people in the society is desirable in order to play a leading role: key people can mobilize and encourage the society for action. They might organize the activities of local people or the communities, resulting increased ability to act. The existence of key people or having leading force is essential in order to coordinate and facilitate common work and participation in rural areas.

The above mentioned factors are closely related and linked, the presence or absence of them can influence the rate and level of participation, consequently the social sustainability.

### **CONCLUSIONS**

The questionnaire survey results concluded that according to the opinion of the Local Action Groups, established to contribute to the implementation of rural development, primarily the economic aspects are the most developed area, but the second most important factor will to be developed is the social aspect, among the three pillars of sustainability.

In rural areas the need and willingness for cooperation is mediocre, which is unfavourable in order to achieve sustainability.

The development of rural areas is significantly hindered by the deficiencies of the rural people and their communities. Cooperation, confidence, interest, the existence of key people, knowledge and information, innovation, as forms of participation, all should be a basis of social sustainability and play an important role in achieving sustainable development.

Consequently, in the realization of sustainable rural development primarily the development of human resources, with special attention to attitudes and willingness should be improved.

There is a need for ‘real’ and ‘working’ communities in order to be able to talk about community initiatives and later effective cooperation. The role of Local Action Groups and other governmental or non- governmental organizations is essential in order to promote and coordinate better participation, cooperation and alliance of local stakeholders.

### **ACKNOWLEDGEMENTS**

Special thanks for the Rural Development Division of the Ministry of Rural Development (Ministry of Agriculture and Rural Development at the time of the research) for the contribution of sending questionnaires to all the LAG’s and thanks for the 90 LAG’s sending back the survey.

The survey was compiled and evaluated by the Rural Development Working Group, operating in the Takács Ferenc Training Centre of University of Szeged, Faculty of Agriculture.

## REFERENCES

- Bulla Miklós – Mozsgai Katalin – Pomázi István (2006): Fenntarthatóság – dilemmák és lehetőségek, In: Bulla Miklós – Tamás Pál (ed.) Fenntartható fejlődés Magyarországon, Jövőképek és forgatókönyvek, Stratégiai kutatások – Magyarország 2015, ÚMK Budapest, 2006 p.109-164
- Colantonio, Andrea (2007): Social Sustainability: An Exploratory Analysis of its definition, Assessment Methods, Metrics and Tools, Oxford Institute for Sustainable Development (OISD) - International Land Markets Group Oxford Brookes University
- EC (2001): A Sustainable Europe for a Better World: A European Union Strategy for Sustainable Development (Commission's proposal to the Gothenburg European Council), Commission of the European Communities Brussels, 15.5.2001 com(2001)264 final
- Gáthy Andrea–Kuti István–Szabó Gábor (2006): Fenntartható fejlődési politikák és stratégiák az Európai Unióban. . In: Bulla Miklós – Tamás Pál (ed.) Fenntartható fejlődés Magyarországon, Jövőképek és forgatókönyvek, Stratégiai kutatások – Magyarország 2015, ÚMK Budapest, 2006 p. 165-194
- Kis Krisztián (2006): A társadalmi tőke, mint a társadalmi és gazdasági folyamatokat befolyásoló erőforrás. Agrártudományi Közlemények (Acta Agraria Debreceniensis), 20. Különszám. p. 69-73
- Kis Krisztián (2008): A Hódmezővásárhelyi kistérség humán erőforrásainak hierarchia-rendszerű vizsgálata. Agrártudományi Közlemények (Acta Agraria Debreceniensis), 29. szám. p. 91-110
- Kis Krisztián- Szekeresné Köteles Rita (2011): A helyi akciócsoportok működése egy országos felmérés tükrében. A gazdálkodás, 2011. 1. szám. p.19-27
- Lippényi Tivadar (ed.) (2005): A tudomány- és technológiapolitika szerepe Magyarország fenntartható fejlődésében. Szakterületi stratégia, háttéranyag a Fenntartható Fejlődés Stratégia megalapozásához. (Vitaanyag.) Budapest, 2005. augusztus.
- Radácsi László (2006): Részvétel és fenntartható fejlődés. In: Bulla Miklós – Tamás Pál (ed.) Fenntartható fejlődés Magyarországon, Jövőképek és forgatókönyvek, Stratégiai kutatások – Magyarország 2015, ÚMK Budapest, 2006 p. 256-274

## **ANALYSIS OF HUNGARIAN BIOFUEL SUPPLY CHAIN**

**VIDA ADRIENN - CSABA B. ILLES**

Szent Istvan University, Faculty of Economic and Social Sciences  
Pater K. str. 1. , 2103 Gödöllő, Hungary  
Vida.Adrienn@gtk.szie.hu

### **Abstract – Analysis of Hungarian biofuel supply chain**

In the last century the increased energy demand of the world population is a huge amount and this trend is proceeding through the increased energy need of developing countries. The dramatically price growing of fossil fuels represents the fact that the traditional energy sources can't cover the energy supply of the whole world. Despite the repetitive conflict between food and fuel, use of agrofuels still topical question of nations.

The use of renewable energy sources is not only an obligation but also a source of opportunities. In spite of the fact that many nations implement them to the energy structure successfully and in a high measure, some countries couldn't use them in high quantity however its ecological manner would be optimal.

The subject of this paper is the biofuels which can (partly) substitute the fossil fuels in Hungary. During the last years, our country took some steps to stimulate the market of biofuels. This paper, using PEST analysis, focuses on the macro-economic conditions which can determine the success of biodiesel and try to connect with supply chain analysis. Using this two method it would be defined the source of risk which could affect the return of the invested capital to a biofuel unit.

**Key words:** bioethanol, biodiesel, PEST analysis, supply chain, source of risk

## **INTRODUCTION**

By nowadays method and rate of application of renewable energy sources became a sphere of topics referring both to developed and developing countries. For the development countries they make possible the development of new industrial sector which can contribute to the growth of the gradually slackening GDP while developing countries can increase the rate of their self supply.

As the member of the EU, Hungary has to perform in the future with success in increasingly more fields, closely related to one another which may have fundamental effect on its competitiveness as compared to that of the nations to be found in the region.

Agricultural traditions, knowledge and experience which have accumulated during centuries may constitute an adequate starting basis for such fields as e.g. biomass utilisation, making possible the development of complex (small scale) energy systems. (Lakner et al., 2010)

In spite of the fact that numerous conditions (ecological potentialities, sources of support) are available for Hungary such changes which could significantly influence efficient and from economic point of view successful application of renewed energy sources are lacking till our days because of which fulfilment of the targets set as a member of EU because questionable. The system of market tools indispensable for the success could not only investments promote but also several advantages could be realized on makro economic and social level. (Popp, 2007; Laczkó, 2008)

## **MATERIAL AND METHOD**

The main target of this paper to identify the source of risk through PEST analysis and to connect these factors with the elements of supply chain. Finally, it would be possible to prove them in the course of investment appraisal calculations.

Traditionally there are three current methods (PEST, five competitive force by Porter and SWOT analysis) to analyze the environment of an enterprise, to substantiate business strategy and to create the balance with external environment. A goal-oriented strategy is able to guarantee some competitive advantage in sector (Salamonné, 2000; Porter 2006; Kotler, 2002). In case of (agrarian) renewable energy sources, the role of PEST analysis rather to reduce the disadvantage in front of fossil fuels, to adopt to the traditional energy supply chain and to realize the expected positive effect, as reduction of greenhouse gases, additional revenues for farmers and other points (Popp, 2007).

General target of supply chain analysis is to identify the position of performers while the product gets to the consumer. Measuring the type and the intensity of relation between each performer, estimating the flow of information, it would be appointed the possible barriers of stock flow that could generate the rise of product, it is so called bullwhip effect. (Szegedi-Prezenszki, 2003)

## **RESULTS AND DISCUSSION**

The PEST analysis was selected to search the four most important categories: **P**olitical, **E**conomical, **S**ocial and **T**echnical elements of macro-environment. During the definition of these factors, the target stills to emphasize the possible risk effects to an investment of biofuel plant.

### **Political environment**

Under EU directives, the Governmental decision 2233/2004 (IX.22.) defined the target about the substitution of fossil fuels with biocomponent and its share must achieve the 0,4-0,6 percent – conversioned to energy equivalence - to 2005 and the 2 % to 2010. The Parliamentary decision 63/2005 (VI. 28.) modified the previous and it defined 2 % to 2007 and 4 % to 2010 regarding the same subject. The next Governmental decision 2058/2006 (III.27.) standed up for the whole original EU directive and made a new target: it must fulfil the common obligation without derogation. In the interest of the share of biodiesel achieves the 5,75 % in transport to 2010, it defined numerous arrangements for example:

- inspiration of biofuel through the taxation system,
- making of E85 fuel's national standard,
- starting on technological researches of agrofuels particularly supporting R&D(developing)&I(innovation) of the second generation technologies,
- extending the row material production and processing capacities for biodiesel.

The excise tax law was changed also: if the biocomponent content of fuel blend is minimum 4,4 % per unit volume the measure of excise tax will be lower, otherwise super-tax have to be paid.



1. Petrol:

- 103,5 HUF per litre if the biocomponent content is minimum 4,4 % per volume unit,
- 111,8 HUF per litre if the biocomponent content is less than 4,4 % per volume unit.

2. Diesel oil:

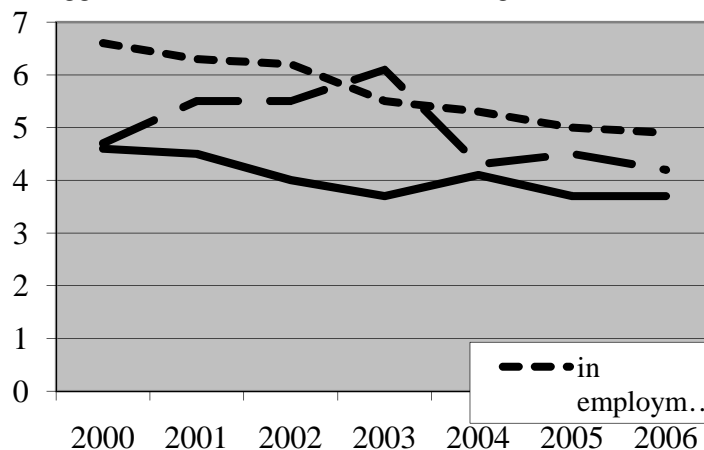
- 85 HUF per litre if the biocomponent content is minimum 4,4 % per volume unit (B5 fuel),
- 88,9 per litre if the biocomponent content is less than 4,4 % per volume unit.

In Hungary for the current mixture obligatory (4,4 % per volume unit) 124.000 tons of biodiesel is needed and to achieve the indicative target of 2010 183.000 tons of biodiesel have to be added to fossil fuel. Because of the blending obligations did not change, presumably the need to biofuels will not increase significantly.

**Economic environment**

In our opinion the line between economical and technical conditions is very thin that is why we considered “economical” effect which represents the agrarian sector, and “technical” which influences the biodiesel production and use.

The Figure 1. shows the most important agrarian indicators from 2000 to 2006. It can be seen that the share of employments shows an increasing trend. The cause of this phenomenon is the significant change which has taken place in the last then years in this sector. The structure of food industry transformed and it was followed by the farmstructure: some farms became bigger and at the same time a shrinkage of arable areas could be seen.



**Figure 1: Agrarian numbers from 2000 to 2006**

Source: Agrarian Statistic Book (2007)

The share of investments also shows a diminutions after an short growth which derives from supports of SAPARD programme. In way of biodiesel this is the most important category because it determines basically the technological and economical efficiency of production of biodiesel’s raw materials and through it the price of biodiesel. The point of view of ecological effects the importance is obvious: the modern appliances permits the decreased use of the chemicals and pesticides and finally realize the sustainable land use.

The trend of GDP also increases but a very important connection should be noted: the agricultural production depends on the demand – in this context: on the demand of food industry – but if we account the outputs of related sectors the amount of GDP can be 12-13 percent. The main thing that the agriculture is the only which can fulfil positive foreign trade balance.

## Social and cultural environment

The most important social problem which could affect indirectly and hard to the investment feasibility is the insufficient communication: the media report about some white lies or not enough professional news and people can't decide which the relevant information is. Often the negative behaviour to the biofuels stems from it.

According to survey of Domán et al (2010; *Table 1.*) the knowledge of biofuels became better from 2006 to 2009. An other important result of their research is the source of information: on the first rank is the television and the next is the internet.

**Table 1. : Citizen's knowledge about biofuels in 2006 and 2009**

		2006	2009
Elementary knowledge (relative prevalence, %)	Biodiesel	61,5	69,5
	Bioethanol	13,2	38,0
Elementary knowledge (percent of mention)	Biodiesel	36,8	35,6
	Bioethanol	5,1	15,5

Source: Own structure by Domán et al, 2010 p. 94-95.

Insufficient governmental communication and consequently insufficient social supporting. The typical example is the use of E5 (the fuel contains 5% bioethanol): people who have suitable car, sometimes don't choose this type of fuels because they don't have enough information about its effect for their car.

## Technical and technological environment

On the one hand the technological conditions means the mount of usable raw materials and one other hand the implacable technologies.

In Hungary the (technology of) production of raw materials for the biodiesel production is eligible but the fluctuation is significant both of rapeseed and corn.

Behind these trends two traps for the biodiesel production can be found. Firstly, the unbalanced raw material production jeopardizes the return of investment capitals through the unstable biodiesel production and indirectly it is impinging to the food security and prices trough the animal husbandry. Secondly on the other view of the same problem: the significant fluctuation denotes the absence of an established (central) plan and these circumstances can't be a stabile found for biodiesel production.

The technological point in Hungary: the first generation technology is available but according the Hungarian Scientifical, Technological and Innovational Strategy (from 2007 to 2013) the research of second generation technologies is one of the national priorities. But in our opinion the firs element of technological success is the reliable material production.

## Supply chain of agrofuels

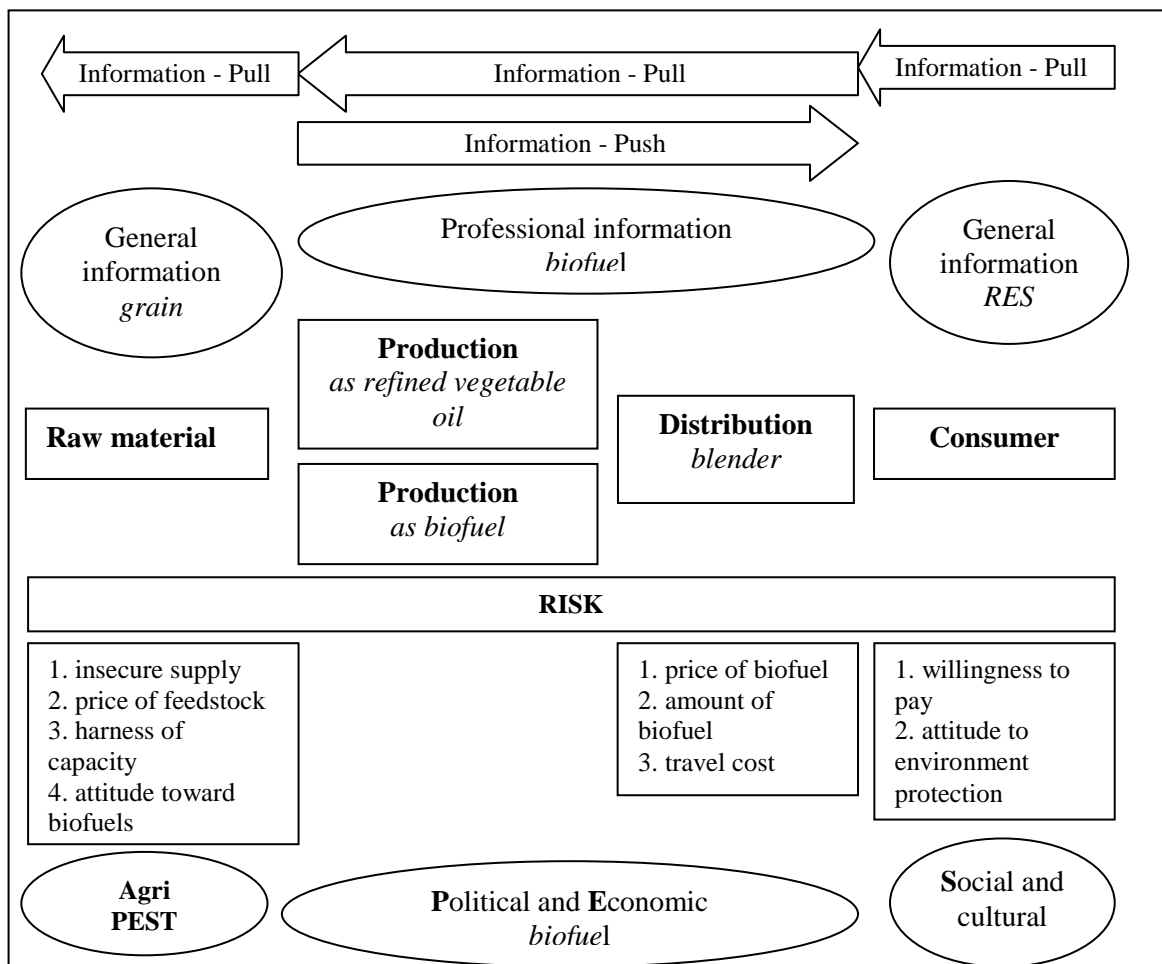
The result of supply chain analysis and PEST analysis is designed by Figure 1. and it is contents also the derived risk that can influence to the return of invested capital in biofuel plant.

During the analysis of biofuel's supply chain it has to concentrate two main topic. Firstly the type of the market – which can be push or pull – defined the rhythm of producing based on the relevance and “quantity” of information.

In face of McComic-Kaberger (2007) and Rentizelas et al. (2009) the Hungarian supply chain is more simply as in developed countries. The production and logistics of feedstock are totally independent from the production of biofuels except contractual rapeseed or corn production. Basically and despite the increase of role of biofuels, the purpose of grain production is feeding for self-sufficient or export. This mentality reflects in the process of biofuel production: in one hand the vegetable oil industry produce refined raw material to biodiesel units to esterase it and in other hand the biofuel is produced in one step. In case of bioethanol, the alcohol industry is the producer.

The next performer of supply chain is the blender, who passes the biofuel to consumer through own infrastructure.

In Hungary the renewable fuel market not typical push market because the main stimulus to the production the governmental/political environment and partly the need of blender. To cover and to perform the commitment, the MOL Ltd. , as the only Hungarian blender, found its own biodiesel unit and that is why the statement above applies only to the independent producers.



**Figure 1. : The relation of supply chain, information flow and PEST analysis**

Source: Own structured by Szegedi-Prezenszki, p. 358

To define the type of market, there is indispensable to analyse the flow of information. In case of push market the way of relevance could be persistent between producer and

contributor but it is hardly limited for consumer who see often only the change of price but according previous result of a survey they do not know the real contain ordinary fuels. An other main problem is the source of information of farmers who can base their decisions preferably on agrarian market not on energy market.

Elemental condition of evaluation of pull market structure is the consumer's strong attitude toward environmental protection, willingness to pay, well knowledgeable and risk-seeking attitude because use of renewable energy sources can ensure independence from supplier (electricity or gas) but it does not able to ensure the same security of supply.

On the one hand the blender has no information about consumers attitudes towards biofuels because the data about consumption does not reflect the potential purpose to get higher biodiesel or bioethanol content. On the other hand there is contrary interest: at the consumer the lower fuel price increases the willingness to pay for green fuels but at the blender higher fuel price induce additionally need for the biocomponent because (assuming average grain produce) it would be more economical than high fossil fuel content.

Absence of long term contraction induces that the stock accumulates at the biofuel producer not at the owner of infrastructure. An other occasion of atypical bullwhip effect is the change of legal/political environment which allows choosing about the share of blended biocomponent or the blender has to pay penalty.

## CONCLUSION

1. In Hungary the food and fuel problem is not topical because of tradition of farmers and food industry. The main problem in view of a biofuel refiner is the harnessing of capacity that is made from the insecurity of raw material supply.
2. The type of information is not fit to the role of each chain's participants and that is why they can't optimize own decision in consideration of indirect effects: the share of blended biocomponent and the amount of biofuel producing is obligatory by the EU.
3. There need sufficient governmental communication which present the national target for every participant of supply chain and what do a part in success of sector. Finally through these complex programs could decrease the informational disharmony and evaluate a hard social supporting which could mean growing demand.
4. These phenomenon can be considered during investment appraisal studies of biofuel production plant as qualitative risk factors, and there can be precisely represented effect that were denoted by only hypothetical percents in sensitivity analysis.
5. The only numerical referred and usable factor is the excise tax and the conformation of the price of crude oil. The producer or the investor can prognosticate the prospective demand (if it independent of blender) using these two economic component of blender's decision and finally the bullwhip effect generate lesser stock aggregation and the risk from produce could be minimize.

## REFERENCES

- AGRARIAN STATISTIC BOOK (2007) Agricultural Economics Research Institute and Hungarian Central Statistical Office, Budapest
- BAI A. (2004) “A bioetanol-előállítás gazdasági kérdései” Agrártudományi Közlemények, 2004 04/14 p. 30-38.
- DOMÁN, SZ. – FODOR, M. – TAMUS A. (2010) “Az alternatív energiaforrások megítélésének változása” Gazdálkodás, 2010/54 1. p. 92-99.
- EKSIÖGLU, S. D. – ACHARYA, A. – LEIGHTLEY, L. E. – ARORA, S. (2009) „Analyzing the design and management of biomass-to-biorefinery supply chain” Computers & Industrial Engineering 2009/57 p. 1342–1352.
- KOTLER, P. (2002) Marketing menedzsment. KJK Kerszöv, Budapest, p. 182-207.
- LACZKÓ, F. (2008) Bioüzemanyagok előállításának lehetőségei Magyarországon. GKI Energiakutató Kft., Budapest, p. 30-41.
- LAKNER, Z. – SZABÓ-BURCSI, D. – MAGÓ, L. (2010) “Some economic aspects of the Hungarian biofuel programs”, Gazdálkodás, 2010/54 24. Special edition, p. 39-58.
- MCCORMIC, K. – KABERGER, T. (2007) “Key barriers for bioenergy in Europe: Economic conditions, know-how and institutional capacity, and supply chain coordination” Biomass and Bioenergy 2007/31 p. 443–452.
- POPP, J. (2007) “A bioüzemanyag-gyártás és agrártermelés nemzetközi összefüggései” AVA Congress, 2007, Debrecen; <http://www.avacongress.net/ava2007/presentations/pl1/4.pdf>
- PORTER, M. E. (2006) Versenysztratégia. Akadémiai Kiadó, Budapest, p. 29-55.
- RENTIZELAS, A. A. – TOLIS, A. J. – TATSIPOULOS, I. P. (2009) „Logistics issues of biomass: The storage problem and the multi-biomass supply chain” Renewable and Sustainable Energy Reviews 13 2009/13 p. 887–894.
- SALAMONNÉ, H. A. (2000) Jövőkép- és stratégiaalkotás. Kossuth Kiadó, Budapest
- SZEGEDI, Z. – PREZENSZKI, J. (2003) Logisztika-menedzsment, Kossuth Kiadó, Budapest, p. 355-399.

## **HUMAN RESOURCE DEVELOPMENT AS A POSSIBILITY FOR DEVELOPING THE MOST UNDERDEVELOPED MICRO-REGIONS OF HUNGARY**

**B. GÁLOSI-KOVÁCS-ZS. M. CSÁSZÁR- N. PAP- P. REMÉNYI-K. KÓMŰVES**

University of Pécs Institute of Geography  
Ifjúság Street 6, 7622 Pécs, Hungary

### **Abstract – Human Resource Development as a Possibility for Developing the Most Underdeveloped Micro-Regions of Hungary**

One of the problems in regional development policy having been present for a long time – and presumably to remain for a long while – is developing the most underdeveloped regions. Unfortunately the difference between the developed and the underdeveloped has increased in Hungary during the last two decades – despite the strengthening regional politics. These regions are usually afflicted with multiple disadvantages, therefore it is not enough to explore and change only one cause leading to underdevelopment. It is of complex origin; the effect of several correlated factor-layers can be observed. It is an elemental thesis in case of local improvements that investing into human resources (to put it in an ordinary way, into people) and improving the conditions of the population (qualification, healthcare, standards of living, etc.) is one of the most efficient and less costly means to eliminate underdevelopment. Despite its cost-efficiency only long-term results can be expected; in many cases it takes generations to benefit from the investment. In this work we will review the conclusions and suggestions of the educational aspects of a complex Hungarian development programme.

Keywords: **flagship programme, development, micro-regions, education, improvement**

### **INTRODUCTION**

*The governmental flagship programme “No one will be left behind”*

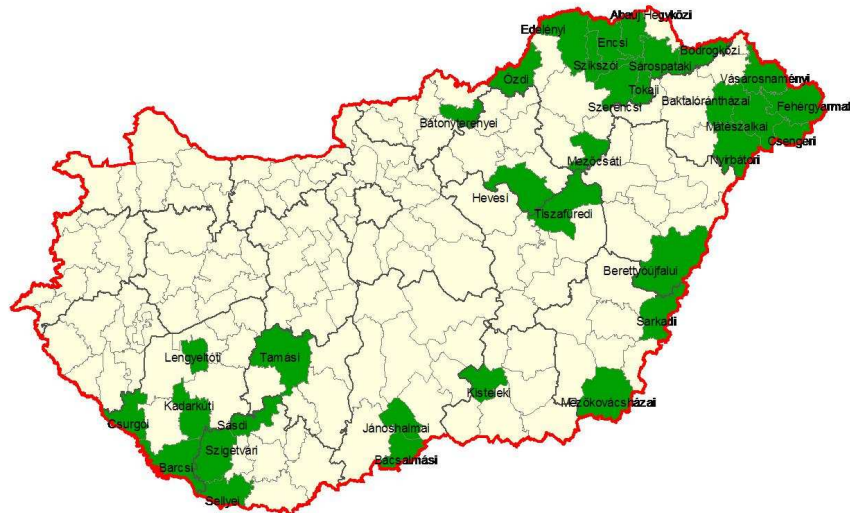
In the summer of 2007 the government selected 33 micro-regions which are the most underdeveloped and in which 10% of the population live, based on the classification according to the survey of the Central Statistical Office and the complex indicator<sup>3</sup> created by the latter. 12 such micro-regions are located in Northern Hungary, 8 in Northern Great Plain, 5 in Southern Great Plain, and 8 in Southern Transdanubia. Regarding the chosen micro-regions the “New Hungary Equalising Developmental Programme” was announced with the motto of “No one will be left behind”.

Due to planning and project generating work, the micro-regions have developed the project package within the centrally prescribed frameworks for the entire sum retained for the 33 micro-regions – respecting the population and the number of settlements. The chosen areas are characterised by a peculiar settlement structure (disintegrated, lacking towns), a generally high rate of unemployment, a low capability for the absorption of resources, deficient lineal and human infrastructure, and a high proportion of the Roma population. The choice for financing may have been influenced by political aspects as well.

---

<sup>3</sup> Statistical data used: income tax, rate of permanent employment-seekers, activity rate, number of functioning enterprises, number of school classrooms, number of completed school grades, number of persons with a secondary school leaving exam, number of recipients of social benefits, number of GP visits, rate of population per the number of General Practitioners, mortality rate, basic access, drinking water supply rate, sewage rate, waste collection rate.

The aim of the programming is on the one hand the initiation of sustainable development processes that, according to the expectations, may slow down or stop dropping off and may enhance standards of living, environment and services, thus the general welfare of the population, and therefore it may strengthen the capability of settlements to retain their population. Thus the programme is aimed at targeted human resource improvement, regional economic development, environmental and infrastructure development in the micro-regions.



**Figure 1 The most disadvantaged micro-regions in Hungary (MD)**

Source: [www.nfu.hu](http://www.nfu.hu)

The basic principles of the flagship programme for subsidy were the following:

- resource-based development (advantage in accessing resources)
- only plans developed together with local participants can be successful
- it is not enough to develop infrastructure, it must be “filled up” with meaning
- no investments only for the sake of prestige!
- social integration of the Roma
- planning in accordance with local needs

These principles were realised in a rather contradictory way:

- resource-based development – resources were collected on the basis of the residual principle,
- only plans developed together with local participants can be successful – partnership is exclusively formal, marketing-viewed, actual local co-operation was not needed, indicators were only quantitative,
- it is not enough to develop infrastructure, it must be “filled up” with meaning – locals were not able to cope with this otherwise advised principle, they did not need it, they attempted to satisfy it to a minimal degree, without any enthusiasm,
- no investments only for the sake of prestige! – the meaning of these

- “prestige-investments” was not defined,
- social integration of the Roma – the leaders of the Roma community participated in the programme only to a very small degree,
  - planning in accordance with local needs – but there was not enough time nor any way to survey local needs, and the NFU (National Development Agency) has specified the directions of development.

### *Criticism of the programme*

Those who dreamed up and realised the programme ignored several questions that could have an essential influence on the realisation and success of the programmes. The first of these questions is the geographical character of the area, that is, the fact that typically borderside regions are in question, the problems of which are strongly connected to the questions of an isolated vicinity. The other one is that the leaders of the programme at the national level did not comprehend the peculiar culture of the developmental target areas. This situation cannot be interpreted merely by quantitative, extrinsic indicators. The development method adapted from Western Europe (resource-based planning) had been developed for social conditions with a high level of qualification, a well-developed, characteristically middle-class society. However, the society of MD regions is not characterised by this. So even the most essential problems cannot be faced with the help of this method.

## **SPATIAL STRUCTURAL ASPECT**

15 out of 33 MD micro-regions are directly on the border of the state, and only 6 are located in a distance more than 50 kms away from the borders. Thus, more than 80% of the area involved in the programme is in a liminary position. Therefore it would be a mistake to plan development ignoring international dimensions that span over the borders at the arrangement. Consequently, the main aspects to be assessed are the following:

- assessment of former and recent vicinity relations
- the question of depopulation
- conditions of traffic and transport
- relying on a strong relationship system extending over the borders

Based on the above typology, the following can be stated about MD regions: small-village, plain-type,

- typically rural,
- located on the inner and outer peripheries,
- characterised by centres with a low capacity of attraction,
- do not possess even the minimum resources for getting through,
- regional development target areas,
- which have a distinct ethnical character in several cases.



## **THE OUTCOME OF OUR RESEARCH**

We have conducted research regarding the improvement of the developmental work of the 8 Transdanubian MD micro-region in order to summarise the experience of the development programme. These were characteristically empirical observations.

- Summarising the experience of planners (based on the opinions of cca.20 planners)
- Conducting a survey by questioning local partners (250-300 persons/50 respondents)
- Evaluation of the nature of the projects that had been accepted

We examined in the following sections:

- Method of planning
- Communication
- Principle of equal opportunities
- Has co-operation been achieved?
- Relationship with micro-regional centres – the question of village-town relationship
- Innovations
- Chances for recovery
- Evaluation of emerging programmes

Chart 2 sums up the most important results of the survey.

**Chart 2 Classification of problems in the order of the need of modification concerning the region**

	<i>Problem</i>	<i>Value</i>
1.	Unemployment	363
2.	Lack of employers, new employment, enterprises with a strong balance sheet, industrial firms and industrial areas	252
3.	Underdeveloped, deficient infrastructure	194
4.	Unfavourable traffic options (deficient access, high rate of dead-end settlements, low level of public transport)	169
5.	Low level of qualification, high rate of unqualified work force	165
6.	Low, decreasing number of enterprises/will to venture, lack of capital, lack of investors, entrepreneurs lacking capital, weak enterprises	131
7.	Deep poverty, low income level, dropped-off classes and settlements	121
8.	Unfavourable demographic conditions (ageing, migration)	117
9.	Unfavourable educational conditions – lack of infrastructure and vocational training, decreasing standards of training	96
10.	Deepening moral crisis, social disintegration	71
11.	Social and ethnic problems, segregatums	60
12.	Low standards of healthcare and social services	44
13.	Settlement-geographical characteristics (locality, peripheral location, small-village structure)	43
14.	Lack of financial subsidizing, deficient financial condition of local governments	40
15.	Lack of touristic developments, weak tourism	33
16.	Difficulties in sales, low engross price for agricultural products, extremely low profitability of economic activities	32
17.	Problems in management and decision making (lack of information for local management, weak capability for enforcement of interests, self-interest of lobbying forces, lack of will of government)	28
18.	Lack of quality public services, cultural , educational and sports facilities and public scenes	28
19.	Low level of co-operation	27
20.	Lacking conceptions for enhancing economy	22
21.	Lack of equal opportunities	12
22.	Lack of a young, creative intelligentsia, and experts able to manage programmes; lack of forcefulness in the civic sphere, low participation rate in public affairs	11
23.	Politics (political disintegration, lack of differentiated policies)	10
24.	Draining effect of cities with a municipal/county authority strongly felt	6

Editors: B. Gálosi-Kovács. – N. Pap

In our opinion, local persons have an appropriate impression of their own conditions and problems. It is interesting that in spite of the fact that they perceive the phenomena of the social and moral crisis, and that its predominance is unquestionable, these phenomena can be found in a cluster in answers 7-12., following the economic difficulties. This fact indicates that the weight of local problems has not been recognised at its whole extent.

Finally we evaluated the projects which had been accepted for support. Despite the fact that borderside location is a general feature of MD regions; their problems were in a decisive relation with the cutting-off of the relationship system across the borders, there is only one out of the hundreds of accepted projects which deals with this problem utterly (KURILLA. – OROSZ – PAP, 2009). Human programmes potentially contributing to social integration had come out rather weak. Almost none of the innovative programmes able to compensate for social disintegration had been accepted (e.g. the *Micro-regional Universitas* programme developed exclusively for this purpose).

### **THE TASKS OF EDUCATION IN DEVELOPMENT**

By the experience of micro-regional planning, most problems occur in connection with unemployment and the related underqualification, and – inclusively – with the underlying drop-out from education. Micro-regional leaders consider lack of human resources, the lack of a layer with secondary and higher education that would be able to control changes as innovative agents, as an important factor of underdevelopment. The questions of low standards of education, the poor quality of public education and insufficient infrastructure arise as well.

Experience in planning show that, a massive layer of marginalised people have evolved, being on the periphery of society with low qualifications, permanently out of the workforce market, living in poverty as a result of the social-economic changes relating to the change of regime. These living conditions have a seriously negative impact on the childhood socialisation of the new generations and lead to disadvantages that are very difficult to reduce later. Educators are forced to face serious difficulties and special pedagogical problems, when they have not received sufficient professional and methodological implements and approaches during their training, and schools are not provided with even the most elementary conditions of efficient educational work in many cases. These problems have been emphasised in all micro-regions. The above problems at micro-regional level are manifested by a high rate of drop-outs and ethnic segregation.

#### **Reducing drop-out in elementary and secondary education, proposals for promoting talent management and training for educators with a special professional attainment**

- **Educational work needs modifications in content** so that individual institutes could be able to educate disadvantaged pupils and students more efficiently. It can be encouraged by the central government in the framework of **normative additional subsidy** and tendering system by its claims made on local programmes and by further means of support, and some curbs can be built in the system as well. The applicability of financing methods varies by the levels of education. In our opinion, financing the owner of the school is a viable way primarily for primary schools and pre-school education; secondary and higher

education answers to be encouraged by **individual support**. However, in case of primary and pre-school education, the problems of education disadvantaged pupils are varied, therefore the same form of assistance not necessarily will be successful in both cases.

- A **special financing source** should be allocated in case of schools involving **remediation programmes** in their programmes and curricula, which could ensure the procurement of equipment. Educators attending such training should gain benefits (number of lessons, income). For the realisation of remediation programmes classes should be divided into smaller groups (not optionally; it should be compulsory).
- Providing schools with **school counsellors/psychologists** with appropriate expertise.
- Employing **professional social workers**.
- The key for educating disadvantaged pupils is **advanced educator training**. It should be achieved for every educator to attend compulsory advanced training courses. There are two solutions possible: it may be incorporated in the existing compulsory 7-year-period training system, by **making the choice of at least one pedagogy/methodology course mandatory**. A solution should be included in teachers' responsibilities as a new advanced training course. The expenses of the training would be ensured by the government.
- Consequently, it would be advisable to bind the range of training courses on offer to a stricter accreditation procedure.
- For schools to be able to apply new pedagogical methods different from the recent practice, central government should support the **development and promotion of developmental pedagogy methods** in specialised institutes.
- It would be reasonable to follow up the application of the knowledge gained at advanced training courses in practice more efficiently. This process needs reconsidering and re-establishing the present quality control system affecting the whole of the education system that can be regarded as unsuccessful.
- There are several ways to **interest educators** via financial motivation. This procedure requires an objective means of measurement or observing the evaluation provided by the school-inspection system mentioned above. Criteria should include reducing the number of drop-out students.
- The other way: **rewarding** teachers in the form of extra stipend or by lesson allowances.
- The above can be joined by a **mentoring teacher** system where the task is following up on individual lives, assisting students and talent management, and the teachers' work can be remunerated depending on the outcome
- Another method can be suggested to increase educator interest: to **support self-organisation** of schools compensating for drop-outs and disadvantages after the followers of **inclusive pedagogy**, observing self-developing school models.
- Additional, capitation-style subsidies paid for local governments can mean only a weak motivation.
- The topic of learning organisation procedures is connected to the **renewal of teacher training**. A motivation system for professionally and pedagogically provided students should be introduced.
- The conditions of drop-out students can be improved not only by educators and school life and the transformation of institutional culture. This question can be

approached by the topics of students and educational scheduling. Foreign experience is provided for the solution as well: it is made possible for **drop-outs to visit school with a flexible schedule**, on days and at times which are suitable for them.

- **Education in a module system**, extending the duration of learning can also mean a solution; flexible adaptation to individual needs and demands can provide motivation not only in case of those exposed to failure.
- **Individual support, grants** offer a suitable solution for the **further education** of students in disadvantage. Financing system must provide an opportunity for individual further education, the government should increase the inclination for further education.
- Another solution for improving the conditions of students in a disadvantaged situation is the **improvement of a boarding-school system**, where each student would have an individual adult mentor to help him/her adapt, to share problems with, to give useful advice. Social workers also can be employed.
- Reforms and regulations aimed at reducing learning failures of students with multiple disadvantages include an already existing **pre-school programme, especially in micro-regions populated by a high proportion of the Roma**.
- An opportunity for **flexible, prolonged start, day-long schools** should be introduced at the primary level.

### RECOMMENDATIONS

1. The utilisation of targeted resources is a simple and welcome method.
2. The perspective of an economic rise is illusory; nearly all conditions are lacking – in case of MD micro-regions the aim can be ensuring liveability.
3. Each micro-region should thread an own path at its peculiar rate.

*“You can’t fix in 1-4 years what have gone wrong in 200 years”*

4. Local societies recognised only partly that their integrity has been damaged seriously; they are disintegrated, so-called “wrecked societies”.
5. The philosophy of development should be placed on a moral basis, on completely different social and individual motivation.

### REFERENCES

- G. FEKETE, É.–BODOLAI, É. (1995): Kistérségi szerveződések megjelenése a területfejlesztésben. MTA RKK Észak-magyarországi Osztálya, Miskolc.
- HAJDÚ, Z. (2001): Magyarország közigazgatási földrajza. Dialóg Campus, Pécs-Budapest, 334 p.
- GÁLOSI-KOVÁCS, B. – PAP, N.–REMÉNYI, P. (2009): Kistérségi tervezési tapasztalatok – Dél-Dunántúl
- KURILLA, A.–OROSZ, É.–PAP, N. (2009): Háttal a határnak. Nemzetközi konferencia, Debrecen
- NEMES NAGY, J. (1997): Régió, regionalizmus. – *Educatio*, Vol. VI./3., p. 409.

- M. CSÁSZÁR. ZS. (2006): Alapfokú oktatás – In. LÁSZLÓ M. (ed.): Közszolgáltatások c. egyetemi jegyzet.
- LÁSZLÓ M.–PAP N. (ed. 2007): A közszolgáltatások szervezésének alternatívái. Lomart Kiadó, Pécs, pp.69- 88
- M. CSÁSZÁR. ZS. (2006) Középfokú oktatás – In: LÁSZLÓ M. (ed.): Közszolgáltatások c. egyetemi jegyzet LÁSZLÓ M.–PAP N. (szerk. 2007): A közszolgáltatások szervezésének alternatívái. Lomart Kiadó, Pécs, pp. 89–102.
- PAP, N. (2003): Geographic Aspects of Regional Development Policy. – Development and Finance, 3. issue. pp. 81–87.
- PAP, N. (2004): A kistérségek helye, szerepe Magyarországon a 21. század első évtizedében. – Tér és Társadalom Vol. XVIII./2. pp. 23–36.

**LOCAL ANSWERS FOR LABOR MARKET DISPROPORTIONS- AN  
OVERVIEW OF AN ORGANIZATION DEVELOPMENT PROJECT BY AN  
AGRICULTURAL REGIONAL INTEGRATED VOCATIONAL TRAINING  
CENTRE**

**DÚL NÁNDOR**

Szent István University, Faculty of Economics and Social Sciences,  
TATA Center of Excellence and IT Institute,  
H-2100 Gödöllő, Tessedik S. u. 6., Hungary  
dulnandor@gmail.com

**ABSTRACT – Local answers for labor market disproportions- an overview of an organization development project by an agricultural regional integrated vocational training centre**

The Eastern Hungarian agricultural regional integrated vocational training centre's currently running organization and human resource development project - sponsored by the European Union – provides new methods and lateral thinking in the institute group's former management practice, in many respects. Both the project based operation and the working in developer workgroups aims at the creation and maintenance of the a more efficient and flexible organization, the project's implementation itself is –from the aspect of management theory – is a change management activity. The final success of the project is essentially depending on the enthusiasm and attitude of the numerous participants; therefore it was expedient to analyze the project staff's qualitative composition through an objective method. The survey allows of the creation of information about the necessary incentives, the examination of success of the initial selection, or rather the viability of a new configuration supplemented with the project organization and the team based working in the scope of public education institutes.

**Keywords:** empowerment, change, agricultural training, organization development, TISZK.

**INTRODUCTION**

After a law change in 2007, the Ministry of Agriculture and Rural Development – towards the continuous development and dissemination of more efficient didactics – needed to alter its supervised vocational training institutes' organizational and operational system. The claim of getting to development resources and funds, the retaining and expansion of their role in education market had necessitated the creation of three regionally defined, so-called integrated vocational training centres (their Hungarian acronym is “TISZK”), allowing of harmonized planning, operation and leadership. In case one of them, the Eastern Hungarian agricultural regional integrated vocational training centre - with its six member vocational training institutes – the financial fund for integration is currently a Social Renewal Operational Programme 2.2.3-09/1 construction based project which is essentially a complex development, that modifies the earlier operation of the whole institution group, at the same time it efficiently serves the spread of new teaching and learning techniques, through the next, for execution predetermined elements: developing common knowledge-, human resource management- and control system; preparation for modular education and training, in line with the economic needs and new training structure; developing community services; marketing innovations; involving socially and economically disadvantaged groups in vocational training; competency based education, project based education, e-learning; developing career tracking system; establishing real, close contacts with local employers and employment services, offices.

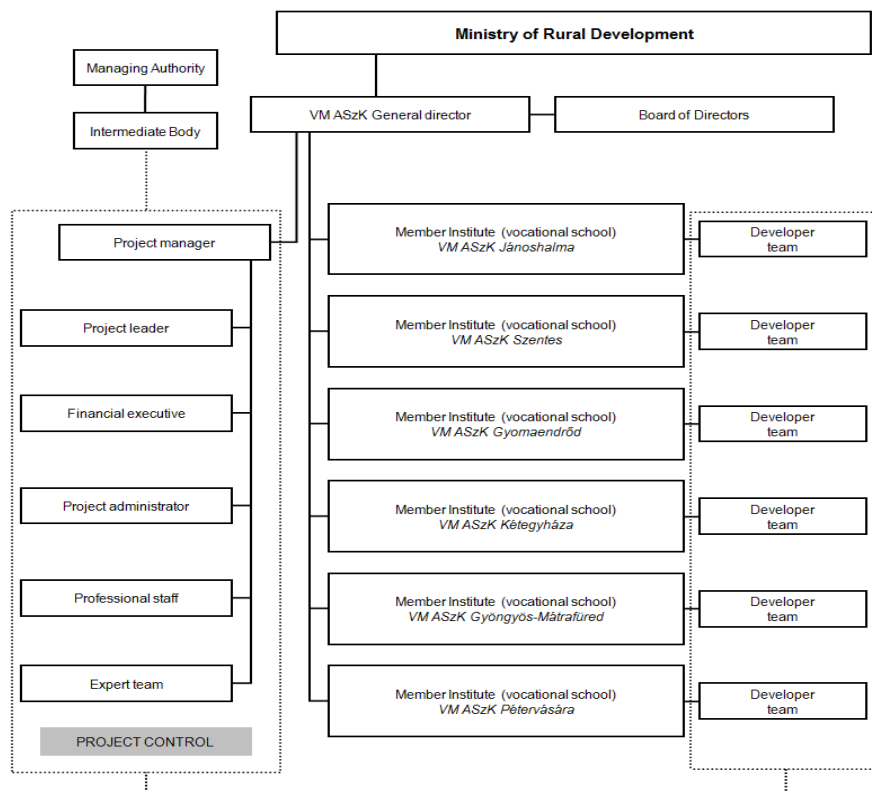
**The background of the development: project-based operation and empowerment**

The instruments of *structural coordination* introduced before and in the course of the inception of the project, are such additional, supportive solutions that ensure the satiation of the increasing coordinative needs. The actuation of these instruments among others provides the following benefits (Dobák, 2008):

- facilitation the handling poorly structured and multifactored problems, and the improvement of quality of decisions;
- boosting the information processes within the organization (i.a. the horizontal information flow), and enhancing internal communication skills;
- the participation in decision supporting and decision making - generally the common thinking - can promote the employees’ satisfaction and their identification with organizational purposes.

The next figure (Fig. 1.) demonstrates the organizational configuration of the Eastern Hungarian agricultural regional integrated vocational training centre in case of the integration and installation of project body, illustrating that after the formation of the integrated institution, the project teams – at least theoretically – can decisively support the horizontal coordination and in general terms the information flow and knowledge sharing.

**Figure 1: Organizational configuration of the Eastern Hungarian agricultural regional integrated vocational training centre**



Source: own construction

At the same time the project carries an additional phenomenon. The projects’ developer teams are working in the framework of *empowerment*. “Empowered organizations give their employees more independence, decision making authority and responsibility than their traditional counterparts. These organizations rely on self-directed work teams,



*empowered – within certain limits – to make decisions that managers reserve for themselves in traditional organizations”* (Lövey et al., 2007) The empowerment is not unprecedented in management science. Its predecessors are the human relations management, the management by participation, the team based working and the autonomous workgroups. Both are intrinsically reflecting similar approach to empowerment.

## MATERIAL AND METHOD

The development tasks in the organization development project are predominantly executed by an internal staff of about 60 persons. For analyzing the selection's efficiency, and the sustainability of the new organization's structure, we made two surveys among the employees, at first right after the project start, then after 12 months of the 24 month term project. In order to follow up the occurrent changes, we used the same query each time, which contained questions about the project's organizational development background and the participants' motivations. In course of the cluster analysis – suitable for the measurement of adequacy and attitudes – the objective was to categorize the contributors in such distinct groups, that are nearly homogenous by the component features, in order to plan the customized interventions and actions for each created (or rather theoretically de facto existent) groups. The starting point for the non-hierarchical, K-means cluster analysis was, that – in virtue of the partial, preliminary recognition of members, and by the exploratory statistics – the suppositions about the project can be aggregated in the next three groups: *first group*: absolutely coincident, absolutely motivated approach about project aims; *second group*: moderately coincident, middling motivated approach; *third group*: dismissive approach, the antipodes. The aim of cluster-analysis was to disclose that is it possible to reasonably create this three group by the available data. Before the analysis we assumed that the headcounts of the individual clusters can be notably different, since – in a favorable case – the third cluster contains much less member; yet it presents fully distinct suppositions than the first and second clusters. Thus a small, but deviant group can also be created. The cluster analysis was executed through two question groups. The utilization of first question group was intended to create clusters by the opinions of the kind and quality of deputed tasks for the staff, together with the availability of necessary information, using the following questions:

- How true is that you work after tangible and clear objectives? (variable: vilagoscelokmenten9)
- How true is that you get properly customized tasks, in appropriate volume in the course of team work? (variable: megfmunka11)
- Do you think that working in developer groups is a diverse activity? (variable: valtozatosmunk12)

The second question group aims at the creation of clusters through the team members' attitude about project tasks, as well as their loyalty about leaders and the organization. The component questions are the following:

- In your opinion: how does the pedagogic coordinator had supported your group's work in the recent period? (variable: tamogataspedagog3)
- In your opinion: how enthusiastic is your workgroup leader about the supporting of your workgroup? (variable: elhiv\_vezetoje6)

- Based on your own rating: how enthusiastic are you about the supporting of your workgroup? (variable: sajátelhivatottsag10)
- Do you think that the work of developer groups is useful? Please choose from the specified aspects. (variables: mierthasznos13nemhasznos/mierthasznos13fejlodesem/ mierthasznos13intezmeny)

## RESULTS

### Clustering through the kind and quality of tasks and the availability of necessary information about the project tasks

The next table (Tab. 1.) contains the final cluster centers issued after the iteration process.

**Table 1: Comparison of final cluster centers of first and second survey**

Variable	Final Cluster Centers, first survey			Final Cluster Centers, second survey		
	Cluster			Cluster		
	1	2	3	1	2	3
vilagoscelokmenten9	5	4	3	5	5	3
megfmunka11	2	5	4	4	5	3
valtozatosmunk12	1	1	3	3	1	3

Source: own calculation

According to the table the three clusters are raising two problems to solve. Namely, the members of first cluster are working after clear objectives, but in the course of division of work they cannot get appropriate, personalized tasks, though they think that working in developer teams would be diversified activity. At the same time the lack of information about the project tasks and objectives came up in the third cluster (value “3” of vilagoscelokmenten9 variable), but more serious problem is that the members considered the workgroups tasks to be rarely diversified. The significance of these recognitions is that these are appointing the orientation of future management actions. The following table (Tab. 2.) contains the number of employees in each group, as well as it allows of drawing conclusions about the qualitative composition of the body. Namely, according to the opinions of the largest Cluster 2, the participants – in most of the cases – are working after definite aims, with the appropriate distribution and diversified tasks. The most problematic cluster (No. 3.) contains only four persons.

**Table 2: Comparison of Number of Cases in each Cluster by first and second survey**

	Number of Cases in each Cluster	
	First survey	Second survey
Cluster 1	4,000	14,000
Cluster 2	32,000	30,000
Cluster 3	12,000	2,000
Valid	48,000	46,000
Missing	1,000	2,000

Source: own calculation

In January 2011, the measurement was repeated, using the same query, principally for the tracking of changes, and checking the effects of corrective interventions. The initial conditions at the second measurement were identical; it was still presumed that the creation of 3 groups was actually reasonable after the first survey’s outcomes. In virtue of the second analysis, some significant changes had predominated, both in point of each group’s headcounts, and qualitative parameters. The patterns are the following: the original first cluster (at the initial measuring) stood for the middle course. By the second survey, the headcount of the group had notably decreased (-10 persons), in general showing a higher standard and – likely –several employees from the original Cluster 3 had migrated here. This fact – beyond that its members find the work rarely diversified – means an important headway.

**Clustering through the attitude about project tasks and loyalty**

The main intention of clustering by the second question group was the possible filtration of deviant elements. Three main approaches are standing out from the table of final cluster centers (Tab. 3.). The first cluster contains the “middle-of-the-roader” employees, who rated their enthusiasm with a “4” value and in general they tended to give this “good” value on the 1-to-5 rating Likert scale, also in case of other questions. This group finds the project useful from the angle of the institute’s future. Second cluster is the group of fully loyal participants, the “elite”, who presented the ideal answers to all of the questions, and find the project useful from both the aspects of the organization and the members’ personal development. These members are appreciating their superiors and the so-called pedagogic coordinator, also.

**Table 3: Comparison of final cluster centers of first and second survey**

Variable	Final Cluster Centers, first survey			Final Cluster Centers, second survey		
	Cluster			Cluster		
	1	2	3	1	2	3
sajatelhivatottsag10	4	5	3	4	5	2
mierthasznos13nemhasznos	0	0	1	0	0	1
elonyosnektartja14	1	1	5	1	1	4
elhiv_vezetoje6	4	5	3	4	5	4
tamogataspedagog3	4	5	3	3	5	3
mierthasznos13fejlodesem	0	1	0	0	0	0
mierthasznos13intezmeny	1	1	0	1	1	0

Source: own calculation

The two, on the whole positive employee groups’ total headcount was 45 at the first survey, which number exceeded the previous expectations, thus it can be declared, that the realization of the project was based on an exceptionally apprehensive body. Of course, the analysis provided the desirable advantage: it disclosed that three-element group, of which members were typical deviants. They did not set store by the project, they were disharmonious with the project’s purposes, in addition they were liable to underestimate their superior performance. In their case, the aim was the prompt identification, the exploration of their intentions, the motivation or in the last resort, the elimination.

**Table 4: Comparison of Number of Cases in each Cluster by first and second survey**

Number of Cases in each Cluster		
	First survey	Second survey
Cluster 1	14,000	11,000
Cluster 2	31,000	33,000
Cluster 3	3,000	1,000
Valid	48,000	45,000
Missing	1,000	3,000

Source: own calculation

By tables 3. and 4. it is apparent, that in the course of the second, repeated measurement, both in qualitative aspects and the headcounts of clusters, a small-scale positive change has occurred. By the two analyses, the qualitative contents of clusters are almost the same. The third cluster still contains one deviant member, though the components of the cluster are presenting a higher standard.

### CONCLUSIONS

The proclaimed long-term aim at the establishing of the new, regional integrated vocational training centre was the creation of an institution, which is fully flexible from the viewpoint of training demand determined by labor market. The related expectations are the professionally and economically sustainable operation and the contribution to the enhancement of the higher local employment rates. As the part and instrument of these aims the SROP project started early in the year of 2010 serves as an excellent starting point, especially through its subservient innovations. Besides the integration, several coordinative elements had been introduced. The project itself, the team-based working and regular meetings and conferences of Board of directors as *structural elements* had temporarily modified or had not modified the primary work distribution and scopes of authorities. After the formal development of the integrated vocational centre, at the beginning of the project and by the first survey demonstrated in this paper, several activities have happened. As a synthesis, it can be stated, that since the initial measurement, significant, positive improvement and redistribution has occurred in the employee structure. The greatest advance can be observed in the mitigation of the lack of information, across the so-called *technocratic coordination* and its instruments, the so formalized regulations that shape the course of activities of certain subfield of the organization in a uniform way: the regulations and methods, the plans, programs, procedures, the budgets, financial plans and internal settlement prices, etc.

Also, the on-line project management and teamwork software belongs to this scope, in which the staff is able to work in a virtually, well organized platform. Additionally, the planning tools such as the work schedules for different time intervals with fixed responsibilities and competencies were also useful. The *person oriented coordination* tools applied in the project are foremost serving the individuals identification with the new organization created by the integration of six, previously separate vocational schools, each with great traditions. The accentuation of the strong organizational values, the raising of organizational culture, the development of management's attitudes and the development and implementation of internal training methods constituted the related main aspects. The necessary coordinative tools are the following: conflict management

related to the new organizational configuration; the selection and nomination of leaders; training and development of human competencies, with special regard to the leaders of self-directed workgroups; team building trainings. On the ground of the instruments, provisions and the supportive analysis presented in this paper it seems that the success of the complex and novel project is assured. The attribute, that the integrated, new institution is a part of a broader educational, economical and social system; raising the project purposes to a higher dimension. Hopefully, by means of the that the training centre along with the agricultural vocational training will take their rightful place in the region, with this giving the answer to the current problems of labor market.

#### **REFERENCES**

- DOBÁK, M. (2008): Szervezeti formák és vezetés. Akadémiai Kiadó. Budapest (pp. 50-55.)
- LÖVEY, I. – NADKARNI, M.S.- ERDÉLYI, E. (2007): How healthy is your organization?- the leader's guide to curing corporate diseases and promoting joyful cultures. Greenwood Publishing Group (pp. 114-117.)

## **SELECTIVE MARKETING FOR SUSTAINABLE TOURISM BASED ON ENVIRONMENTALLY UNSPOILT AREAS TOURIST DEMAND CONSIDERING THE ECOLOGICAL FOOTPRINT**

**FETAHU, ELVIRA AND BEJTJA, ILIR**

University “Aleksander Xhuvani” of Elbasan, Economic Faculty  
Department of Marketing, Group Subjects of Marketing on Travel and Tourism  
3000 Elbasan, Albania  
[elvira fetahu@yahoo.com](mailto:elvira fetahu@yahoo.com)

### **ABSTRACT - Selective Marketing for sustainable tourism based on environmentally unspoilt areas tourist demand, considering the ecological footprint**

Taking an eye on the recent developments of the demand for tourist products, we notice some very important changes in the tourists' preferences of consumption toward a different sense of quality, asking for new quality models based on virginity, pure nature, highly maintained clean spaces, authenticity, cultural heritage and high responsibility and consciousness on sustainability. The natural environment represents the main resource to this demand on many tourism destinations. This is related to the fact that tourists increasingly are interested in consuming their holidays in unspoiled natural territories.

To this end, destination managers recently are under increased pressure to improve their eco-quality, maximize the hygiene, as well as to implement ecologically sustainable practices and systems.

Based and stimulated by this evidence, a process of selective targeting/segmentation of tourist market could be an approach to sustainable destination management, both generally in the international market, but very promising to the Albanian case of the tourist sector future development, focusing at the region of Elbasan. Considering and analyzing also the ecological footprint of Albania, and especially that of the region of Elbasan, this study will try to test these possibilities. In order to observe the feasibility of this approach, the study will be focused on tourists, between Albanians and foreign visitors, regarding their main reasons of returning in the same destinations. The questions to be treated will be mainly focused on the quality of the tourist services, the environmentally friendly behavior, as well as psychographic, behavioral and socio-demographic personal characteristics of the tourists. Focusing and deepening in sustainable tourism destinations' management could foster the increase in the number of day-vacations during one year, strongly influencing also in the normal development of the supporting industries. This asks for techniques which focus on eco-tourism and sustainability at the destinations, even why the tourist himself generally may not necessarily be interested in protecting and caring to the local environment.

**Keywords:** Sustainability, Ecological Footprint, Tourism.

## **INTRODUCTION**

According to the World Travel and Tourism Council (2011), world tourism contribution to the gross domestic product (GDP) is about \$ 6 trillion generating more than 258 million jobs and \$652 trillion of capital investment. These figures show a lot about the significance and the ability of tourism industry to contribute in the change of the worlds' and regional economy.

However, this enormous contribution and unplanned growth of tourism has its own impact to the recent changes of the world environment which is directly affected by the policies of tourism businesses and tourist managers. These undesirable effects toward environment and the tourism destinations have increased the concern of people involved

in it about preservation of the natural resources and long term preservation of tourism destinations.

The World Commission on Environment and Development (WCED) issued the first report on sustainability which defined the sustainable development as development that “meets the needs of the present without compromising the ability of future generations to meet their own needs”. (Choi, Sirakaya, 2005, p.1275). After this report the concept of sustainability was internationalized and universally asked to be applied in all levels of tourism business. But, experience has showed that it has not been fully adapted in local levels and that many countries have not clearly implemented policies to support and monitor it.

A special focus is placed upon the sustainable development for the community tourism which according to Choi and Sirakya (2005) is evaluated to be a long- term economic linkage between destination communities and industries and of great importance in improving the lives of the residents and minimizing the negative effects of tourism on the natural environment. It is of crucial importance in this point, the role of the community managers whose responsibility is to provide information and organize programs for the community stakeholders to raise the awareness on the importance of conservation of the community tourism resources. The last ones should be very actively involved and participate directly in the decision making process.

According to the literature and recent debates the sustainable tourism involves different dimensions such as ecological, economic, social political technological at the international, national regional and local community levels. It is obvious that these dimensions are interdependent and each of them has its own role to the tourism development.

“Tourism is now so pervasive in modern society that, rather than conceiving tourism as a “departure” from the routines and practices of everyday life, tourism has become an established part of everyday life culture and consumption” ( McCabe, 2002:63). Following the above logic it is evident that tourism is a integral part of the modern life of our society. Moreover consumer patterns and consumer decision making is very important and has been subject of changes recently. It has been affected considerably from the environment footprint of the tourists themselves too, when we find a very important trade-off regarding their preference for unspoilt preserved ecologically areas and destination and its high preference for entertainment and fun at the destination increasing its footprint to these destinations.

Ecological footprint analysis (EF) is evaluated to be a key environmental and effective aggregate indicator of sustainable tourism (ST) that uses gha as the common currency to express impact magnitude across all its components (Hunter and Shaw, 2007, p.46).

First provided in the early to the mid-1990s the EF analysis were first defined from their authors as “an accounting tool that enables us to estimate the resource consumption and waste assimilation requirements of a defined human population or economy in terms of a corresponding productive land area” (Hunter and Shaw, 2007, p.46).

The main attribute of ecological footprint is to provide a powerful educational tool by expressing the demand of natural resources in terms of an equivalent land/sea area by facilitating comprehension of environmental impact. According to Hunter and Shaw, following this logic, it is obvious that EF conceptualizes a population or economy as having “industrial metabolism” which consumes resources and produces wastes in order to sustain itself by appropriating in this way a portion of the planetary biosphere.

The applications of ecological footprint in tourism are analyzed in the context of environmental impacts on tourist travel mainly and demand upon natural resources to

destination areas recently, by attempting to calculate the so called according to Hunter (2002), tourism – related EF.

By methodology the net tourism EF is the sum of the components in the transit and destination area less the source country EF for the period away from home generated by the tourist when away from home by leaving on some heating or security lighting<sup>4</sup>.

The discussion naturally is not limited only to the ecological footprint, even to the total of sustainable tourist indicators, local and global. Here after we shall see an analysis on some factors considered for the pro environmental behavior of the tourists related to their past experiences at the destinations.

## **MATERIAL AND METHOD**

As a beginning we defined a list of factors possibly affecting the tourist demand and the product design for sustainability and environment preservation and care as follow:

- Luxury request of the tourist
- Sports preference during the vacation
- Leisure measured through preferences for fun and entertainment
- Good company at the destination
- The intense experience with the nature at the destination
- The familiar atmosphere at the destination
- Customers altruist attitude toward environment
- Romantic and nostalgic atmosphere at the destination
- Population density at the destination in top season periods
- Relax space at the destination hotel structure
- Transport pollution (Ecologic footprint)
- Level of acoustic pollution
- Services on site
- Typology of accommodation
- Relationship status of the tourist
- Attractions at the destinations
- Seasonality
- Local community hospitality
- Safeness at the destination
- Local community hospitality

---

<sup>4</sup> The procedure for calculating net per capita EF includes five steps in which we have to come across the estimates for each indicative (Hunter and Shaw, 2007, p.49).

Transit zone;

Determine the total round trip flight distance (km)

Obtain energy use per tourist (MJ)

Obtain the equivalent land area (ha of forest) per tourist (per year)

Allow for the additional radiative forcing of aircraft emissions

Multiply by the appropriate “equivalence factor”

Destination area;

Use the host or source country average per capita EF

Net per capita EF= Transit zone + Destination area - The average per capita EF of the source country and the length of stay away from home



- Local community hospitality
- Safeness at the destination
- Obligation and state of order
- Education level
- Gender of the tourist

In order to study the customer preferences on tourist products, we designed a questionnaire with questions regarding the related factors affecting their demand, using a Likert scale of five classifications as it is shown in the table below:

The Question	Agreement on a five-point-scale					Not applicable
	5	4	3	2	1	
I am interested on luxury rather than taking care on the environment pollution						99
I like unspoilt surroundings at the destinations						
I care about hygiene at the destination						
I like sports						
I like entertainment and fun						
I like doing friendship at the destination						
I like of road and nature experiences						
I like familiar treatment at the destination						
I have the habit to take care on the tourist environment						
I chose romantic destinations						
I enjoy high population at the destination during top season						
I like relax and peaceful places at destination						
I like transport traffic at the destination						
I like noisy vacations						
I like tourist structures with the largest set of services on site						
I like vacation in family						
I lonely individual vacations						
I like culture offers at destinations						
I like moving during all years to the tourist destinations						
I like moving at the top seasons at the tourist destinations						
I like hospitality communities at the destinations						
I like feeling safe during the holidays at tourist destination						
I like obligation, control and state of order at destinations						
I am educated						
Gender of tourists counts at environment preservation						
Monthly income in 000 ALL	>100	70-100	50-70	30-50	>30	

We introduced a question on the income level in order to see the effect of this factor on the total quality of the vacation.

Based on the previous experiences of the interviewed persons at the region of Elbasan during the holiday of the Summer Day on 14<sup>th</sup> of March 2011, between home people and visitors in sample sizes of 100 people each - 200 all, many explanatory variables were not significant. We used the backward model selection using the Akaike information criterion (AIC) to eliminate non-significant variables. We run then a multiple linear regression on the remaining significant explanatory variables, in order to measure customers' preference for environmentally sustainable tourist structures and destination using demand for unspoilt tourist areas and destinations or pro-environmental behavior as a dependent variable.

We resulted at a sample multiple linear regression model of 7 explanatory variables.

The resulting final model with seven explanatory variables, resulted with a determination coefficient of 0.56 ( $R^2$ ), not very strong but still explaining most of the tourist behavior pro environment preservation and care. (F-statistic: 8.13 on 7 and 192 DF, p-value 0.001), we tested the variables for significance in order to receive the final sample regression model. It resulted that not all the variables have a strong significance on the dependent variable. This explains also the value of  $R^2$ . The final regression we run has five principal explanatory variables once tested for significance testifying that their results explained better the friendly pro environmental behavior at the destination. These variables are:

1. I am interested on luxury rather than taking care on the environment pollution (coefficient negative)
2. I like entertainment and fun (negative)
3. I like of road and nature experiences (positive)
4. I like culture offers at destinations (positive)
5. I like unspoilt surroundings at the destinations (positive)

We also analyzed the data on these factors first classifying the customers in three large groups:

1. Small environmental footprint tourists
2. Medium environmental footprint tourists
3. Large environmental footprint tourists)

Resulted that male have a larger ecologic footprint and the first group has a significant share on 100% of 38%.

As for the model of tourism to answer to the tourist demand for unspoilt tourist areas and products we think we can use QFD (quality function deployment). It can make possible to deploy tourist product especially those already existing in the market, even in the Albanian market, and chose e part mix of these products to find the ways of improving those by maximization of their effect to the customers related to their pro environmental behavior and perception.

This is an analysis based on performance maximization of the tourist products. In order to deploy and create the part mix of the tourist product we can use a four step technique,

called HOQ (House of Quality) used by George L. Vairaktarakis<sup>5</sup> creating four matrices (HOQ) on each step:

1. Voice of the customers to a product's technical requirements - quality deployment based on engineering characteristics and customer requirements
2. Component requirements - parts' deployment based on parts' characteristics and engineering characteristics
3. Manufacturing operations - process planning based on process operations and parts' characteristics
4. Quality control plans - production planning based on quality control and process operations (application of the new standard for competitive advantage)

The process is deeply customer oriented and focuses on a customer ranking based on the preferences on the part mix of the presumed tourist product in order to improve it for a higher performance.

## RESULTS

### Target marketing for quality tourism

The discussion on marketing for quality in tourism, recently has widely taken the route of sustainability, focusing on the modern tourist demand for unspoilt tourist areas and destinations, as well as cultural and historical tourism. We can hold on this perspective and measure the trend on this regard, finding out the possibility to design the product according to this demand. As we mentioned above discussing on methodology, we used environment footprint of the tourists to identify three segments of tourists based on their relation to the environment (Ecological Footprint), confirming also that the group of small environment footprint has a very important share of the market.

Considering the simple moving average method and comparing the data with the international statistics on this regard, we can say that it will result an increasing trend for unspoilt areas measuring a small environmental footprint in the future.

This segmentation gives us the possibility to improve the tourist products, as well as to design new tourist products for the future tourist demand in a differentiated way, having differentiated mix for each of the three segments analyzed.

The model used on customer ranking for tourist product improvement could be:

$$\text{Customer preferences} = \sum_{k=1}^n W_k P_{klk}(C_{klk}) \quad (1)$$

and its costs on part mix improvement are  $\sum_{k=1}^n (C_{klk})$

Where:

$W_k$  – weights of the  $k^{\text{th}}$  part improvement

$P_k(C_{kl})$  – performance rating of  $p_{kl}$  under  $C_{kl}$  costs

$p_{kl}$  –  $k^{\text{th}}$  part of the product

$n$  – Number of parts in a tourist product

$k$  – Number of parts in a part mix of tourist product

---

<sup>5</sup> George L. Vairaktarakis, Optimization tools for design and marketing of new / improved products using the house of quality, Journal of Operations Management 17, 1999. pp 645–663

$l - 1^{\text{th}}$  alternative part choice for  $p_{kl}$

Solving the equation we rank the customers on their preferences to the different alternative part mixes.

While we can model for performance maximization of the tourist product still using QFD adding to the equation a dummy variable (binary one), For  $1 \leq k \leq n_0$  and  $1 \leq l_k \leq n_k$

introducing it to the model:

$$X_{kl_k} = \begin{cases} 1, & \text{if } p_{kl_k} \text{ is selected among the alternatives for } p_k \\ 0, & \text{otherwise} \end{cases}$$

and

$$\text{Best-of-class part mix} = (P) \max \sum_{k=1}^{n_0} \sum_{t=1}^{n_k} W_k P_{kl_k}(C_{kl_k}) X_{kl} \quad (2)$$

with these constraints:

$$\sum_{i=0}^n X_{kl} = 1 \text{ for } k = 1, 2, \dots, n_0 \quad (1)$$

$$\sum_{k=1}^{n_0} \sum_{t=1}^{n_k} C_{kl_k} X_{kl} \leq W \quad (2)$$

$$X_{kl_k} \in \{0, 1\} \text{ for } 1 \leq k \leq n_0 \text{ and } 1 \leq l_k \leq n_k \quad (3)$$

The constraints (1) correspond to the assignment of the part options in the parts' mix, constraint (2) are budget constraints and constraint (3) corresponds to the integrality constraints. The model of performance (P) maximization is widely acceptable even we introduce a set of parameters which are already calculated and bring to the model the risk of stereotyping of the customer preferences.

The second expression (equation) introduces the probability that the improvement in a specific part increase the performance, giving estimation to each alternative due to relevance of the improvement in a specific part of the product.

## CONCLUSIONS

The study confirms the increasing trend of the orientation of the tourist demand toward unspoilt destinations and attractions, as well as the tendency to safeguard the environment and to use sustainable tourist resources.

It confirms too that the tourists have a strong attraction to turn back to those destinations where their recent or last experience was based more on sustainable tourist activities, both environmental and cultural care based.

It states that a lot of the demand for unsplit tourist destinations is determined considerably by factors related to the total quality of the tourist product, compound by the set of quality services and the destination management in terms of environment care

and hygiene and safety at the tourist destination, where the landscape and wild life play an important role. There are very much appreciated the nature sports too.

The orientation on leisure time is not totally dependent on fun and entertainment, but toward local community life and culture too.

The segmentation of the market due to this important changes on the modern tourist demand recently, ask for selective marketing and product design according to the customer preferences. The model used to optimize and maximize the parts' mix of the tourist product through QFD is a widely good effort and approach to this end.

The model should consider the competition rating too, in order to design the tourist product, but it belongs to another study and research.

## REFERENCES

- AKAO Y. Ed... (1990): "Quality Function Deployment", ProductivityPress, Cambridge, MA.
- BADAL J., A I. (2003): "Measuring sustainability in a mass tourist destination: Pressures, perceptions and policy responses in Torrevieja, Spain", *Journal of Sustainable Tourism*, 11(2, 3), pp. 181–203.
- BARBER N., TAYLOR CH. (2009): "DEALE, C. A Case for Selective Marketing: Identifying the Ecological Wine Tourist", *International CHRIE Conference-Refereed Track*.
- BERENGUER J.,CORRALIZA J. (2005): "A.,MARTIN, R. Rural-urban differences in environmental concern, attitude and actions", *European Journal of Psychological Assessment*, 21(2), pp. 128–138.
- BUDENAU A. (2005): "Impacts and responsibilities for sustainable tourism: a tour operator's perspective", *Journal of Cleaner Production* 13, pp. 89–97.
- BURNS G.L., HOWARD P. (2003): "When wildlife tourism goes wrong: a case study of stakeholder and management issues regarding Dingoes on Fraser Island, Australia", *Journal of Tourism Management* 24, pp. 699–712.
- CHOI HWANSUK CH. (2006): "SIRAKAYA, E. Sustainability indicators for managing community tourism", *Journal of Tourism Management* 27, pp 1274-1289.
- CORRALIZA J., BERENGUER J.( 2000): "Environmental values, beliefs, and actions: A situational approach", *Environment and Behavior*, 32, pp. 832–848.
- COSTANZA R. (2000): "The dynamics of the ecological footprint concept", *Ecological Economics*, 32, pp. 341–345.
- DAY R.G. (1993): "Quality Function Deployment: Linking a Company with its Customers". ASQC, Milwaukee, WI.
- DOLCINAR S. (2004): "Insight into sustainable tourists in Austria: Data based a priori segmentation approach", *Journal of Sustainable Tourism*, 12(3), pp. 209–218.
- FENNELL D. A. (2002): "Ecotourism programme planning", Wallingford, UK: CABI Publishing.
- FERGUSON A. (1999): "The logical foundation of ecological footprints", *Environment, Development and Sustainability*, 1, pp. 149–156.
- GEORGE L. VAIRAKTARAKIS. (1999): "Optimization tools for design and marketing of new/ improved products using the house of quality", *Journal of Operations Management* 17, pp 645–663
- GOSSLING S. (2002): "Human–environmental relations with tourism". *Annals of Tourism Research*, 29(2), pp. 539–556.

HUNTER C., SHAW J.( 2007): “The ecological footprint as a key indicator of sustainable tourism”, *Journal of Tourism Management* 28, pp 46-57.

SCOTT D.( 2006): “Global environmental change and mountain tourism”, In S. Gossling, & C. M. Hall (Eds.), *Tourism & global environmental change*, pp. 54–75. Oxon: Routledge.

VENETOULIS J., CHAZAN D., GAUDET C.( 2004): “Ecological footprint of nations. Oakland: Redefining Progress”.

TSAUR SH., LIN Y., LIN J. (2006), “Evaluating ecotourism sustainability from the integrated Perspective of resource, community and tourism”. *Tourism Management* 27, pp. 640–653.

WARD J., HUGHEY K., & URLICH, S.( 2002): “A framework for managing the biophysical effects of tourism on the natural environment in New Zealand”, *Journal of Sustainable Tourism*, 10(3), pp. 239–259.

WARNKEN J., BRADLEY M., GUILDING CH.( 2005): “Eco-resorts vs. mainstream accommodation providers: an investigation of the viability of benchmarking environmental performance”, *Rebollo, Journal of Tourism Management* 26, pp 367–379  
World Travel and Tourism Council

[http://www.wttc.org/eng/Tourism\\_Research/Economic\\_Data\\_Search\\_Tool/](http://www.wttc.org/eng/Tourism_Research/Economic_Data_Search_Tool/)

***SECTION 5: PLANT SCIENCES AND ENVIRONMENTAL  
MANAGEMENT***

**Moderátorok/Moderators:**

Prof. Dr. Jelena Boskovic

Prof. Dr. Pauk János

**Secretary:**

Dr. Süli-Zakar Tímea

## **SUSTAINABLE AGRICULTURE AND ENVIRONMENTAL PROTECTION**

**JELENA BOSKOVIC, VESELINKA ZECEVIC, TAMARA GALONJA COGHILL,  
ALEKSANDAR IVANC, SLOBODAN MILENKOVIC, GORDANA DOZET, TIBOR KÖNYVES**

Megatrend University, Belgrade  
Faculty of Biofarming, Backa Topola, Serbia  
Email: jboskovic@biofarming.edu.rs

*“Most of the fundamental ideas of science are essentially simple, and may, as a rule, be expressed in a language comprehensible to everyone.”*

*Albert Einstein*

### **ABSTRACT – Sustainable agriculture and environmental protection**

Human population growth caused the World Commission on Environment and Development to call attention to necessity of changes in strategies for attaining security in food production and conservation of natural resources and environmental protection. Sustainable agriculture goals may be shortly abridged to stable market supply by biologically quality food, on employment of rural population and suppressing of poverty, as well as natural resources management and environment protection on local and global level. For the system of such sustainable and organic agriculture, ecology provides basic conditions through the development of diversified agroecological systems. Integration of plant and animal biodiversity which improves interactions and synergy is the advantage. It enables biological regulation of harmful organisms, nutrition circling, biomass production and accumulation. The end result is improvement of economical and ecological agroecology system maintenance. In accomplishing these aims new initiatives in education, application of economical stimulations and development of relevant new technologies are included.

**Key words:** sustainable agriculture, agroecology, biodiversity, biological control

## **INTRODUCTION**

Modernization of agriculture often disrupted the balance between ecology and agricultural production, ignoring or neglecting ecological principles (WEBSTER, 1997). An increasing number of agricultural experts realized that modern agriculture will soon face a crisis, and public in many countries became concerned about the continuation of the current agricultural production system.

Amongst these negative consequences, the most important are: depletion of soil, ground water pollution, reduced number of family farms, deteriorated working and living conditions of rural population, production costs growth and destruction of economic and social conditions in rural communities.

The evidence have accumulated showing that system that favours highly productive and competitive capital intensive technologies and production, also causes ecological, economic and social problems (BOSKOVIC *et al.*, 2003). The nature of the current agricultural structure and prevailing strategies in agriculture have led to damaging the environment, mostly favoring large farms, specialized production, crop monoculture and mechanization.



## **THE EFFECTS OF CONVENTIONAL AGRICULTURE**

Today, as more and more manufacturers join in the international economy, the imperative for diversity disappears and economic mechanisms have awarded monoculture as a mode of production (IKERD, 2010). In turn, lack of crop rotation and production diversity removed key regulatory mechanisms in turning monocultures into agro-ecosystems that are vulnerable and dependent on high dosages of chemicals (ASTHANA and KUMAR, 2008).

From the ecological point of view, there are multiple regional consequences of monocultural specialisation:

- Agricultural systems growing specialized crops in vast cultivated lack the components of the former farms having almost entirely lost links and complementarity between the crop production, soils, crops and animals.
- Circulation of nutrients, energy, water and waste no longer exists and the circuit is open as opposed to natural ecosystems.

Despite significant amounts of crop residues and manure produced on farms, it has become difficult to secure the circulation of nutrients, even within agricultural systems. It is no longer financially justified to return the manure into the nutrients circulation process, since the productive land and animal farms are geographically distant. In many areas, agricultural residues have become a burden rather than a source of nutrients.

It is also impossible to recycle nutrients from urban waste material, because of distance that makes it not financially justified.

- Partially, instability and vulnerability of agroecosystems to diseases can be attributed to monoculture production on vast areas, concentrating high amounts of food for harmful specialized herbivores and increasing the area available to immigration of pests. By ecosystems simplification, pests' natural predators are also diminished. In connection with these pest problems, there is always a possibility of new pests introduction or growth inhibition of beneficial insects.

The first wave of environmental problems is caused by monoculture system that favours the use of high technologies and farming practices that degrade natural resources. Therefore, the problem of agricultural production can not be viewed only as a technological problem but also as a social, cultural and economic problem, that contributes to the crisis in these areas (ZECEVIC *et al.*, 2010).

## **REASONS FOR SUSTAINABLE AGRICULTURE DEVELOPMENT**

Despite the growing awareness of the effects of modern technologies on the environment, due to pesticides in food chain and plant nutrients in rivers and groundwaters, there are still those who oppose the challenges of the 21st century, arguing that intensification of agriculture should continue.

Researchers are increasingly showing that it is possible to provide a balanced environment, sustainable production and yield, achieved by biological soil fertility and natural pest control through the organization of diversity in agroecosystems, using technologies that require less investment (ALTIERI, 1993).

Such alternative crop production systems have already been tested, some of them being crops in alternate plots, growing protective crops in orchards and cultivation of intercrops.

Data obtained at farms that implement alternative ways of growing show optimal circulation of nutrients and organic matter as well as closed flow of energy, contributing to the protection of water layers in the soil and the soil structure (HOJKA *et al.*, 2006). In addition, balanced number of harmful organisms and their natural predators is established.

Optimal planning and functioning of agroecosystems depends on the degree of interaction between its various abiotic and biotic components (IKERD, 2010). Successfully established functional biodiversity will initiate synergistic relationships that can facilitate specific agro-ecological mechanisms, such as activation of soil organisms, nutrient circulation, increasing number of beneficial arthropods and antagonists, etc.

There are a number of available organizing modes of such production, which vary in strategies applied as well as in the achieved effects (OECD, 1998).

### **AGROECOLOGICAL PRINCIPLES IN SUSTAINABLE AGRICULTURE**

To restore agricultural production that is both ecological and efficient, it is important to thoroughly understand the nature of agroecosystems and the principles on which they work. Agroecosystems are communities of plants and animals developing mutual relationships, as well as relationships with external physical and chemical conditions, modified by man. They can be manipulated to improve production in terms of sustainable agriculture, with fewer negative effects (BOSKOVIC *et al.*, 2010). Agroecology is a discipline that creates a strategy for agro-production and is oriented towards the conservation of natural resources. It studies agroecosystems with their genetics, land configuration, external conditions and human influence, and incorporates understanding of environmental and social achievements of co-evolution, its structure and function. This way it emphasizes the inter-connection of all components of agroecosystems and the dynamics of complex ecological processes (HERDT *et al.*, 1995).

Creating such systems is based on the application of ecological principles, such as:

- Increase biomass recycling and optimizing available nutrients balancing their flow.
- Securing favorable soil conditions for plants, especially through organic matter management and increasing soil biotic activity.
- Reduction of losses due to the influence of solar radiation, air and water through microclimate management.
- The genetic diversification of agroecosystems in time and space.
- Increase of favorable biological interactions and synergism between components of agrobiodiversity, enhancing basic ecological processes.

### **BIODIVERSITY IN SUSTAINABLE AGRICULTURE**

Agricultural biodiversity of all species intended for human food is a significant part of biodiversity in general, highly considered in food market globalisation, intellectual property system and spreading unsustainable industrial food production. It is also known as agri-biodiversity or the genetic resources for food and agriculture. It includes:

- harvested types of crops, selected animal species, various fish species, wild resources in the fields, forests and aquatic ecosystems;
- not harvested species within production ecosystems that support food supply, including soil micro-organisms, pollinators, etc.;
- not harvested species in the broader field conditions that promote food production ecosystems (agricultural regions, forest and aquatic ecosystems).

However, the interaction between the environment and genetic resources management practice determines evolutionary processes. These may include introgression from wild relatives, hybridization between cultivated plants, mutation of natural and artificial selection, since the genetic material (variety of farm crops or domestic animals selected) is well adapted to local variations in biotic and abiotic external conditions.

### **BIODIVERSIFICATION IN SUSTAINABLE AGRICULTURE**

Biodiversification of sustainable agroecosystem can be achieved through reviving functional biodiversity, thus initiating synergisms that provide environmental conditions, such as soil biology activation, nutrient cycle re-establishing, increasing favorable arthropods and antagonists. Key actions are preventive, providing strengthening of agroecosystems' "immunity", through series of mechanisms (PRETTY, 1995). Those mechanisms include:

1. Diversification of plant species and genetic diversity in time and space.
2. Increase in functional biodiversity (natural enemies, antagonistic organisms etc.)
3. increase in soil organic matter and its biological activities.
4. Increase in soil layer that positively affects the crop.
5. Removal of toxic residuals.

#### **Different biodiversity strategies based on ecological principles**

Biological diversification in agroecosystems can be performed by:

1. Crop rotation. Occasional diversification provides crops feed and terminates life cycles of some insect pests, parasites and weeds.
2. Polyculture. The complex system of plant crops in which two or more crops are sown within sufficient spatial proximity, which results in competition or complementarity to increase yield.
3. Agro-forestal systems. Agricultural systems where the forest trees are grown together with annual crops and domestic animals, resulting in increased complementary relations between components with multiple use of agroecosystems.
4. Leguminous crops. The use of pure or mixed cultures of legumes or other annual plant species under fruit trees to increase soil fertility, while increasing the biological pest control with modification of orchards microclimate.
5. Integration of domestic animals into agroecosystems contributes increase in biomass production and optimal cycling of nutrients.

## **Dimensions of agricultural diversity**

Agricultural biodiversity has a partial, temporary and graded dimensions at the level of agroecosystems. These agroecosystems, e.g. ecosystems applied in agriculture, are determined by three series of factors: genetic resources, physical external conditions and human production management.

In reality, there is not a system in the world that would be "natural", in the sense that human influence is annulled. Most ecosystems have, to certain degree, been modified or cultivated by human activities directed towards food production and satisfying other needs (ALTIERI, 1995).

Agricultural diversity is not purely a result of human activities. Man's life is entirely dependent on it, not only for obtaining immediate food and other goods, but also to maintain areas of land that will sustain production on a large (COPPER *et al.*, 1998).

## **AGROECOLOGY AS THE BASIS OF SUSTAINABLE AGRO-ECOSYSTEMS**

Implemented systems of sustainable agriculture seek to maintain productivity in the long run by:

- a) optimizing the use of locally available resources by combining different components of the farm system so that they condition each other and have the highest possible synergistic effects;
- b) reduction of external influences that are potentially harmful to the environment and health of farmers and consumers;
- c) use of resources of the agroecosystem itself (the circulation of nutrients, improved conservation);
- d) balancing crop properties and production potential, limiting external climate and land conditions to ensure long term sustainability of the existing level of production;
- e) conservation of biological diversity in natural and cultivated land areas, by optimum use of biological and genetic resources of plant and animal species;
- f) use of local knowledge and practices, including innovative approaches that are not fully clarified by scientists but used by farmers.

## **CONCLUSION**

The concept of sustainable agriculture, although controversial because of its various interpretations, clearly is necessary because it involves a series of adjustments in agriculture, based on the understanding of co-evolution of social economic and natural systems. Sustainable agriculture is usually defined as an agricultural methodology that is economically viable, meets human need for food, and at the same time has positive impact on the environment and quality of life. As these goals can be achieved by

various methods, sustainable agriculture is not tied to any particular technological process. Sustainable agriculture is also not in exclusive dependence of organic farming.

## REFERENCES

- ALTIERI, M. A. (1995). Biodiversity and biocontrol: lessons from insect pest management. *Advances in Plant Pathology* 11: 191-209.
- ALTIERI, M.A. (1993) : Designing and improving pest management systems for subsistence farmers. pp. 1-20. In: *Crop Protection Strategies for Subsistence Farmers*. M.A. Altieri, ed. Westview Press, Inc. Boulder, CO.
- ASTHANA, A. AND KUMAR, S. (2008): Soil Health and Sustainable Crop Production: Adoption and Awareness of Soil Testing, *Journal of Sustainable Agriculture*, Vol. 32., Iss. 2 2008, pp. 303-320
- BOŠKOVIĆ, J., ISAJEV, V., PRIJIĆ, Ž., ZEČEVIĆ, V., HOJKA, Z., DOZET, G. (2010): Assessing ecological risks and benefits of genetically modified crops. *Journal of Agricultural Sciences*. Vol. 55, No. 1, 2010. pp. 89-101.
- BOŠKOVIĆ, J., IVANC, A., HOJKA, Z., SARIĆ, R. (2003): Basic determinants in sustainable agriculture development (in Serbian). Thematic unit in the Monograph. Publisher: Megatrend University of Applied Sciences, Belgrade. pp. 65-101.
- COOPER, H., D., SPILLANE, I., KERMALI, N., ANISHETTY, M. (1998) : Harnessing Plant Genetic Resources for Sustainable Agriculture, *Plant Genetic Resources Newsletter* 114: pp.1-8.
- HERDT, R., W., STEINER, R., A., BARNETT, V. (1995) : Agricultural Sustainability: Concepts and Conundrums, in: *Agricultural Sustainability: Economic, Environmental and Statistical Considerations*, (V Barnett, R Payne, and RA Steiner, eds). Chichester UK: John Wiley & Sons, pp. 3-13
- HOJKA Z., BOŠKOVIĆ, J., SIMIĆ J., KRMPOTIĆ T. (2006): Rational use of nitrogen in plant production for the purpose of sustainability of agroecosystems (in Serbian). *Ekonomika poljoprivrede*. Vol. 53, No 2 (93-524), pp. 915-927.
- IKERD, J. (2010): The Nature of Sustainable Change, *Journal of Sustainable Agriculture*, Vol. 34., Iss. 3 2010, pp. 241-243
- OECD (1998) : Co-Operative Approaches to Sustainable Agriculture, by Organisation for Economic Cooperation and Development. Paris: OECD, 1998.
- PRETTY, J., N. (1995): Regenerating Agriculture: Policies and Practice for Sustainability and Self-Reliance, by JN Pretty. Washington: Joseph Henry Press, 1995.
- WEBSTER, J.P.G. (1997): Assessing the Economic Consequences of Sustainability in Agriculture. *Agriculture, Ecosystems and Environment* (1997) 64(2) : pp. 95-102.
- ZECEVIC, V., BOSKOVIC, J., DIMITRIJEVIC, M., PETROVIC, S. (2010): Genetic and phenotypic variability of yield components in wheat (*Triticum aestivum* L.). *Bulg. J. Agric. Sci.*, Publisher: Agricultural Academy, Bulgaria, Vol. 16, N<sup>o</sup>4. pp. 422-428

## ACKNOWLEDGEMENTS

The research was financed by the Ministry of Science and Technology of the Republic of Serbia under project TR 31031 " Improvement sustainability and competitiveness in the organic crop and livestock production using new technologies and inputs.

## **SURFACE REACTION AND INTERACTION OF NO + CO ON CATALYST**

**SÜLI-ZAKAR TÍMEA**

Institute of Crop Production and Environment Protection, University of Szeged  
Andrássy út 15, 6800 Hódmezővásárhely, Hungary  
[sulizakartimea@mgk.u-szeged.hu](mailto:sulizakartimea@mgk.u-szeged.hu)

### **ABSTRACT**

The adsorption and reaction of NO with CO has been investigated on supported Au Catalysts. The main method was FT IR spectroscopy. Although very limited dissociation of NO was noticed on reduced Au catalyst, catalytic tests showed that all the samples used effectively catalyse the NO+CO reaction above 573 K. By means of FTIR spectroscopy several new absorption bands have been detected on the Au samples, the position of which depended on the nature of the support: it was 2305 cm<sup>-1</sup> for Au/SiO<sub>2</sub>, 2256 cm<sup>-1</sup> for Au/Al<sub>2</sub>O<sub>3</sub>, 2212 cm<sup>-1</sup> for Au/TiO<sub>2</sub> and 2220-2230 cm<sup>-1</sup> for Au/MgO. These bands were attributed to the asymmetric stretch of NCO attached to the oxides. This idea was strengthened by the results obtained following HNCO adsorption on supports alone, which gave the same absorption bands. It was demonstrated and assumed that an NCO species is formed on Au crystallites, and then migrates from the Au onto the acceptor sites of the support where it is accumulated and stabilized. The Au-NCO species was characterized by an absorption band at 2185-2195 cm<sup>-1</sup> produced either by the low temperature reaction or by the adsorption of HNCO on Au/SiO<sub>2</sub>.

**Keywords:** catalyst, support, adsorption, NO + CO reaction on Au, NCO formation on Au

### **INTRODUCTION**

Data on the properties of the adsorbed species and/or surface intermediates playing decisive role in the catalytic reactions have been previously obtained only indirectly through the study of the kinetics of the whole reaction, or through isotope exchange investigations. Vibration spectroscopic studies in the infrared range, however, give direct proofs on the structure of adsorbed forms. The infrared spectroscopy became one of the most effective surface science methods due to its easy handling and cheapness.

One of the most important areas of the environmental protection is decreasing air pollution. Converting the produced materials in catalyst way has great part in removing the toxic materials exhausted by chemical factories and cars. A possible way of removing NO of the exhaust is a catalytic reaction with reduced gases, especially CO.

Infrared spectroscopic studies showed the formation of isocyanate surface complex in the NO + CO reaction on supported noble metal catalysts. As this surface complex plays decisive role in the undesired side reaction of the catalytic transformation of the auto exhaust gases, great attention should be paid to its properties and to the mechanism of its formation. For this purpose the interaction of NO + CO gas mixture with supported gold catalysts was investigated.

## MATERIAL AND METHOD

Supported Au catalysts with a gold loading of 1 and 5 wt% were prepared by a deposition-precipitation method from  $\text{HAuCl}_4 \cdot \text{aq}$  p.a. 49% Au, Fluka AG with NaOH. Following supports were used:  $\text{SiO}_2$  (CAB-O-SiL, and MS Scintran BDH);  $\text{Al}_2\text{O}_3$  (Degussa );  $\text{TiO}_2$  (Degussa P25) and MgO (DAB). The fine powder of oxidic support was suspended and kept at 343 K for 1 hour with continuous stirring. The suspension was aged for 24h at room temperature and repeatedly washed then dried at 353 K and then calcined in air at 573 K for 4 h. The dried samples were reduced at 673 K for 60 min.

The gases used were of commercial purity (Linde), CO (99,97%), NO (99%). HNCO was prepared by the reaction of  $\text{H}_3\text{PO}_4$  and KOCN (SOLYMOSI et al., 1979). NO and HNCO was purified by fractional distillation.

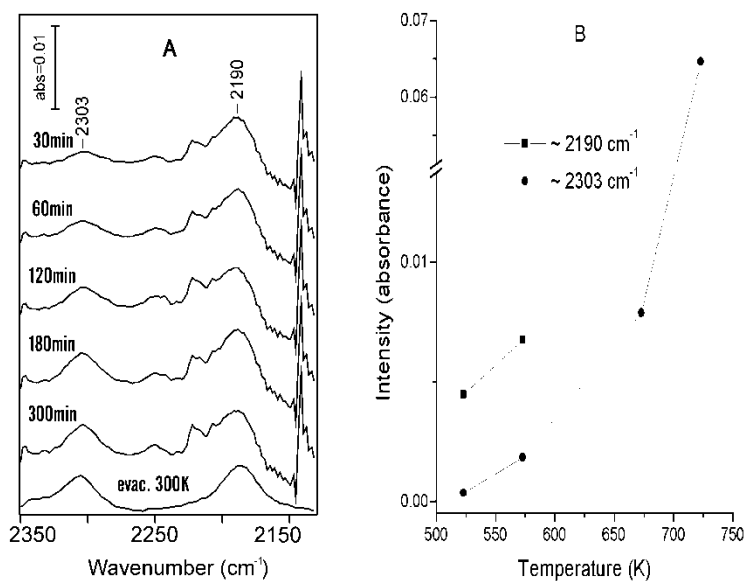
Infrared spectra were recorded with a Biorad (Digilab. Div. FTS 155) with a wave number accuracy  $\pm 4 \text{ cm}^{-1}$ . Typically 128 scans were collected. All of the spectra were taken without the use of a scaling factor ( $f = 1.0$ ). Catalytic studies have been performed in a closed circulation system. In this case the reaction was followed by analyzing the composition of gas phase with a Quadrupole mass spectrometer.

## RESULTS

Before infrared spectroscopic measurements we examined the reactivity of our Au samples towards the decomposition of NO on 5% Au/oxides. We found an easily measurable reaction above 573 K, producing mainly  $\text{N}_2\text{O}$  with a small amount of  $\text{N}_2$ .

The aim of the catalytic study is to confirm that the Au samples used in this work can catalyze the reduction of NO with CO and to establish the temperature range of the process. Reaction started above 473-523 K, as indicated by the consumption of reacting gases and the evolution of  $\text{CO}_2$  and  $\text{N}_2$ . At 623 K the reaction occurred rapidly and was almost complete in 15 min. The most effective sample was Au/ $\text{TiO}_2$  and the least active was Au/MgO.

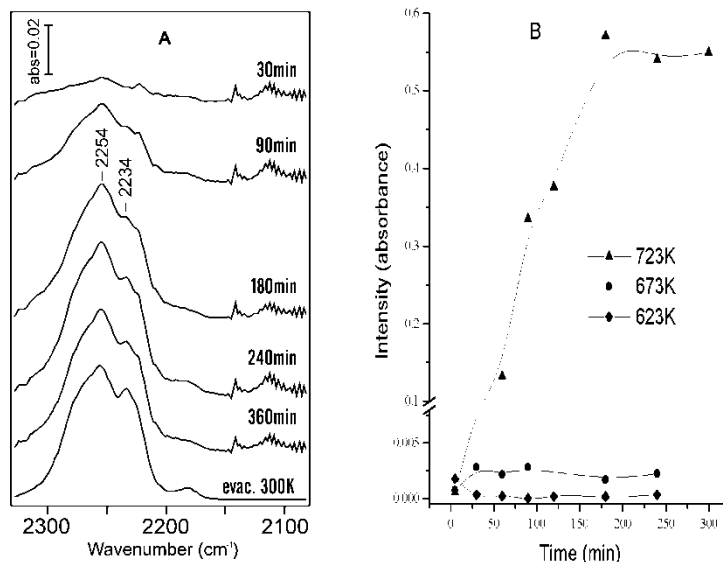
Before the examination of isocyanate complex we registered the spectrums of gases separately and NO + CO together. Adsorption of NO no bands were detected above  $1800 \text{ cm}^{-1}$ . The adsorption of CO on 1 % Au/ $\text{TiO}_2$  produced one band at  $2185 \text{ cm}^{-1}$ , which was eliminated by degassing. On 5% Au/ $\text{SiO}_2$  sample in the gas mixture a new band at  $2190 \text{ cm}^{-1}$  developed at 573 K. The band at  $2303 \text{ cm}^{-1}$  appeared with a less intensity, which slowly grew with the progress of adsorption. After evacuation at 300 K both bands remained unchanged (Fig.1.)



**Figure 1: (A) Infrared spectra of 5% Au/SiO<sub>2</sub> following NO + CO adsorption at 573 K. (B) Intensities of the bands at 2190 and 2300 cm<sup>-1</sup> formed following the adsorption of NO + CO on 5% Au/SiO<sub>2</sub> at different temperatures. The values were taken at 60 min.**

Performing similar measurements on reduced 5wt% Au/Al<sub>2</sub>O<sub>3</sub>, we detected new absorption bands at 2234 and 2254 cm<sup>-1</sup>. After evacuation at 300 K both bands remained unchanged (Fig. 2A).

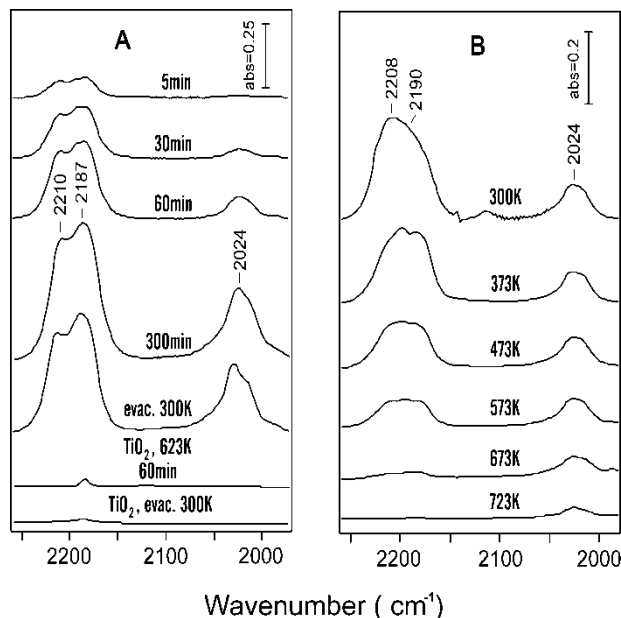
The time dependence of the 2254 cm<sup>-1</sup> band at different temperatures is shown in Fig. 2B.



**Figure 2: (A) Infrared spectra of 5% Au/Al<sub>2</sub>O<sub>3</sub> following NO + CO adsorption at 673 K. (B) Intensities of the bands at 2254 cm<sup>-1</sup> formed following the adsorption of NO + CO on 5% Au/Al<sub>2</sub>O<sub>3</sub> at different temperatures.**

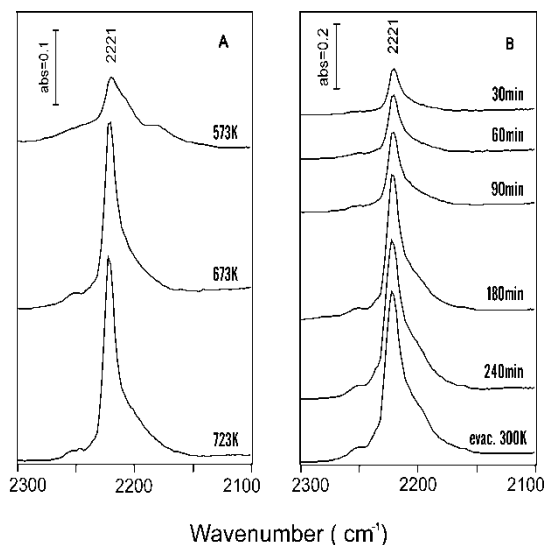


On Au/TiO<sub>2</sub> sample two absorption bands indicating of the formation of surface complexes appeared at 2187 and 2210 cm<sup>-1</sup>. The result of evacuation at 300 K their intensity decreased slightly (Fig. 3A). Two absorption bands were detected at 2208 and 2190 cm<sup>-1</sup> on metal-free TiO<sub>2</sub> but they disappeared at higher temperatures (Fig. 3B).



**Figure 3: (A) Infrared spectra of 5% Au/TiO<sub>2</sub> following the NO + CO adsorption at 623 K and (B) Spectra of Au-free TiO<sub>2</sub>, treated with NO+CO gas mixture at 623 K for 60 min and evacuated at 300 K (A).**

In Figure 4 we show spectra of 5% Au/MgO following the reaction of NO+CO. Significant spectral changes were first observed at 573 K, where a new absorption band appeared at 2221 cm<sup>-1</sup>.

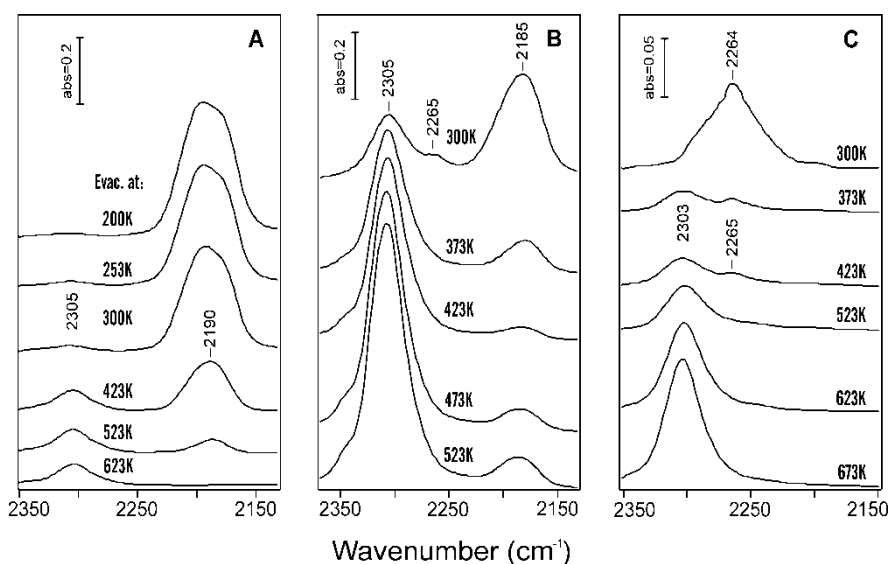


**Figure 4: The effect of temperature (A) and the reaction time at 673 K (B) on infrared spectra of 5% Au/MgO following the adsorption NO + CO.**

The intensity of this band increased at higher temperatures and with the extension of the adsorption time.

In order to help assignment of the new absorption bands observed in the NO+CO mixture the IR spectra of adsorbed HNCO have been taken on 5 % Au/SiO<sub>2</sub> and metal-free SiO<sub>2</sub> (Fig. 5.)

The adsorption of HNCO at 200 K produced a strong absorption band at 2190 cm<sup>-1</sup>. Annealing the catalyst under continuous degassing the intensity of the 2190 cm<sup>-1</sup> band slightly decreased and at the same time a weak band at 2305 cm<sup>-1</sup> developed. A strengthening of the 2305 cm<sup>-1</sup> band occurred above 300 K with simultaneous weakening of the band at 2190 cm<sup>-1</sup>. When the adsorption of HNCO was performed at 300 K the 2305 cm<sup>-1</sup> band appeared with higher intensity. Heating the sample in HNCO caused a dramatic growth of the 2305 cm<sup>-1</sup> band above 300 K, whereas the 2185-2190 cm<sup>-1</sup> band remained practically the same in the temperature range 373-523 K. Performing similar experiments with Au-free SiO<sub>2</sub> we obtained an absorption band at 2305 cm<sup>-1</sup>, but it was much weaker at all temperatures.



**Figure 5: Infrared spectra of 5% Au/SiO<sub>2</sub> following the adsorption of 0.02 Torr HNCO at 200 K and after subsequent heating to higher temperatures under continuous evacuation. (A) Infrared spectra of 5% Au/SiO<sub>2</sub> (B) and SiO<sub>2</sub>(C) following the adsorption of 1.0 Torr HNCO at 300 K and after subsequent heating to higher temperatures in the presence of HNCO.**

## CONCLUSIONS

The primary aim of this work was to examine the NO + CO interaction on supported Au catalyst and to identify the possible surface intermediates formed during the reaction. Summarizing the above results, we can conclude that the intense absorption bands appeared in the NO + CO reaction in the range of 2180-2310 cm<sup>-1</sup> and remained after evacuation on the spectra. We observed this effect only in gas mixture.

The positions of new bands depended on the nature of the support. It was 2212 cm<sup>-1</sup> for Au/TiO<sub>2</sub> 2220-2230 cm<sup>-1</sup> for Au/MgO 2256 cm<sup>-1</sup> for Au/Al<sub>2</sub>O<sub>3</sub> and 2305 cm<sup>-1</sup> for Au/SiO<sub>2</sub>. These bands were attributed to the asymmetric stretch of NCO attached to the oxides. This idea was strengthened by the results

obtained following HNCO adsorption on supports alone which gave the same absorption bands.

NCO species is formed on Au crystallites, and then migrates from the Au onto the acceptor sites of support where it is accumulated and stabilized. Spectral changes following the adsorption of HNCO on Au/SiO<sub>2</sub> at 200-400 K provide evidences for the spillover process.

**Acknowledgement:** The author wishes to express her sincere thanks to Tamás Bánsági and Frigyes Solymosi (CRC-Institute of Nanochemistry and Catalysis, University of Szeged) for their basic help in the preparation of this paper.

### REFERENCES

- H. Sakurai, S. Tsubota and M. Haruta, *Appl. Catal. A Gen.* 1993, **102**, 125.  
G.C. Bond and D.T. Thompson, *Catal. Rev. Sci. Eng.* 1999, **41**, 319.  
G.J. Hutchings, *Catal. Today* 2002, **72**, 11.  
A. Ueda and M. Haruta, *Gold Bulletin* 1999, **32**, 3.  
M. L. Unland, *J. Phys. Chem.* 1973, **77**, 1952., *J. Catal.* 1973, **31**, 459.  
J. W. London and A. T. Bell, *J. Catal.* 1973, **31**, 96.  
A.A. Davydov and A.T. Bell, *J. Catal.* 1977, **49**, 345.  
M.F. Brown and R.D. Gonzalez, *J. Catal.* 1976, **44**, 477.

## RESISTANCE OF *VENTURIA INAEQUALIS* TO HEXACONAZOLE, TRIFLOXISTROBIN AND CAPTAN

ISMET YILDRIM<sup>1</sup>, METIN AYDIN<sup>2</sup>

<sup>1</sup>Çanakkale Onsekiz Mart University, Faculty of Agriculture, Department of Plant Protection, 17020 Çanakkale-Turkey.

<sup>2</sup>HEKTAŞ Tic.Taş. Pazarlama Geliştirme Müdürlüğü, Bursa-Turkey.  
yismet96@gmail.com

### ABSTRACT - RESISTANCE of *Venturia inaequalis* to HEXACONAZOLE, TRIFLOXISTROBIN and CAPTAN

4.3% of 2.2 million tons of apple produced in Turkey annually is obtained from Çanakkale. Apple scab caused by *Venturia inaequalis* (Cooke.) Wint. is the most important problem observed in the apples growing in the province. Especially if the disease pressure is high, it cannot be controlled and thus it causes a significant loss in yield and quality despite the intensive spraying against the disease.

The objective of this study was to investigate whether this problem originated from fungicide sensitivity. Sensitivities of *V. inaequalis* isolates to hexaconazole (DMI), trifloxystrobin (Strobilurin) and Captan (Trichloromethylthiocarbamide) were determined for twenty isolates by measuring the germination rate of conidiospore obtained from single scab lesions. According to ED<sub>50</sub> value, the isolates treated with captan and hexaconazole varied from 0.01 to 0.3 µg/ml. The sensitivity of the isolates to both fungicides was found less than the sensitivity to trifloxystrobin. The isolates treated with trifloxystrobin were divided in two groups (0.01-0.03 and 0.03-0.1 µg/ml). On the other hand, according to minimum inhibition concentration, the isolates at captan and trifloxystrobin were in three groups (0.3-1; 1-3 and 3-10 µg/ml), however for hexaconazole they were in two groups (1-3 and 3-10 µg/ml).

*In vitro* studies showed that the sensitivity of *V. inaequalis* to Demethylation Inhibitor fungicide hexaconazole and Trichloromethylthiocarbamide fungicide captan was reduced.

**Keywords:** *Venturia inaequalis*, sensitivity, fungicide.

## INTRODUCTION

In Turkey *Venturia inaequalis* is one of the most important apple diseases and causes serious losses of yield and quality (TÜRKOĞLU, 1956; BENLIOĞLU AND KILIÇ, 1995). The producers apply 14-15 sprayings in a vegetation period if climatic conditions are favorable for the disease. Nevertheless, *Venturia inaequalis* cannot be controlled in some gardens despite intensive spraying. The failure in the combat against apple *Venturia inaequalis* has been associated with the decrease in the sensitivity of *V. inaequalis* as a consequence of the use of DMIs for long years against the disease (SMITH ET AL., 1991; SHOLBERG AND HAAG, 1993; ROBERTS AND CRUT, 1994; PALANI AND LALITAKUMARI, 1999; KÖLLER AND WILCOX, 2001). Hexaconazole and captan have long been used in Turkey against apple *Venturia inaequalis*. Floxystrobin, on the other hand, began to be used only recently compared to the other two fungicides. BENLIOĞLU AND KILIÇ (1995) found that the sensitivity of the isolates they collected from the province of Eğirdir in Isparta (Turkey) to hexaconazole and flusilazole had decreased. Although *V. inaequalis* conidia with reduced sensitivity to Qol inhibitors were obtained in another study from the garden treated with trifloxystrobin, it was determined that the

performance of the fungicides in the group was not reduced, yet they had resistance risks (KÜNG FÄRBER ET AL., 2000). On the other hand, KÖLLER ET AL. (2004) reported that the isolates obtained from the gardens treated with Qol had high sensitivity to kresoxim-methyl and trifloxystrobin and that this finding was characterized with G143A cytochrome *b* mutants.

In this study, the sensitivity of *V. inaequalis* isolates obtained from the apple gardens in Çanakkale to hexaconazole, floxystrobin and captan was investigated.

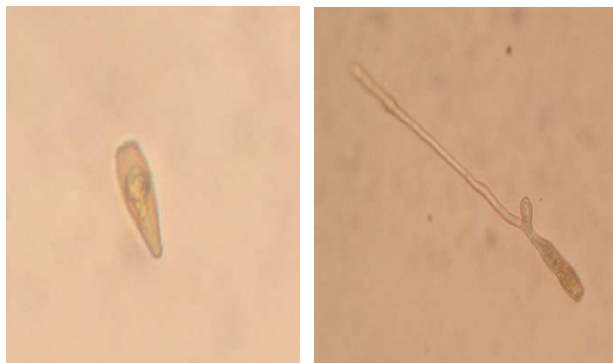
## MATERIAL AND METHOD

### *Venturia inaequalis* isolation and production

The leaves infected with *Venturia inaequalis* in 2010 vegetation period were collected from the apple gardens in four different locations of Çanakkale, and they were placed into polyethylene bags and transferred to the laboratory in cooling containers. Sterile pure water (25 µl/ml) with Tween 85 was dropped on the leaf lesions inside the sterile container with the help of a micropipette, and conidiospores permeated into the water. Conidial suspension was inoculated into the water agar inside the petri dishes. The conidiospores germinated in the water agar medium were taken and inoculated into PDA (Potato Dextrose Agar) medium, and single conidium cultures were obtained by incubating at 20 °C for 18 days. *V. inaequalis* cultures developed in PDA medium were transferred into petri dishes and tubes with sterile PDYA (Potato Dextrose Yeast Extract Agar) medium and incubated at 20 °C for 30 days. The cultures developed in PDA medium were then transferred to VE medium (Apple Juice-Malt Extract Amino Acid Solution) and left to incubation at 20 °C for 25 days.

### Determination of the sensitivity of isolates to fungicides

Conidia obtained from the cultures developed in VE medium were taken and spore suspension was prepared in the density of 10<sup>5</sup> conidium/ml. Spore suspension (25 µl) was inoculated into petri dishes with PDA to which trifloxystrobin, hexaconazole and captan were added (0,001; 0,003; 0,01; 0,03; 0,1; 0,3; 1;3 and 10 µg effective material/ml) with the help of a micropipette. Only sterile pure water was placed into the control petri dishes. The petri dishes were inhibited in the dark with 7% formalin at 20 °C for 48 hours after inoculation. After inhibition, the conidia inside the petri dishes (100 conidia/petri) germinated, atrophied, and were considered ungerminated. Conidia with a tube twice longer than conidium in the counts were considered as germinated (Fig. 1).



**Figure 1. Germinated and ungerminated conidia (Original).**

Germination rate was determined by proportioning the germinated conidia to the total conidia number. The data were evaluated by finding ED<sub>50</sub> and MIC (Minimum Inhibition Concentration) values. ED<sub>50</sub> values of fungicides were determined by using logarithmic charts. The trials were designed as four replications in random block trial design.

## RESULTS AND DISCUSSION

The sensitivity of isolates to fungicides in *in vitro* trials according to ED<sub>50</sub> values is presented in Table 1.

**Table 1. Distribution of *V. inaequalis* isolates according to ED<sub>50</sub> values (µg / ml).**

Fungicide	Number of isolates	<0,001	0,001-0,003	0,003-0,01	0,01-0,03	0,03-0,1	0,1-0,3	0,3-1	1-3	3-10
Captan	20	0	0	0	7	12	1	0	0	0
Hexaconazole	20	0	0	0	6	13	1	0	0	0
Trifloxystrobin	20	0	0	0	12	8	0	0	0	0

A decrease was observed in the sensitivity of *V. inaequalis* to captan and hexaconazole according to ED<sub>50</sub> values. *V. inaequalis* isolates were gathered in three groups in captan and hexaconazole according to ED<sub>50</sub> values (0,01-0,03 µg/ml, 0,03-0,1 µg/ml and 0,1-0,3 µg/ml), while they were gathered in two groups in trifloxystrobin (0,01-0,03 µg/ml and 0,03-0,1 µg/ml) (Table 1). It was determined according to ED<sub>50</sub> values that the sensitivity of isolates to captan and hexaconazole intensively used in apple gardens in the region was lower than their sensitivity to trifloxystrobin. It was especially considered remarkable that the same isolate has a similar sensitivity to both fungicides despite the absence of cross-resistance between them. While the previous studies had not reveal any reduction in the sensitivity of *V. inaequalis* to captan; it was found that different fungi, such as *Botrytis cinerea*, had decreased sensitivity to fungicides and that this decrease was permanent (DELEN ET AL., 1999; 2000). Some *V. inaequalis* isolates had higher concentrations according to ED<sub>50</sub> values (0,03-0,1 µg/ml and 0,1-0,3 µg/ml), and this finding was associated with the possibility that the pathogen had developed resistance against captan used in the region for long years (Table 1). This decrease in sensitivity indicates that there may be individuals in the fungal population which have decreased sensitivity also to hexaconazole, a sterol biosynthesis inhibitor (SBI). In the study conducted with isolates obtained from Egridir in the city of Isparta, it was determined that the pathogen's sensitivity to flusilazole and hexaconazole in Triazole group decreased (BENLIOĞLU AND KILIÇ, 1995).

On the other hand, the dose range of 8 isolates in trifloxystrobin was between 0,03 and 0,1 µg/ml according to ED<sub>50</sub> values, and this finding indicates a resistance risk although the fungicide began to be used only recently in the region. KÖLLER ET AL. (2004) reported that cytochrome bound to Qol center in the fungal cell where trifloxystrobin and kresoxim-methyl was found and thus there was no resistance against the fungicides inhibiting respiration, yet the isolates of *V. inaequalis* obtained from the gardens where Qol's were intensively used has high resistance against both fungicides and these were the mutants of G143A cytochrome b. In the study conducted by OLAYA AND KÖLLER (1999) in 5 leasing apple growing regions in North America, they detected 25 different

*V. inaequalis* populations against kresoxym-methyl which is in the same group as trifloxystrobin (QoI), and their baseline sensitivity values was found to be 0,35 µg/ml as ED<sub>50</sub> value. These previous studies indicate that resistant individuals may be found also in the apple gardens in Çanakkale region although *V. inaequalis* isolates have not developed resistance yet against trifloxystrobin in this location. The sensitivity of isolates to fungicides according to MIC (minimum inhibitory concentration) values is given in Table 2.

**Table 2: Distribution of *Venturia inaequalis* isolates according to MIC values (µg / ml)**

Fungicide	Number of isolates	<0,0 - 01	0,001-0,03	0,003-0,01	0,01-0,03	0,03-0,1	0,1-0,3	0,3-1	1-3	3-10
Captan	20	-	-	-	-	-	-	5	9	6
Hexaconazole	20	-	-	-	-	-	-	-	5	15
Trifloxystrobin	20	-	-	-	-	-	-	8	10	2

The isolates demonstrated a different distribution according to MIC (Minimum Inhibitory Concentration) values. The isolates formed 3 groups in captan and trifloxystrobin according to MIC values (0,3-1 µg/ml; 1-3 µg/ml; 3-10 µg/ml ), and 2 groups in hexaconazole (1-3 µg ml; 3-10 µg/ml) (Table 2). While 6 isolates were completely inhibited against captan in the concentration rate of 3-10 µg / ml, 15 isolates in hexaconazole and 2 isolates in trifloxystrobin were inhibited in this dose range. A significant part of the isolates were found to have low sensitivities to hexaconazole in the SBI group according to MIC values. A similar decrease in sensitivity according to MIC values was observed against captan with 6 isolates, which is in the group of Trichloromethylthiocarboxamids and does not have a specific mode of action, and against trifloxystrobin in QoI group with only 2 isolates (Table 2).

## CONCLUSIONS

The sensitivity of isolates to fungicides were observed to be higher when ED<sub>50</sub> values were considered, but it was found to be lower according to MIC values, indicating that these isolates have different sensitivities to fungicides. This study also revealed that the isolates collected from Çanakkale region had similar sensitivities to captan in the group of Trichloromethylthiocarboxamids, hexaconazole in Triazole group, and trifloxystrobin in Stroblurin group.

## ACKNOWLEDGEMENTS

This research was funded by the Research Fund of Çanakkale Onsekiz Mart University (Project Number: 2009/95).

## REFERENCES

- BENLIOĞLU S., B. KILIÇ (1995): *Venturia inaequalis* (Cke.) Wint. Studies on the Sensitivity of Isolates to Flusilazole and Hexaconazole. 7<sup>th</sup> Turkish Pythopathology Congress, 26-29 September 1995, Adana. pp. 207-210.
- DELEN N. (2008): Fungicides. p. 318, Nobel Publications, Ankara.
- DELEN N., TOSUN N., YILMAZ O., YILDIZ Z. (2000): Variation in the sensitivities of *Botrytis cinerea* isolates to some fungicides with non-specific mode of action. International *Botrytis* Symposium, 3-7 July 2000, Reims, France. p.64.
- FÄRBER R.B.K., CHIN K.M., LEADBITTER N. (2002): Sensitivity of *Venturia inaequalis* to Trifloxystrobin. Pest Management Science, 50 (3); 261-267.
- KÖLLER W., PARKER D.M., TURECHEK W.W., AVILA-ADAME C. (2004): A Two-Phase Resistance Response of *Venturia inaequalis* Populations to the QoI Fungicides Kresoxim-Methyl and Trifloxystrobin. Plant Disease, 88(5): 537-544.
- KÖLLER W., WILCOX W.F. (2001): Evidence for the Predisposition of Fungicide Resistant isolates of *Venturia inaequalis* to a Preferential Selection for Resistance to Other Fungicides. Phytopathology, 91(8): 776:781.
- OLAYA G., KÖLLER W. (1999): Baseline sensitivities of *Venturia inaequalis* populations to the strobilurin fungicide kresoxim-methyl. Plant Dis. 83:274-278.
- PALANI P.V., LALITAKUMARI D. (1999): Resistance of *Venturia inaequalis* to the Sterol Biosynthesis-Inhibiting Fungicide, penconazole [1-(2-(2,4-diclorophenyl) pentyl)-1H-1,2,4-triazole]. Mycol. Res., 103 (9); 1157-1164.
- ROBERTS A.L., CRUTE I.R. (1994): Variation in Sensitivity to Fungicides among UK Isolates of *Venturia inaequalis*. In BCPC Monograph of Fungicide Resistance (ed. S. Heaney, D. Slawson, D.W. Hollomon, M. Smith, P.E. Russell and D.W. Parry), 107-110.
- SHOLBERG P.L., HAAG P.D. (1993): Sensitivity of *Venturia inaequalis* Isolates from British Columbia to Flusilazole and Myclobutanil. Canadian Journal of Plant Pathology, 15, 102-106.
- SMITH F.D., PARKER D.M., KOLLER W. (1991): Sensitivity Distribution of *Venturia inaequalis* to the Sterol Demethylation Inhibitor Flusilazole: Baseline Sensitivity and Implication for Resistance Monitoring. Phytopathology, 81, 392-396.
- TÜRKOĞLU K. (1956): Studies on the Biology of *Fusicladium Dendriticum* Fungus Causing Damage in Konya-Ereğli Apples and Combat Facilities. The Turkish Ministry of Culture, Ankara Directorate of Agricultural Combat Institute, Vol. 6, Ankara, p. 135.



## THE INFLUENCE OF SOME SOWING TECHNOLOGY PARAMETERS ON WINTER WHEAT IN BANAT PLAIN

DRAGOȘ, MARCELA –PIRȘAN PAUL

Banat's University of Agricultural Sciences and Veterinary Medicine, Faculty of  
Agricultural Sciences,  
Timisoara, Aradului street, No. 119, RO-300645, ROMANIA  
[marceladragos@yahoo.com](mailto:marceladragos@yahoo.com)

### Abstract - Influence of some sowing technology parameters on winter wheat in Banat Plain

The two years experience was organized at the Didactic Faculty of Banat's University of Agricultural Sciences and Veterinary Medicine of Timișoara.

The research objectives are determining the influence of sowing period, row distance and sowing density on the winter wheat yield, the variety used in the study being Alex, a variety representative for the Western Romania.

The experimental plots were laid down after the subdivision of plots using three replications, under the climatic conditions of Timișoara. We monitored four sowing periods, three row distances and four sowing densities. In the experimental plots the technology applied was the classic one. The forecrop was corn. Wheat (*Triticum aestivum ssp. vulgare* L, var. *erythrospermum*) ensures approximately 35-45% of the world food necessity, specifically being used for producing bread and other flour products, as well as for domestic animal feeding. Thus, obtaining a high productivity is very important.

The average data obtained after two years indicate that the first period of sowing, 1-15 October, registered the best results in both years by experience, followed by the variant sown during 15 - 30 October. Periods three and four resulted in significant yield losses. The row distance of the best results was the control, followed by sowing at a row distance of 25 cm with a drop by over 80 kg/ha. The variant sown by scattering registered in both years losses by approximately 1500 kg/ha. Sowing density resulted in constant increases in the yield, from the control variant with a density of 400 seeds/m<sup>2</sup>, to 700 seeds/m<sup>2</sup>, increases were statistically significant.

**Key words:** row distance, sowing density, sowing period, winter wheat

## INTRODUCTION

Wheat (*Triticum aestivum ssp. vulgare* L, var. *erythrospermum*) is the most important cultivated plant, with the highest prevalence in the world, cultivated in over 100 countries. The importance of wheat (BĂLTEANU, 1988; CEAPOIU ET AL., 1984; MOGÂRZAN ET AL., 2004; MUNTEAN ET AL., 2008) is given by:

- Chemical composition of grains and the ratio of carbohydrates and protein requirements in relation to the human body;
- High ecological plasticity: it is grown in areas of different climates (subtropical, Mediterranean, oceanic, continental steppe), different types of soil regarding the level of fertility;
- Possibility of full mechanization of crop production;
- The possibility of transport and storage without spoiling.

Time of sowing has a major influence on the coming harvest, whereas it provides a good tillering plant in autumn, and accumulation of reserve substances needed in the cold season and good winter hardiness.

In recent years in Romania there has been a delay in winter wheat sowing, above the optimal time determined experimentally, recording crop losses (BĂLTEANU, 2003).

The main causes of late sowing is the most often, late harvest and late preparing of the land for sowing (PÎRŞAN ET AL., 2006).

Winter wheat sowing can be done with sowing machine, in rows, and only in rare cases, by spreading by hand or with special machines. The most common method of planting winter wheat in our country and the world is normal drill at a row distance of 12.5 cm (PÎRŞAN, 2003).

In some situations it is recommended to sow at larger distances, 25cm, as in wheat breeding and to ensure more rapid multiplication of seeds. The disadvantage of the longer distance is the reduced capacity of plants to fight against weeds (PÎRŞAN ET AL., 2006).

Because wheat is not thinning, the sowing density is to be determined based on the number of germinable seeds per square meter (g.s./m<sup>2</sup>).

Planting density is determined by the ability of tillering of the variety, the sowing time (compared with the optimal time), the quality of seedbed preparation, the soil moisture (humidity ensures a rapid springing) (BÂLTEANU, 1974, 1989, 2003).

## MATERIAL AND METHODS

The purpose of the research is to determine the influence of sowing time and row distance on the number of spikes and the number of plants per square meter.

The material investigated was the variety Alex (Lovrin 50), a variety created by S.C.D.A Lovrin and approved in 1994, representative for the western part of the country and with a production capacity of 7000-8000 kg/ha.

The research was conducted at the Teaching Resort of USAMVB Timișoara. Trials were of the polifactorial type with three repetitions. The sown experimental plot size is of 28.8 sqm (3.6 mx8 m). The harvested area was 20 sqm. In the study the following factors were taken:

- *Factor A* - period of sowing: A1 - 1-15 October ; A2 - 16-31 October ; A3 - 1-15 November ; A4 - 16-30 November.
- *Factor B* – row distance: B1 - 12.5 cm; B2 - 25 cm; B3 – Scattering.
- *Factor C* – sowing density: C1 - 400 g.s./m<sup>2</sup> ; C2 - 500 g.s./m<sup>2</sup> ; C3 - 600 g.s./m<sup>2</sup> ; C4 - g.s./m<sup>2</sup>.

In the experimental plot, the forecrop was corn, which is the most common forecrop for wheat.

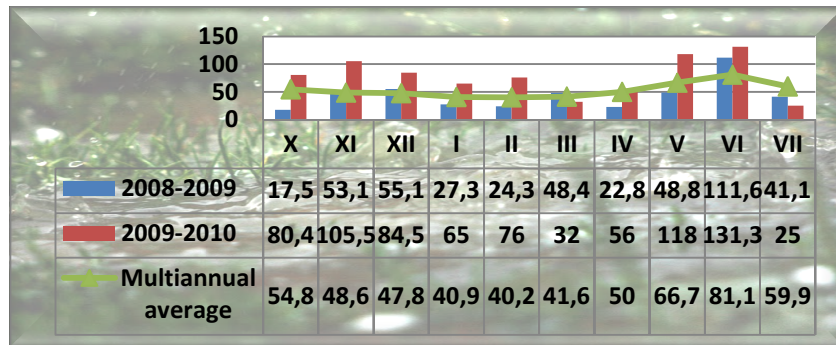
The technology applied in the experimental field was the classic one. After the harvest of maize a plowing with disc harrow perpendicular on row direction of corn was conducted to shred vegetal remains. Basic plowing was done at a depth of 22 cm. Seedbed was prepared by milling.

The fertilization recipe was N100 P50 K0 kg/ha. In autumn, together with the seedbed preparation, N50 P50 was applied from the fertilizer complex 20:20:0, and in the early spring the difference of N50.

Combating pests and diseases was made by 1 to 2 treatments in vegetation, depending on the conditions of that year. Weed control was based on existing weeds growing.

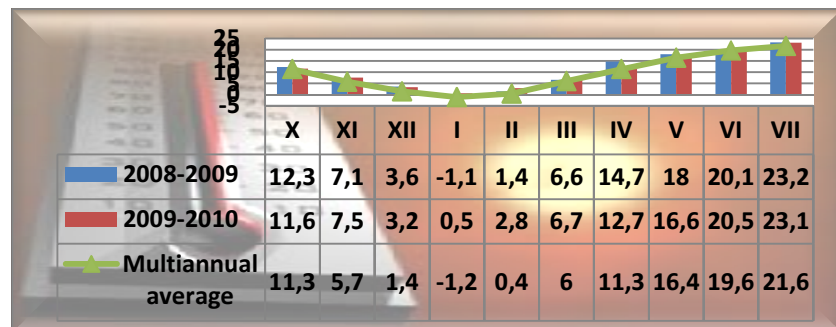
The amount of precipitation fallen in the two years of experience was different (Figure 1). The first year was dry, especially October, January, February, April and May recorded a lower amount of precipitation compared to the annual average. However, the amount of rainfall throughout the growing season provided a minimum of 400 mm.

The second year was characterized by heavy rainfall above the annual average, summing up over 700 mm precipitation throughout the vegetation period. Rainfall has not provided the required amount of browsing phase of maximum consumption of wheat, a crop with less uniform emergence in autumn and in summer even though there was the phenomenon of shriveled, formation and grain filling was not conducted in optimal conditions.



**Figure 1.** Monthly rainfall, annual and multiannual average (mm)  
 Meteorological Station Timișoara

Temperatures recorded in the two years of experience were slightly above the annual average during the growing season providing the needs for winter wheat (Figure 2). Temperatures from April to June, going through stages of spike emergence and filling of grains provided good condition for the crop.



**Figure 2.** Monthly temperature °C, annual and multiannual average  
 Meteorological station Timișoara

## RESULTS AND DISCUSSION

The lack of rainfall from the first year had a negative influence, the yield being relatively smaller than the productivity of the variety of 7000-8000 kg/ha. The results obtained in the first year of experience are presented in the Table 1.

**Table 1.** Yield obtained in year 2009

Factor A Sowing period	Factor B Row distance (cm)	Factor C Sowing density (g.s./m <sup>2</sup> )				Average factor A			
		400	500	600	700	Average	Difference	%	Significance
Period I	12.5	5,564	5,732	5,658	5,600	5,104.08	Mt.	Mt.	Mt.
	25	5,648	5,704	5,520	5,414				
	Scattering	3,834	4,012	4,217	4,346				
Period II	12.5	5,606	5,874	5,888	5,704	5,053.94	-50.14	99	-
	25	5,530	5,617	5,605	5,512				
	Scattering	3,616	3,849	3,861	3,985				
Period III	12.5	4,810	4,980	5,147	5,236	4,408.50	-695.58	86	00
	25	4,938	4,890	5,064	5,118				
	Scattering	2,900	3,112	3,229	3,478				
Period IV	12.5	2,870	3,146	3,398	3,548	2,996.25	-2,107.83	59	000
	25	3,010	3,160	3,284	3,340				
	Scattering	2,417	2,528	2,573	2,681				

DL 5%=226.47kg/ha, DL 1%=522.99kg/ha, DL 0.1%=1664.32kg/ha

Average factor C					Average factor B			
Average	4,228.58	4,383.67	4,453.67	4,496.86	Average	Difference	%	Significance
Difference	Mt.	155.08	225.08	268.28	4,922.56	Mt.	Mt.	Mt.
%	Mt.	104	105	106	4,834.63	-87.94	98	0
Significance	Mt.	X	XX	XX	3,414.90	-1,507.67	69	000

DL 5%=93.06 kg/ha,  
 5%=80.59kg/ha,  
 DL 1%=170.91kg/ha,  
 1%=148.01kg/ha,  
 DL 0.1%=378-68kg/ha  
 0.1%=327.95kg/ha

DL

DL

DL

The period of the sowing had a negative influence on yield obtained in the first year of experience, the difference ranging from 50.14 kg/ha up to 2107.83 kg/ha, compared to the control. The losses of harvest in the periods III and IV are statistically very significant and, distinct significant, respectively.

With regard to the row distance, crop losses range from 2% at 25 cm distance between rows, to 31% at sowing by scattering.

Increasing sowing density had a beneficial effect, the increase being over the statistically significant level in all variants.

In the second year of the experience there were more favorable climatic conditions for the culture, a fact reflected also in the yields obtained. Production results in experimental year 2009-2010 are provided in Table 2.

**Table 2.** Yield obtained in year 2010

Factor A Sowing period	Factor B Row distance (cm)	Factor C Sowing density (g.s./m <sup>2</sup> )				Average factor A			
		400	500	600	700	Average	Difference	%	Significance
Period I	12.5	6,347	6,548	6,510	6,596	5,985.83	Mt.	Mt.	Mt.
	25	6,440	6,578	6,314	6,212				
	Scattering	4,602	4,839	5,260	5,584				
Period II	12.5	6,280	6,634	6,692	6,650	5,964.25	-21.58	100	-
	25	6,415	6,610	6,664	6,518				
	Scattering	4,439	4,683	4,912	5,074				
Period III	12.5	5,570	5,892	6,147	6,318	5,344.67	-641.17	89	00
	25	5,432	5,818	5,954	5,810				
	Scattering	3,844	4,205	4,518	4,628				
Period IV	12.5	4,107	4,328	4,585	4,663	4,074.17	-1,911.67	68	000
	25	4,233	4,357	4,494	4,587				
	Scattering	3,110	3,224	3,514	3,688				

DL 5%=205.80kg/ha, DL 1%=475.25kg/ha, DL 0.1%=1512.38kg/ha

Average factor C					Average factor B			
Average	5,068.25	5,309.67	5,463.67	5,527.33	Average	Difference	%	Significance
Difference	Mt.	241.42	395.42	459.08	5,866.69	Mt.	Mt.	Mt.
%	Mt.	105	108	109	5,777.25	-89.44	98	0
Significance	Mt.	XX	XXX	XXX	4,382.75	-1,483.94	75	000

DL 5%=84.76kg/ha,

DL

5%=73.41kg/ha,

DL 1%=155.66kg/ha,

DL

1%=134.81kg/ha,

DL 0.1%=344.92kg/ha

DL

0.1%=298.71kg/ha

Sowing after 1<sup>st</sup> of November registered major losses of production compared to the control, ranging from 11% in the third period, up 32% in the fourth period, being statistically very or distinct significant, respectively.

With regard to the distance between rows, the loss of harvest was statistically significant, the deficit ranging from 89.44 kg/ha in the variant sown at 25 cm row distance up to 1483.94 kg/ha in the variant sown by scattering.

Higher densities resulted in increases in production, statistically assured as very significant, significant and distinct significant, the differences ranging from 241.42 kg/ha to 459.08 kg/ha.

## CONCLUSIONS

Research conducted in the experimental cycle of 2008-2009, aimed mainly at establishing a technology based on the common situations in which, for various reasons, we can not sow in the optimal sowing period. The influence of sowing period, sowing density and row distance on yield was monitored by using the wheat variety, Alex.

On the average of the two years of experience and sowing technology applied, harvest results showed the following:

- The first period of sowing, 1-15 October, gave the best results in both years of experience, followed by the variant sown during 15-30 October. Sowing periods No. three and four resulted in significant yield losses, thus the sowing of winter wheat is not recommended after 1<sup>st</sup> of November.
- The row distance with the best results was that of the control variant, followed by sowing at a row distance of 25 cm with a drop by over 80 kg/ha. The variant sown by scattering resulted in losses by approximately 1500 kg/ha both years.
- Sowing density registered constant increases of the in yield, from control variant, density of 400 g.s./m<sup>2</sup> to 700 g.s./m<sup>2</sup>, increases statistically assured as significant.

#### REFERENCES

- BÂLTEANU GH. (1974) Fitotehnie. Editura Didactică și Pedagogică, Bucuresti
- BÂLTEANU GH. (2003) Fitotehnie, Ed. Ceres
- BÂLTEANU GH., BÂRNAURE V. (1989) Fitotehnie, vol. I. Editura “Ceres”, București
- BÂLTEANU GH., BÂRNAURE V. (1988) Mica enciclopedie agricolă, Ed Științifică și Enciclopedică, București
- CEAPOIU N., BÂLTEANU GH., SĂULESCU N.N., NEGULESCU FLOARE, BĂRBULESCU AL. (1984) Grâul, Editura Academiei, Bucuresti
- CIULCĂ S. (2006) Metodologii de experimentare în agricultură și biologie, Ed Agroprint, Timișoara
- MOGÂRZAN AGLAE, MORAR G., ȘTEFAN M. (2004) Fitotehnie. Editura “IonIonescu de la Brad”, Iași
- MUNTEAN L.S. (1995) Mic tratat de fitotehnie, vol.I, Cereale și leguminoase pentru boabe, Ed. Ceres
- MUNTEAN L., CERNEA S., MORAR G., DUDA M.M., VÂRBAN D.I., MUNTEAN S. (2008) Fitotehnie. Editura “Academic Pres”, Cluj-Napoca
- PÎRȘAN P., DAVID GH., IMBREA FL. (2006) Fitotehnie, Eurobit
- PÎRȘAN P. (2003) Tehnologia plantelor de câmp, Editura Agroprint, Timișoara
- XXX – Administrația Națională de Meteorologie: Stația meteorologică: Timișoara

***POSTER PRESENTATION***

**Moderátorok/Moderators:**

Prof. Dr. Tanács Lajos  
Prof. Dr. Ismet Yildirim

**Secretary:**

Molnár Tamás

## **POSSIBILITIES OF QUALITATIVE RISK ANALYSIS**

**VIDA ADRIENN**

Szent Istvan University, Faculty of Economic and Social Sciences  
Pater K. str. 1. , 2103 Gödöllő, Hungary  
Vida.Adrienn@gtk.szie.hu

### **ABSTRACT – Possibilities of qualitative risk analysis**

Every project or program has to deal with risks which jeopardize the success of it. The nature and the source of a risk could be clear and easily defined but often they are complex or covert. To value a risk among the factors that intensifies the uncertainty of the achievements of an activity is one of the hardest steps to make, but there are the quantitative and qualitative risk assessments. The most popular and precise method during economic calculation is the Monte Carlo analysis as quantitative approach but in many cases its adaptation is not easy because of the absence of a required database. An other way to calculate with uncertainty during investment appraisal studies is the sensitivity analysis that shows how the (discounted) net can change present value if one element would increase or decrease a hypothetical percent. The most important deficiency of it is that there are not objective explications behind the value of percents or other numerical valuation but sometimes it is not possible. It can be valued by a lot factors (as stakeholders attitude) and represented during feasibility studies by qualitative risk analysis.

**Key words:** qualification, risk, qualitative risk assessment methods, renewable energy sources, environment analysis

### **INTRODUCTION**

The risk analysis can originate in two main sectors: IT and bank or financial sector. The latter uses the wide scale of quantitative risk assessments to analyze financial portfolios and the first one uses additionally qualitative methods and the keys to connect the two types.

According to some literature “the most straightforward solution will be to import data for quantitative one from qualitative risk results”. (KAPUSCINSKI ET AL., 2007; WORLD BANK, 2010)

Still the biggest question is, which sector can offer a better way to renewable energy sources which is supported mainly by the EU and national governments budget. However the consumption characteristically depends on choice which is based on the participation in the supply chain. After identification of attitude or motivation, it can be possible to represent qualitative phenomena in economic calculation through qualitative risk analysis.

Traditionally the IT and the energy sector are different but the theoretical frames of methods are usable because these assessments are often suggested by governments as general state of the art achievements.

The definition of risk can be simply “an effect of uncertainty on objectives” (ERA NET, 2009) or more complex “uncertainty which effects undesired event and there is often economic consequences”.

An other question is the difference between risk analysis and risk management which is defined by two main conceptions: on one hand these two actions completing with risk



evaluation are a cycle wherein every component relate and interact. (BELL-GLADE, 2004).

As it can be seen on the *Table 1.*, there is numerous approaches to define their connection and parts or actions. Generally, the risk analysis is a part of risk management, it focuses on one specific phase, tries to handle one very well identified problem that can originate to one stakeholder and the useable method during the process is determinate. In front of analysis, the risk management is multidisciplinary and it resides in every phase of project or program. On the centre of management is the whole organization with multi or all stakeholders and it can be characterized by multi problem approach.

*Table 1.* represents three European partition of way to handle risk. Basically the definition depends on the focus of project and the expected and required result. For example, in case of climate change the main problem is to identify and to describe the uncertainties and theirs effects but because of sometimes inconsistent scientific indicators the quantitative calculations are not realizable. And an additional part of project likes it, to reflect the financial consequences is rarely required by government decision makers.

**Table 1. Relation of risk management, analysis and its possible contents**

		Swedish Road Administration		Four steps	Five steps
		Stage	Part		
<b>Risk management</b>	<b>Risk analysis</b>	Risk identification	– Inventory	1. Determination of analysis objectives,	1. Describe analysis object, purpose and criteria for assessment
			– Description		
	Risk evaluation	– Rough estimate	3. Risk classification	3. Assess the risk	
	– Order of precedence				4. Propose measures
		– Calculation			
		– Action proposal	4. Determine risk remediation measures		
	Implementation	– Decision			5. Documentation
		– Execution			
		– Follow-up			
		– Evaluation			

Source: ERA NET, 2009; p. 15, 17, 19.

The selected method should be compatible with the database and it has to allow further calculations if it is required. In the literature it can be available three elementary group of methods. The most objective is the quantitative risk analysis which is use wide scale of mathematical and statistical frame of theories. If the information about the project, the organisation or the environment where the object of analysis exists is not numerical

or it can not be transformable to number, use of the qualitative one is better decision. Selected combination of two previous and less numerically intensive method, it is so called modified qualitative or semi-quantitative analysis.

The database can made from questionnaire survey or one of possible environment analysis as RISMAN method that it is used during environmental projects, as climate change projects. It advises four steps to realize risk management and an underlineable part of it the risk matrix that base on stakeholder analyses or RISMAN-glasses. (Table 2., ERA NET, 2009)

### METHODS OF QUALITATIVE RISK ANALYSIS

To identify and to classify risks in a systematic way which bases on stakeholder analyses or 7 identified aspects it is useable the RISMAN-glasses. (Table 2.) Its components represent strong similarity to generally used PEST analysis or its variations. The only difference is the organisational aspect but to solve this difference it can be applied SWOT analysis covering the internal environment of enterprise or program.

**Table 2. Compare of RISMAN-glasses and traditional PEST analysis**

RISMAN-glasses	PEST analysis (also in other form)	
Political/governmental	Political/governmental	<b>PESTL</b> <b>STEEP</b>
Financial	Economic	
Social	Social	
Technical	Technical	
Legal	Legal	
Spatial planning	Ecological	
Organizational		

Source: Own construction by ERA NET, 2009 and Salamonné, 2000

To determine the risk level, the most known tool is the Risk Matrix based on different dimensions. It shows one possible combination of result of multiplication of probabilities and strength of incidents occurrence (Table 3.)

**Table 3. Risk Level Matrix**

Probability of threat appearance	Results		
	Low (10)	Medium (50)	High (100)
High (0,1)	Low	Medium	High
Medium (0,5)	Low	Medium	Medium
Low (0,1)	Low	Low	Low

Source: ROT, 2008

Through this matrix the whole risk can be defined for every identified threat. An other way to evaluate the risk of a program or project is to use risk ranking along the identified risk factors and project versions or activities within one project (Table 3.)

**Table 4. Risk factor evaluation matrix**

Risk factor	Activities of a project or project possibilities			Risk factor total
	A	B	C	
I.	Low (1)		None (0)	
II.		Medium (2)		
III.		High (3)		
Activity total				

Source: Kindinger-Darby, 2000

The final step to summarize every column and row that shows the relevance of not only the risk factors but also the place of possible activities or projects.

It is also used graduation is the very high, high, medium, low, very low ordinal scale and the numerical scale that can be linear or non-linear to show the individual preference of project or organisation.

ACCORDING SEGUDOVIC (2006) it can four main type of Risk Assessment Matrix and a modified one reducing the disadvantage of previous ones.

**Table 5. Qualitative risk assessment matrix**

Method	Dimension horizontal	Dimension vertical	Assessed risk
Predefined value matrix	Threat Vulnerability	Resource value	$R = f(AV_I, V_{I,P}, T_{I,V,P})$ $R = AV + V + T$
Threat ranking by risk evaluation	Impact, Realisation probability, Risk, Threat ranges	Threat	$R = f(I_{AV,T}, P_{V,T})$ $R = I * P$
Assessment of the probability of a threat being realized and it's consequences	M1: Threat Vulnerability	Realisation probability	$P = f(V, T)$ $R = f(P_{V,T}, AV_{I,T})$
	M2: Resource's value		$P = V + T$ $R = AV + P = AV + V + T$
Acceptable and unacceptable risk separation	Resource's value	Realisation probability	Risk can be acceptable (0) or unacceptable (1)
Modified risk assessment matrix	Probability Consequence	Resource value	$R = f(AV, P_T, I_T) = f(V)$ $R = AV * P_T * I_T$

Source: Own construction by Segudovic, 2006

As it can be seen the methods develop to the usability for quantitative assessment and take into the analysis other and other element to make more and more complex them.

The final step of risk analysis to refer 1. combinations of probability and impact result and 2. the own preference of enterprise which is signed by colours and they can help to make risk response actions.

## CONCLUSION

This paper has represented and summarized the most important qualitative risk assessment methods and their content with the possible overlaps.

In many cases the expectation is only the identification of key risk factors but if the investment portfolio contains private capital, it is indispensable to consider them during economic calculations. Applying the qualitative risk assessment methods the most important, not numerical uncertainty factors became expressible in standard formulas as for example in net present value or cost-benefit analysis. Finally it can be revised as the weakest area of project documents (BELLI – GUERRERO, 2009).

However, it is typically problematic that the base information of qualification shows only a present status of the topic and the objectivity and replicability is controversial. This doubt is not reasonable in the Hungarian energy sector because it is a developing sector in view of renewable energy sources. The information level of consumers has been better than it was in 2006 but the share of renewable energy sources in total energy consumption does not increase significantly.

The most important advantage of the presented methods is the flexibility because there are used intervals which can represent not only the difference between qualitative indicators without information loss but also their prioritization.

The input of qualitative risk analysis could be the result of traditional environment analyses, as PEST and SWOT analysis. This is a very important support for those interested projects in use renewable energy sources which know well their environment and the mode of action that is why they can classify these uncertainties on ordinal scale. These results are useable not only independently but also a database to refine and to make more complex previous Cost-Benefit Analysis or Life Cycle Analysis.

## REFERENCES

- BELL, R – GLADE, T. (2004) “Quantitative risk analysis for landslides – Examples from BÍLDUDALUR, NW-Iceland” , *Natural Hazards and Earth System Sciences* 2004:4, p. 117–131.
- BELLI, P. – GUERRERO, R. P. (2009) “Quality of Economic Analysis in Investment Projects Approved in 2007 and 2008” in *The World Bank (2010) Cost-Benefit Analysis in World Bank Projects*, Washington. p. 22-23.
- LÖFROTH, H. – ENNESSER, Y. – BLES, T. – FALEMO, S. (2009) “Existing methods for risk analysis and risk management within ERA NET ROAD countries – applicable for roads in relation to climate change”, *ERA NET ROAD*, p. 15,17,19.
- KAPUSCINSKI, A.R. – HAYES, K.R. – LI, S. – DANA, G. (editors, 2007) *Environmental Risk assessment of Genetically Modified Organisms*, CAB International, London.
- KINDINGER, J. P. – DARBY, J. L. (2000) “Risk Factor Analysis – A New Qualitative Risk Management Tool” *Proceedings of the Project Management Institute Annual Seminars and Symposium*, Houston, USA
- ROT, A. (2008) “IT Risk Assessment: quantitative and Qualitative Approach” *Proceedings of the World Congress on Engineering and Computer Science*, San Francisco, USA
- SALAMONNÉ, H. A. (2000) *Jövőkép- és stratégiaalkotás*. Kossuth Kiadó, Budapest
- SEGUDOVIC, H. (2006) “Qualitative risk analysis method comparison”; [http://www.infigo.hr/files/INFIGO-MD-2006-06-01-RiskAsses\\_ENG.pdf](http://www.infigo.hr/files/INFIGO-MD-2006-06-01-RiskAsses_ENG.pdf)

## QUALITY CHARACTERS OF WINTER WHEAT – AMARANTH FLOUR

BARANCSI ÁGNES

Szolnok University College  
H-5000 Szolnok, Tiszaleti sétány, Hungary  
barancsi@szolf.hu

### **ABSTRACT – Quality characters of winter wheat - amaranth flour**

Amaranth is quite nutritious. It contains high amounts of vitamin C, iron, carotene, calcium, folic acid. Both the leaves and seeds contain protein of an unusually high quality. The protein is high in the amino acid lysine, which is the limiting amino acid in cereals like maize, wheat and rice. In our work we have analysed alveographical and extensigraphical parameters, wet gluten content, gluten expansiveness and baking parameters of winter wheat – amaranth flour.

**Keywords:** winter wheat, amaranth, alveographical and extensigraphical parameters, wet gluten content, baking value

### INTRODUCTION

Grain amaranth is a new crop that is in its adolescence. The cultivation and utilization of grain amaranth will continue to increase as more information is developed to exploit the market niches for high quality protein foods. This extra information can give us help to select special quality types for wheat growing and quality the different export rate. Amaranth has been cultivated for 8,000 years in Aztecs word (ROBERT, 2002). Now grain amaranth is known hardly in agriculture fields in North America and Europe, but range of amaranth products are sold in health food shop in Europe (AUFHAMMER, 2000). CHATURVEDI ET AL. (1997) according to the protein is high in the amino acid lysine, which is the limiting amino acid in cereals like maize, wheat and rice. The protein is relatively rich in the sulphur-containing amino acids, which are normally limiting in the pulse crops, it has not gluten contain.

The quality of wheat is a complex concept (MATUZ ET AL., 1993; VÉHA AND GYIMES, 1999; SIPOS ET AL. 2006). Nowadays, there is a growing claim for the special rheological examinations, mostly for the extensibility and resistance of extension parameters both in the international and most of the Hungarian wheat export markets. The alveograph is suitable for the examination of rheological characteristics which characterises the extensibility of dough (RAKSZEGI ET AL., 2005). VIDA ET AL. (1996) analysed the relation between the alveographical and other baking industry quality characteristics of 19 winter wheat varieties and they established the close positive correlation between the alveographical G, W and gluten index with statistical method. The alveographical G and W are in satisfactory significant relation with the wet gluten content (TANÁCS ET AL., 2008).

MATUZ ET AL. (1999) established the values and the value relation of 13 parameters (among others alveographical P, L, P/L, W, G wet gluten content, spreading of wet gluten) of 29 winter wheat varieties produced in 1995, 1996 and 1997. The aim of their

analyses was to define the parameter that has the closest correlation with the alveographical W.

## MATERIAL AND METHODS

The winter wheat and grain amaranth samples came from mill industry from 2009 cropping year, these are industrial flour samples. We made alveographical examinations with SMS2 texture analyser (ISO 5530-4:1991) and extensigraph research with Brabender extensigraph (ISO 5530-2:1997). Wet gluten content and gluten expansiveness were analysed with MSZ 6369/5-87 standard. The parameters were analysed in Laboratory of ABO-MILL ZRt. in Törökszentmiklós, Hungary (*Table 1.*).

**Table 1. Methodes and instruments in analysis**

Examination	Method	Instrument
Moisture content	MSZ 6369/4-1987	LP 303 type dryer machine
Examination by Farinograph	MSZ 6369/6-1998	Brabender farinograph
Extenziographical examination (Brabender)	ISO 5530-2:1997	Brabender extensigraph
Kneading for Alveographical examination (Dobraszczyk) SMS2 texture analyser	ISO 5530-4:1991	Chopin MR 2L Rotary Mixer
Alveographical examination (Dobraszczyk) SMS2 texture analyser	ISO 5530-4:1991	SMS2 Texture Analyser (Dobraszczyk) D/R system
Wet gluten content	MSZ 6369/5-87	Glutomatic
Gluten expansiveness	MSZ 6369/5-87	Glutomatic

## RESULTS AND DISCUSSION

During examination we used the following mixing ratio: control winter wheat flour, 95% winter wheat flour+5% amaranth flour, 90% winter wheat flour+10% amaranth flour, 85% winter wheat flour+15% amaranth flour, 80% winter wheat flour+20% amaranth flour. Table 2. shows the wet gluten content and gluten expansiveness. Parameters show, that increasing of quantity of grain amaranth resulted decrease of wet gluten content, but gluten expansiveness not changed.

During measuring I specified alveographical W, P, L and P/L value. I analysed three parallel measurings. Table 3. shows the average values. We can see in Table 2., that

increasing of quantity of grain amaranth resulted decrease of W, P and L parameters. According to the requirement of the French baking industry, various bread types were determined. Cardinal parameter is the P/L. P/L values of cracker and paste are from 0,4 to 0,5 values, in traditional bread  $0,6\pm 0,1$  and in brioche  $0,7\pm 0,1$ . The data in *Table 2.* show high values.

**Table 2. Wet gluten content (%) and gluten expansiveness (mm/h) parameters**

mixture	wet gluten content (%)	gluten expansiveness (mm/h)
winter wheat flour	29,4	1,5
95% winter wheat flour+5% amaranth flour	29,0	1,5
90% winter wheat flour+10% amaranth flour	25,9	1,5
85% winter wheat flour+15% amaranth flour	25,05	1,5
80% winter wheat flour+20% amaranth flour	20,20	2,0

**Table 3. Alveographical parameters with SMS2 texture analyser**

Mixture	W ( $10^{-4}$ J/g)	P (mm)	L (mm)	P/L
winter wheat flour (control)	233	110	84	1,32
95% winter wheat flour+5% amaranth flour	201	122	51	2,44
90% winter wheat flour+10% amaranth flour	168	121	36	3,41
85% winter wheat flour+15% amaranth flour	140	118	28	4,44
80% winter wheat flour+20% amaranth flour	139	153	18	8,62

**Table 4. Extensigraphical parameters with Brabender extensigraph**

Mixture	energy ( $\text{cm}^2$ )	resistance to extension (BU)	extensibility (mm)	extensibility ratio value
winter wheat flour	92	336	151	2,2
95% winter wheat flour+5% amaranth flour	79	332	142	2,3
90% winter wheat flour+10% amaranth flour	66	278	149	1,9
85% winter wheat flour+15% amaranth flour	54	278	128	2,2
80% winter wheat flour+20% amaranth flour	43	278	113	2,5

I specified extensographical energy, resistance to extension, extensibility and extensibility ratio values, too. The Table 4. show, that increase of quantity of grain amaranth resulted in the decrease of energy, resistance to extension and extensibility parameters.

In *table 4.* we can see, that every parameters decreased with increase of quantity of grain amaranth.

The baking dates show standard level in *Table 5.* Amaranth flour increased water absorption.

**Table 5. Baking parameters**

mixture	baking value		water absorption (%)
winter wheat flour (control)	65,70	B1	60,60
95% winter wheat flour+5% amaranth flour	64,20	B1	61,00
90% winter wheat flour+10% amaranth flour	65,90	B1	62,00
85% winter wheat flour+15% amaranth flour	65,20	B1	63,00
80% winter wheat flour+20% amaranth flour	65,90	B1	64,00

## CONCLUSIONS

In our present work we have analysed especially rheological quality parameters of mixed grain amaranth and winter wheat. Amaranth flour decreased extensographical, alveographical and wet gluten content, it increased water absorption. The following parameters were standard: baking value and wet gluten expansiveness.

## REFERENCES

- AUFHAMMER, W. (2000): Pszeudocereáliák: quinoa és amarantusz hasznosítás és termelés. Új mezőgazdasági termények: a mezőgazdasági termelés diverzifikálása tudományos tanácskozás. Szent István Egyetem, Gödöllő.
- CHATURVEDI, A., SARIJINI, G., NIRMALA, G., NIRMALAMMA N., SATYANARAYANA, D. (1997): Glycemic index of grain amaranth, wheat and rice in NIDDM subjects. *Plant Food for Human Nutrition*, 50, 171-178.
- ISO 5530–2. (1997): Wheat flour (*Triticum aestivum* L.)–Physical characteristics of doughs–Part 2: Determination of rheological properties using an extensigraph.
- ISO 5530–4. (2002): Wheat flour (*Triticum aestivum* L.)–Physical characteristics of doughs–Part 4: Determination of rheological properties using an alveograph.
- MATUZ, J., KERTÉSZ, Z., ÁCS, ZS. (1993): Inheritance of bread making quality in crosses of Hungarian and North-American winter wheats (*Triticum aestivum* L.). *Cereal Research Communications*, 21. 1. 39-43.



- MATUZ, J., MARKOVICS, E., ÁCS, E., VÉHA, A. (1999): Őszi búza fajták lisztjének tulajdonságai közötti összefüggések vizsgálata. *Növénytermelés*. 3. 243-254.
- MSZ 6369/4-1987. Lisztvizsgáló módszerek. Nedvességtartalom meghatározása.
- MSZ 6369/6-1998. Lisztvizsgáló módszerek. A vízfellevő-képesség és sütőipari értékszám vizsgálat.
- MSZ 6369/5-87 A sikér vizsgálata.
- RAKSZEGI, M., LÁNG, L., BEDŐ, Z. (2005): Tészta nyújthatóság vizsgálatok a búzanemesítésben. *Martonvásár, 2005/1.* 12-13.
- ROBERT, M. (2002): Grain amaranth a lost crop of the amaranth. *Jefferson Institute, Columbia, 10/02,* 1-4.
- SIPOS, Á. TÓTH, É. MARS, Z. GYŐRI Z. (2006): Effect of weather conditions on the alveographic W value of winter wheat. *Cereal Research Communications*, 34. 1. 657-660.
- TANÁCS L., MATUZ, J., PETRÓCZI I. (2008): Correlations between wet gluten content, valorigraphic value and alveographic parameters of winter wheat. *Cereal Research Communications*, 36. 89-95.
- VÉHA, A., GYIMES, E. (1999): Investigation Of Kernel Hardness In Winter Wheat Varieties With Hammermill. *Cereal Research Communications*, 27. 4. 463-470.
- VIDA, GY., LÁNG, L., BEDŐ, Z. (1996): Őszi búzák alveográfus és más sütőipari minőségi tulajdonságai közötti összefüggések elemzése főkomponensanalízissel. *Növénytermelés. MTA Mezőgazdasági Kutatóintézete, Martonvásár.* 45.56. 435-445.

## **THE TRADITIONS AND HABITS OF ROMANIAN PEOPLE FROM MÉHKERÉK, HUNGARY COUNTRY)**

**BLAGA DIANA\*, NICOLETA MATEOC-SÎRB\*, CAMELIA MĂNESCU\*, GAIȚĂ  
RUXANDRA\*, MIROSLAV RAICOV**

Banat'S University Of Agricultural Sciences And Veterinary Medicine Timișoara  
Faculty of Agricultural Management  
diana.blaga@uex-usamvbt.org

### **ABSTRACT - The traditions and habits of Romanian people from Méhkerék, Hungary country)**

Romanians in Hungary have never belonged to the Romanian state, so they built its identity on language, religion and traditions, habits, trying to keep specific. In the identity preservation the situation of Romanian communities in Hungary differ from one place to another. Because their life was carried out according to historical and social conditions of the locality where they lived, Romanian communities are in different phases in terms of native language proficiency and assimilation process. Romanians in Hungary have long maintained the identity of the settlements with mixed population from Bechiș County, where live together with Hungarians, Serbs, Germans, Slovaks and Gypsies.

**Keywords:** Wedding, Christmas carols, traditions, customs, Romanian community

## **INTRODUCTION**

Micherechi, is known as the only purely Romanian village with a population of Hungary, where people know each of the local dialect.

Micherechi village is the village where from the 1960 is found in the center of Romanian research in Hungary- being considered- with all local and ethnic traits - a real curiosity.

## **MATERIAL AND METHOD**

To achieve the objectives of this paper, the working method used were: study data collection, processing, analysis and interpretation.

To identify Romanian traditions and customs of the community from Micherechi I appeal to the analysis of the rural community from Micherechi namely: Data collection was done so in consultation with several existing bibliographic sources and through field research. The study of bibliographical sources and field research were conducted in the library of Szeged Hungary and in the Micherechi village, with the occasion of the doctoral internship carrying between 1 November 2009 to 30 June 2010, at the Faculty of Agriculture – Hódmezővásárhely, as part of the University of Szeged.

## RESULTS AND DISCUSSIONS

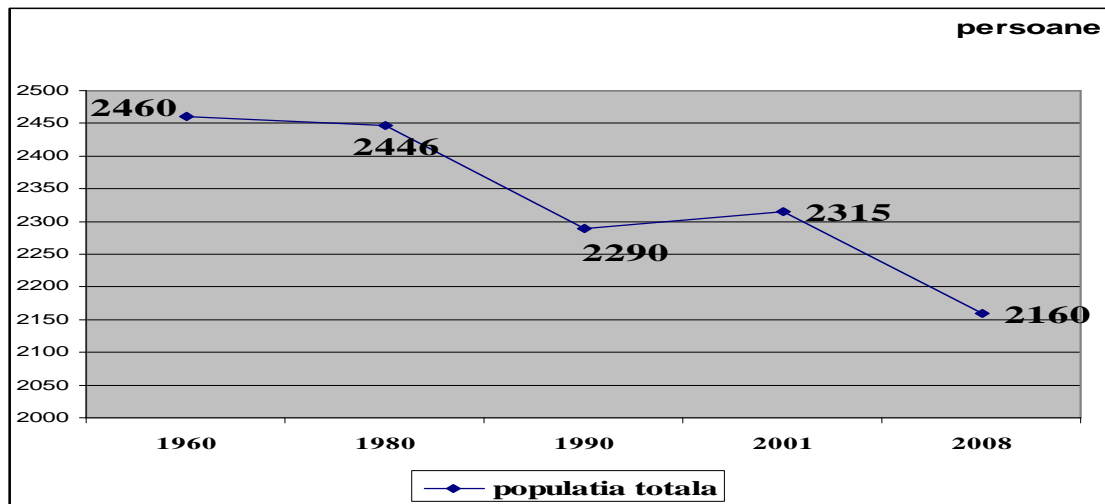
In 2008 the total population of the Micherechi village was 2160 people. According to statistics data the population of Micherechi has fluctuated during 1960-2008 (*table 1*).

**Table 1. Evolution of Micherechi village between 1960-2008**

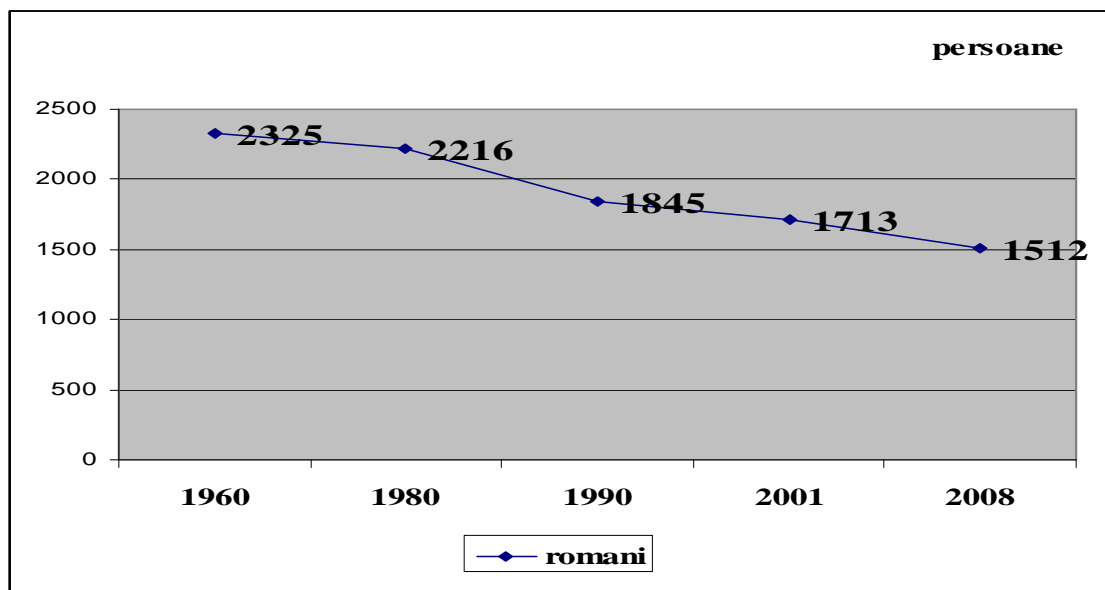
Year	1960		1980		1990		2001		2008	
	nr.	%	nr.	%	nr.	%	nr.	%	nr.	%
<b>Total</b>	2460	100	2446	100	2290	100	2315	100	2160	100
<b>Romania</b>	2325	94,5	2216	90,6	1845	80,6	1713	74	~1512*	~70*

Note: \* 2008 estimates data

Source: Data processed according to BERÉNYI MARIA, MIHAELA BUCIU, *Publicație a Institutului de Cercetări al Românilor din Ungaria, MICHERECHI – Pagini istorico- culturale and* <http://hu.wikipedia.org/wiki/M%C3%A9hker%C3%A9k>



**Fig. 1. Evolution of the total population in the village Micherechi**



**Fig. 2. Evolution of Romanian nationality in the village Micherechi**

According to the graphic we can observe that the majority of the population from Micherechi has Romanian nationality but the evolution during 1960-2008 is downward. The Romanian community from Micherechi has retained his habits since the most remote times, when they established their places today.

Come and sit in the village, hamlets and dwellings, of the area between the Black and the White Criş have brought with them a language - default a spiritual wealth linkedit, which have maintained a strict until the mid-twentieth century.

This phenomenon partly explained by the fact that of all its socio-cultural manifestations in general habits proved to be the toughest time.

In traditional culture - whether it's calendar habits, whether we are dealing with traditions related to the main moments of family life, implicitly covers all the so-called traditional culture- Micherechiul left us an resembles a rich and varied heritage.

The name of the village came to be known in Hungary and traditional dances put on stage in various choreographers.

Romanian dances from Micherechi are not only repertoire of dance team of the town founded in the 1940s, but are spread by different professional ensembles, reaching a national reputation.

### **Family cycle habits**

The social life of young people from Micherechi a major role - they had habits as: evening sitting of village women, opportunities for working together, games held on Sundays year and holidays.

The game is not meant only for entertainment but an opportunity had an important role in linking knowledge and prediction of future marriages.

We can say with certainty that during the micherechene wedding there are many private note: wedding celebration represent even today the richest folk event known of all Romanians in Hungary

Here the wedding combines a perfect harmony with dance music, poetic, dramatic scenes populated with some solemn moments of sadness of parting.

The suite ceremony from Micherechi, even today, has retained a unique scenario, not only because it takes place according to ancient traditions, but also by the fact that here were rigorously maintained and a series of intermediate sequences splendid, even if some of them are borrowed - and adapted to the site - the vast range ungurimii same gender, who live in the bosom of centuries to come.

Of course, over the centuries, the functionality of sequences could happen - and probably have spent - some changes, but they could not be essential- decisive inferred from the unparalleled wealth of features "pure Romanian" certified yet., there are differences between the wedding from micherecheana and the wedding from giulana, săcăleana, aleteana, băţianiana and others.

In Romanian villages mentioned, for instance, the wedding last, often a day or two at best, say three- Saturday preceding, Sunday Gala and Monday party, - in Micherechi this socio-folk event last one week.

The funeral ceremony of Romanians Micherechi is as rich in customs and beliefs, like the Romanians from Romania, which are rooted in mystery and fear a transcendental world of the dead, of the world after death.

At Micherechi means someone dead if the dog yelp, the owl sing, the fowl sing with the cock, a star falls, doors or furniture pieces snap, the mirror on the wall falls.

In the circle of Romanians from Micherechi "dead man's complaint" as of all Romanians regardless of location, is an old tradition, practiced today, which is based on faith in the survival of the soul of the deceased.

By the early 1990s was done alms immediately after the funeral at the house of the dead, where those present were feast with brandy, bread and bacon. Currently alms dead acquired other connotations due to infusion of urban modernism.

### **Holiday calendar**

In Micherechi habits Holidays, especially those of Christmas, Easter and Pentecost, is practiced today following the Romanian traditions.

The largest celebration of the winter cycle is Christmas, festival dedicated to the solar god of the winter solstice period over which overlapped the Nativity of Jesus Christianity.

Christmas is anticipated during the Advent period, but this is not represented by such strict abstention from food such as Lent period.

The most common Christmas tradition practiced in his simplified form even today is caroling „*walking with cucuțare*”.

The carolers are usually organized in groups of male or groups of children, interpreting from house to house, magical texts with formulas ceremonial, wearing with them ritual props.

During the Easter holidays the most significant is Easter Sunday, celebration at different dates, when there is surrounding the church.

According to writings about the Easter holidays, in earlier times the Christians celebrated the Resurrection with a procession through a larger area in order to keep the territory surrounded by evil spirits and evil nature.

The Red Egg occupy a central role in Easter traditions. The eggs are colour with onion leaf and green wheat, and decoration was done with the leaves application on the eggs, before being boiled in colored solution, as their place to stay white.



**Traditional Easter Eggs from Micherechi Traditional Easter Eggs from Crisana area**

Music and dancing are an important means of expressing the feelings, aspirations, human aspirations, influenced his spiritual life.

Folk music includes all thoughts and concerns, reflecting the social, spiritual emotional problems which crystallized emotional richness of the community, as well as the personal lives of the interpreter. Interpreters popular songs and dances were inspired by their own experiences, and the opportunities to sing and dance were numerous: Romanian round dance, wedding, evening sitting of village women.

In addition to numerous places reserved specifically for parties, people from villages at any time less or more important in their lives gathered and with the musicians together begin to dance.



### Popular Costume from Micherechi area      Popular Costume from Crisana area

Micherechi **musical folklore** is characterized by beauty and melody with a through a varied pace.

The life particularity and the local traditions have given to the micherechean song specific feature of content and form, clearly distinguished from other Romanian cities.

Micherechiului musical tradition belongs to the Bihor area folk.

Composer *Bela Bartok*, researching the folk music from Bihor excited about their beauty, said: „ *We must be seen the Romanian folk music from Hunedoara and particular of Bihor, as the more typical Romanian folk music*”.

At Micherechi they say: „*Come and horim!*”, as in other villages of Bihar.

Grouping the micherechean folk music heritage in terms of musical categories seems to be the most comprehensive.

I found the songs in the following categories: Romanian round dance (*horă*), carol (*corindă*), disenchantment after dead (*bocete*).

Following the research conducted and presented in this paper on Micherechi village was made an inventory of popular customs and traditions relating to family life and community celebrations of the Romania calendar countries who live in this locality, all this being found in Bihor area.

We mention that these customs and traditions are preserved today in the neighboring towns of Romania especially in the former region Crisana Romania, which includes the locality of Arad, Bihor and Satu Mare.

## CONCLUSIONS

- Over the time (1960-2008) Micherechi village population was dominant population of Romanian nationality (Romanian 94.5% in 1960 and about 70% in 2008) who have kept the culture, traditions and customs.
- The Romanians people from Hungary have found to keep a continuous form of affirmation and reaffirmation of national consciousness.
- We can speak, about a attempt more or less conscious of recovering the cultural memory.
- Taking into account the situation and the facts, today we can not talk, in the true sense of the word of a traditional culture but in the last years is seen more pronounced the desire to revive and introduce in some events (wedding) for old items, so causing the extension of their existence.
- Most traditions and customs presented to the Romanians people from Micherechi is kept today in Romania, especially in Cris country.

## REFERENCES

- BERÉNYI MARIA, MIHAELA BUCIU, Publicație a Institutului de Cercetări al Românilor din Ungaria, MICHERECHI – Pagini istorico- culturale
- EMILIA MARTIN, ELENA RODICA COLTA (2008) Publicația Societății Etnografică Maghiară, DIN TRADIȚIILE POPULARE ALE ROMÂNILOR DIN UNGARIA, Ed. Magyar Néprajzi Társaság, Budapest
- EMILIA MARTIN, EDDA ILLYÉS (1997) Publicația A Asociației Etnografică Maghiară, DIN TRADIȚIILE POPULARE ALE ROMÂNILOR DIN UNGARIA, Ed. Magyar Néprajzi Társaság, Gyula.



## **HEALTHY FOOD, LIVING FOOD**

**BLAGA DIANA\*, NICOLETA MATEOC-SÍRB\*, CAMELIA MÂNESCU\*, MORARIU  
LUCIAN\*, GAIȚĂ RUXANDRA\***

\* Banat's University of Agricultural Sciences and Veterinary Medicine, Timisoara –  
Faculty of Agricultural Management  
diana.blaga@uex-usamvbt.org

### **Abstract - Healthy food, living food**

We can not talk about the future, without knowing the current issues of agriculture and food crisis. Humanity as a whole faces a number of serious problems - the economic crisis, fast population growth, natural environmental degradation, energy and raw materials, and their unresolved threat the existence of life on earth. Agriculture and Food is a global problem with the most profound and complex implications and effects on the economic and social condition of contemporary political. Food and agriculture are vital necessities and activities are essential elements without which human life is conceivable. Food products are life-giving, hope and net day security.

**Keywords:** food, processed products, organic agriculture

## **INTRODUCTION**

Currently about 20% of the over 6 billion inhabitants of the planet suffer from absolute poverty primarily for the lack of food security, and over 800 million people worldwide suffer from chronic undernutrition in rural areas of the developing countries. These data point to the existence evidentă a global food crisis and the rapid population growth that continues to widen the demographic explosion of the crisis. These data reveal the existence of a global food crisis and the fast population growth respectively the demographic explosion continues to deepen this crisis.

## **MATERIAL AND METHOD**

To achieve the objectives of this paper, the working method used were: study data collection, processing, analysis and interpretation.

In the achievement of this paper as working methodology I started consulting the statistical data from the "Statistical Yearbook of Romania" on the agri-food sector and more specifically the evolution of the average food consumption per inhabitant in Romania in the 1990-2009.

With the processed data and other information sources specify on the bibliography I analyzed: the food preservation methods and their influences on human health and organic production systems as a production source of clean food.

## **RESULTS AND DISCUSSIONS**

Over the time, the agricultural sector has enjoyed a positive image among consumers. The situation has changed in recent years, with unprecedented development, with the introduction of intensive and extensive in the production of the latest scientific achievements.

Of course, progress in agro-food production were perceived, in a first phase, as beneficial for consumers, but, in time, they discover and negative valences of modern technologies.

Modern era foods, obtained by artificial procedures and treatments are charged with toxic substances. They are considered by nutritionists, dead food, because, does not keep active principles. Basically, they don't send anything, just provide that sensation of saturating.

In contrast, raw food, fresh, as our ancestors once ate them, are filled with vitamins, minerals, enzymes and beneficial substances. This is raw food.

Few of us realize that just food quality determines our physical, emotional and mental performance. For maximum health, you need to know which foods are healthy and clean and what benefits we have from them.

Fruits, plants and seeds are foods consumed in their natural state, provide maximum health for the body plagued anyway by stress and pollution.

Concern for quality of food has become more intense once people began to investigate the causes for " the disease of the end of the century ": cancer or diabetes.

### ***Food consumption***

Romania is one of the two countries from the European Union that disposes of optimal natural premises in assuring the population a proper feeding level. In the EU, Hungary is found in a similar situation (POPOVICI, VERAART, VAN DE KERK, 2008).

The pattern of food consumption in Romania is distinguished through the following:

- the relatively high weight factor of nutritional cost in the total of consumption costs;
- the relatively high weight factor of nutritional consumption from the agricultural production of personal households (reduced marketing of the rural economy);
- excessive consumption of cereals and potatoes – food with a relatively low nutritive potential and that present a high risk of hyperglycemia in intensive stress conditions;
- excessive consumption of alcohol, tobacco and fats – as a consequence, the incidence of affections such as cancer, cardiovascular diseases, tuberculosis and nutritional diseases increases, while alcoholism induces severe malfunctions in the social life, in general;
- the relatively low presence of autochthonous ecological markets in building the food daily basket of households.

Together with the burst of consumption, after 1990, choices became more and more difficult and a new criteria appeared : healthy feeding.

The consumed quantity of nutritional products increased and their requirements towards these products became more and more diverse and complex.

**Tabel 1. Anual medium consumption of the main nutritional products and beverages, on the romanian population**

SPECIFICATION	U.M.	1990	2002	2006	2007	2008	2009*
<b>Products of vegetal origin</b>	<b>kg</b>	<b>658,2</b>	<b>729,4</b>	<b>742,9</b>	<b>704,7</b>	<b>711,1</b>	<b>688,2</b>
Cereals and cereal products							
- in equivalent beans	kg	213,6	225,0	207,9	206,9	204,0	200
- in equivalent flour	kg	158,5	169,8	157,3	156,0	154,1	151
Potatoes	kg	59,4	90,1	97,4	96,1	99,5	93
Vegetables and vegetable products (in equivalent fresh vegetables), bean legumes and melons	kg	127,0	162,6	181,7	164,1	176,0	168,2
Fruit and fruit products (in equivalent fresh fruit)	kg	86,6	68,9	83,2	67,8	62,9	60
Sugar and sugar products (in equivalent refined sugar)							
Vegetable fats (gross weight)	kg	13,1	13,0	15,4	13,8	14,6	16
<b>Products of animal origin</b>	<b>kg</b>	<b>227</b>	<b>294,9</b>	<b>346,1</b>	<b>347,5</b>	<b>349,5</b>	<b>328,4</b>
Milk and milk products (in equivalent milk with 3,5% fat (excluding butter))	litres	140,1	215,0	246,6	252,8	254,7	233
Eggs	pieces	246,0	238,0	277	268	267	243
Fish and fish products (in equivalent fresh fish)	kg	5,1	3,2	4,6	3,8	4,0	4,8
Meat, meat products and edible organs (in equivalent fresh meat)	kg	61,0	54,3	69,9	66,7	66,6	67,5
Animal fats (gross weight)	kg	5,1	4,0	3,8	3,3	3,3	3,7
<b>Beverages - Total</b>	<b>litres</b>	<b>84,8</b>	<b>188,9</b>	<b>235,3</b>	<b>263,6</b>	<b>277,1</b>	<b>-</b>
Non-alcoholic beverages	litres	18,9	101,1	134,1	146,6	157,6	-
Beer	litres	43,5	56,0	78,2	92,0	92,5	-
Wine and wine products	litres	18,5	27,0	21,1	23,4	24,6	-
Distilated alcohol beverages distilate (in equivalent alcohol 100%)	litres	3,9	4,8	1,9	1,6	2,4	-
<b>Total consumption</b>	<b>kg</b>	<b>970,0</b>	<b>1213,2</b>	<b>1324,3</b>	<b>1315,8</b>	<b>1337,7</b>	<b>1016,4</b>

Source: Year Book of Statistics, 2009

\* INS data in course of finalisation

In 1990, the medium consumption of nutritional products per inhabitant head was 970 kg, from which 658,2 kg products of vegetal origin, 227 kg products of animal origin and 84,8 l beverages, from which 18,5 l alcoholic beverages.

In 2002, the medium consumption of products per inhabitant head was 1213,2 kg, from which 729,4 kg products of vegetal origin, 294,9 kg products of animal origin and 188,9 l beverages, from which 101,1 l alcoholic beverages.

In regard to 1990, in the year 2002 the medium consumption per inhabitant head has increased with approximately 25%, in 2006 with 36% and in 2008 with 37.9.

The medium consumption of beverages per inhabitant head was bigger with 137% in 2002, with 177% in 2006 and with 219% bigger in 2008 in relation to 1990.

More exactly, in the year when the level of poverty increased the medium anual cereal consumption has known a sensible growth. During 1991-2006 the potato consumption nearly doubled (table 1). From 1991 to 2002 the meat consumption has reached a substantial downsize, although it was already amongst the lowest in Europe.

We can remark that milk and milk products hold an important rank in human alimentation and because the milk production was subsidized from the state for a period of time it decreased less. The fish production and consumption decreased a few times, which had a negative impact on the nutritional diversity of the consumer.

### ***Product conservation***

**The more sophisticated, industrialized and processed the food is the more toxic and harmful it is.**

A clean food, free of toxins, means a life free of disease. Any living food becomes dead when it is burned. When we talk about natural alimentation we talk about the respect towards life, ourselves and most of all towards the universal laws.

For centuries people discovered and perfected different methods of conserving food, such as :

- drying it through sunlight, natural ventilation or on a wood fire;
- salting and fumigating meat;
- eliminating the water (dehydrating);
- conservation in fat or sugar;

- keeping the olives in water –approximately 4000 years ago jugs for keeping olives were found in the palace from Cnossos. This procedure was also used for fruit, spices kept in alcohol or vinegar. Eggs were conserved in weakly acidified solutions.

- fermentation was applied to bread, which was certified in Turkey 900 years ago, and also in obtaining alcoholic beverages – beer, cider, wine – and on fruit, when being stored in wrack.

- conservation through the use of artificial cold was applied approximately 4000 years ago at the austro-italian border (in Tyrol) by hunters that preserved the kill in ice at an altitude of 3200 metres. The romans preserved in ice mussels, fish from Rhine and lobster from Sardinia so that they can be mentained fresh until arriving to Rome. The north burried the hunting kill or the fish in the snow or ice so they can preserve it during wintertime. Alexander the Great and Nero served fruit icecream and honey. On the premises of Versailles, Ludovic the XIV-th installed coolers in order to preserve food. There is also documentary certification that illustrates the appliance of different conservation methods from ancient times. Part of this techniques were kept until moder times, when they are subjected to modernism and technical and scientific progress.

1. *Eliminating microorganisms though fizical separation* : microfiltering and ultracentrifugation.

2. *Destroying microorganism (sterilization) through* :

● heat action: classic boiling (100°C), sterilization – appertization (110...140°C) and UHT;

● ionic radiations (cold sterlization): accelerated electrons,  $\gamma$  and X rays and ultraviolet radiations;

● usage of liquid or vapoury antiseptics: alcohols, acids and chemical conservants.

3. *Stopping effect of microorganism* – protection effect (not of exclusion) :

● Usage of low temperatures: refrigerating through decreasing the temperature to 0...3°C, refrigeration in vacuum, freezing and overfreezing;

● reducing the water content (eliminating 60-70% from the constitution water): dessicating and dessication-fumigation, dehydration and lyophilisation;

Other particular dessicating procedures are:

- dessication with infrared radiations;
- dessication with microwaves;
- dessication favorized by ultrasounds;
- azeotrope dessication;
- partially osmotic dessication.

Attention towards the risks of using chemicals in agriculture, considering both the health of the consumers and ecological effects, has been manifested since the 50's. Then research was conducted for discovering technological alternatives that will diminish this negative impact. Their results were embodied in alternative agricultural systems such as : biological agriculture (bio), biodynamic agriculture, etc., that can eliminate or substantially diminish the use of chemical fertilizers and pesticides.

## CONCLUSIONS

Whether we discuss the quality of food in a restrictive way, as in looking at it like material goods or whether we discuss its quality on a larger scale, in present times the accent is put especially on enhancing the quality of the food. However, it has to be mentioned that the evolution of food quality will be dependent of the existence of a real economical growth that will allow the promotion of the term quality at all levels, for the satisfaction of the final consumers.

- A healthy life style implies living in harmony with nature.
- Clean food means less processed nutrients and less use of chemical substances.
- Without acting together we will destroy some of the most precious ecosystems of the Earth, leaving humanity profoundly affected.

## REFERENCES

- CAMBIR, A. (2006), Coordonate ale nivelului de trai în România. Veniturile și consumul populației în anul, București, INS, p. 56.
- MATEOC-SÎRB, NICOLETA și colaboratorii, *Studiul economiei rurale și a calității vieții în spațiul rural românesc*, Simpozion științific internațional „Economia sectorului agroalimentar – realizări și perspective”, Facultatea de Economie, Vol. 25(1), Chișinău, 2010
- MATEOC-SÎRB, NICOLETA și colaboratorii, *Locul agriculturii și implicațiile ei în dezvoltarea economiei rurale*, Institutul de Economie Agrară, București, Vol. Economie Agrară și Dezvoltare Rurală, Editura Academiei Române, 2010
- MIHĂILESCU, A. (2006) Evoluții în sfera minimului de trai din România, în „Calitatea Vieții”, nr. 1–2, p. 117–131.
- POPOVICI, C. (2008) Veraart, R., van de Kerk, G., *Indicele Societății Durabile, România 2008, România către o societate durabilă*, ANPM, SSF.
- VOINEAGU, V. (2005–2006) (coord.), *Starea socială și economică a României*, București, INS.

\*\*\*<http://epp.eurostat.ec.europa.eu>

## DESTRUCTION OF SALMONELLA ENTERITIDIS IN LIQUID EGG WHITE AS THE FUNCTION OF TREATMENT TEMPERATURE AND HEATING RATE

NÉMETH CSABA, NÉMETH ZOLTÁN, DALMADI ISTVÁN FRIEDRICH LÁSZLÓ,  
SURÁNYI JÓZSEF, BALLA CSABA

Department of Refrigeration and Livestock Products Technology, Faculty of Food Science, Corvinus University of Budapest, H-1118 Budapest, Ménesi út 43-45, Hungary  
csaba.nemeth@uni-corvinus.hu

### ABSTRACT – Destruction of *Salmonella enteritidis* in liquid egg white as the function of treatment temperature and heating rate

In our study we investigated the effect of heat treatment temperature and heating rate on heat resistance of *Salmonella enteritidis*. The samples were heated from 4 °C to 48,96-56,04 °C by a heating rate 0,76-9,24 °C·min<sup>-1</sup> and the changes of the colony counts were determined at given time by plating to XLD agar with overlay.

We used Central Composite Rotatable Design (CCRD) in our experiment and Response Surface Method (RSM) was used to evaluate the data. Our results pointed out that beside the temperature of heat treatment the heating rate have also an effect on the heat destruction of *Salmonella enteritidis*. In case of heating rate 9,24 °C·min<sup>-1</sup> the D<sub>52,5</sub>-value was 2.32 min, however at heating rate 0,76 °C·min<sup>-1</sup> the D<sub>52,5</sub>-value was 19.23 min.

In our measurements the samples were heated with linear heating rate in laboratory scale. so further studies are necessary to describe the heat resistance changes of *Salmonella enteritidis* under parameters which model the industrial heating circumstances.

**Key words:** *Salmonella*, liquid egg, heat treatment, heating rate

## INTRODUCTION

Nowadays, the food industry uses pre-processed egg products as raw materials instead of shell eggs. These are commercialized as liquid egg products or egg powders, which are produced by breaking the shell eggs followed by a pasteurization step, moreover when the customer needs only the egg white, he can purchase it separately (FRONING *et al.*, 2002). Most customers prefer liquid egg products because these well preserve the original properties of native egg, however the beneficial microbial growth inhibition properties of native egg does not prevail in liquid egg white (PARK *et al.*, 2006; BOARD & FULLER, 2008). Pathogenic microbes can occur in liquid egg products even after the extensive disinfection of egg shell since the *Salmonella enteritidis* can infest egg in the oviduct (T. J. HUMPHREY, 1994). For this reason the raw liquid egg white must be pasteurized below the temperature 60 °C, since the konalbumin, which is the most heat sensitive protein of the egg, denaturates at higher temperatures (FERREIRA *et al.*, 1997). Some studies showed the general pasteurization procedure is inefficient in some cases and the heat treated product proved to contain pathogenic microbes (PETRAK *et al.* 2000) which can proliferate at improper storage conditions (SCHOENI *et al.* 1995; McQUESTIN *et al.*, 2010). During the last decade several new liquid egg preservation technologies have been investigated but most of them are hardly feasible in industrial scale or their application is limited through the heat sensitivity of the egg proteins (SCHWARZEL & PALANIAPPAN, 1997; HAMID-SAMIMI, 2000; ANDRASSY *et al.*, 2006). Such a new procedure is the long time (6-24 h) heat treatment at lower temperature (50-55 °C) of liquid egg which we studied in case of packed products (NÉMETH *et al.*,

2010). In these studies we investigated the heat destruction of *Salmonella* and we experienced much higher heat tolerance ( $D_{55}=47,4$ ) than earlier researchers ( $D_{54-52} = 1,51-6,12$  min) (SÖRQVIST *et al.* 2003; Jin *et al.*, 2008). Some microbes such as *Salmonella* show an increasing resistance after heat shock (MAÑAS *et al.*, 2003; CEBRIÁN *et al.*, 2009). Such a heat shock could be the heating of refrigerated liquid eggs to the temperature of long time heat treatment.

The aim of our work was to investigate the extent of heat resistance changes of *Salmonella enteritidis* in liquid egg products during heating from 4°C to 50-55 °C in 5-60 minutes.

## MATERIALS AND METHODS

### *Samples*

The liquid egg white (pH=8.9±0.1) was purchased from a Hungarian egg processing factory. The samples were unpasteurized liquid egg white. Samples were taken from the production line 8 hours prior to the measurements and until the tests they were stored at 4 °C in a refrigerator. The total aerobic colony counts were below  $10^3$  CFU·ml<sup>-1</sup>.

### *Inoculation of samples*

1000 g sample was inoculated with overnight culture of *Salmonella enteritidis* NCAIM B2052. 10 loops of overnight cultures from the surface of three plates of modified GPM agar (18 g·l<sup>-1</sup> agar, 5 g·l<sup>-1</sup> peptone, 5 g/l glucose, 3 g·l<sup>-1</sup> meat extract, 0,5 g·l<sup>-1</sup> sodium chloride) were transferred into 10 ml of sterile water. This was used to set the initial cell number of liquid egg white to  $\sim 10^8$  CFU·ml<sup>-1</sup>.

### *Experimental set up, data analysis*

We used Central Composite Rotatable Design (CCRD) in the experiment (BOX & DRAPER, 1987). Response Surface Method (RSM) was used to assess the effect of variables (heating rate, holding temperature) on the decimal reduction time (D-value). *Table 1* and *Table 2* contains the experimental set up and the level of factors. The main advantage of this kind of experimental approach was, that lower number of experiments was necessary to get statistically acceptable information. We used the response surfaces provided by the quadratic polynomial model. The experiments were processed in random order, and the data were analyzed using software (SPSS for Windows, v. 8.0. SPSS Inc., Chicago, IL). Our present study used a general form of cubic polynomial model included two variables X:

$$Y = \beta_{11} + \beta_1 X_1 + \beta_2 X_2 + \beta_{11} \cdot X_1^2 + \beta_{22} X_2^2 + \beta_{12} \cdot X_1 \cdot X_2 \quad (1)$$

which contains linear terms  $X_1$ ,  $X_2$ , and quadratic terms  $X_1^2$ ,  $X_2^2$ . Variable  $X_1$  means the heat treatment temperature, variable  $X_2$  means the heating rate. The independent variable for modelling is Y. The  $\beta_1$ ,  $\beta_2$ ,  $\beta_{11}$ ,  $\beta_{22}$ ,  $\beta_{12}$  are the regression coefficient expressions of the model (*Table 3*).

**Table 1. The experimental set up and the level of factors with coded values**

Variable	Factor	-1,4142	-1	0	+1	+1,4142
Temperature (°C)	X1	48.96	50.0	52.5	55.0	56.04
Heating rate (°C·min <sup>-1</sup> )	X2	0.76	2.0	5.0	8.0	9.24

**Table 2. Experimental set up and the level of factors (%) with real values**

Test	The real value of factors	
	Temperature (°C)	Heating rate (°C·min <sup>-1</sup> )
1	48.96	5.00
2	52.50	5.00
3	55.00	8.00
4	52.50	9.24
5	50.00	8.00
6	52.50	0.76
7	52.50	5.00
8	50.00	2.00
9	56.04	5.00
10	55.00	2.00
11	52.50	5.00

#### Sample treatment

Prior to the experiment the liquid egg white samples inoculated with *Salmonella enteritidis* were placed into sterile adjustable-temperature thermostate. The samples were stirred during the experiment. The heating rate was linear: 0.76; 2; 5; 8 and 9.24 °C/min to the final temperature 48.96; 50.0; 52.0; 55 and 56.04 °C. The samples were held at the final temperature for 30 min and the changes of the colony counts were determined.

#### Determination of colony counts

The viable cell number of *Salmonella enteritidis* was determined by counting colony forming unites when the temperature reached the holding temperature and after 2, 5, 7, 10, 15, 20, 25 and 30 minute. The stir homogenized samples were decimal-diluted in sterile water and XLD agar (Merck) plates were poured with overlay. The plates were incubated at 37 °C for 24 h and the typical colonies were counted (MSZ 3640/21-83). Three parallel samples were counted. Plates with less than 30 colonies were not counted.

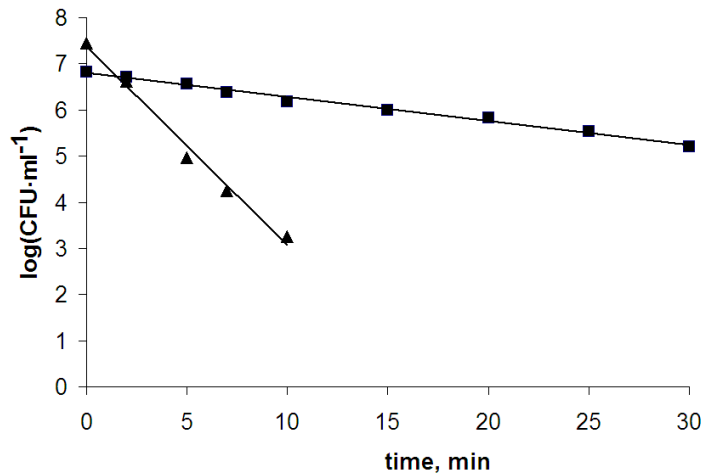
## RESULTS AND DISCUSSION

#### Changes in the heat resistance of *Salmonella enteritidis*

The heat destruction of *Salmonella enteritidis* was different at the same holding temperature (50; 52.5; and 55 °C) when the applied heating rate of the refrigerated was different (Figure 1). When the heating rate of the refrigerated liquid egg white was 9.24 °C·min<sup>-1</sup> and 5 °C·min<sup>-1</sup> the D<sub>52.5</sub> value ranged from 1.88 to 2.42. In case of lower



heating rate ( $0.76\text{ }^{\circ}\text{C}\cdot\text{min}^{-1}$ ) when the time of the heating to the holding temperature was 62.5 minute the  $D_{52.5}$  value was 19.23. At 50 and 55  $^{\circ}\text{C}$  at which temperatures only 2-2 experiments were done with different heating rate the decimal reduction time was significantly ( $P < 0.05$ ) higher at lower heating rate like in the case of 52.5  $^{\circ}\text{C}$  (Table 3).



**Figure 1.** Heat destruction of *Salmonella enteritidis* at 52.5  $^{\circ}\text{C}$  with warming from 4  $^{\circ}\text{C}$  with a heating rate of  $0.76\text{ }^{\circ}\text{C}\cdot\text{min}^{-1}$  (■) and  $9.24\text{ }^{\circ}\text{C}\cdot\text{min}^{-1}$  (▲)

**Table 3.** Heat destruction of *Salmonella enteritidis* in different tests

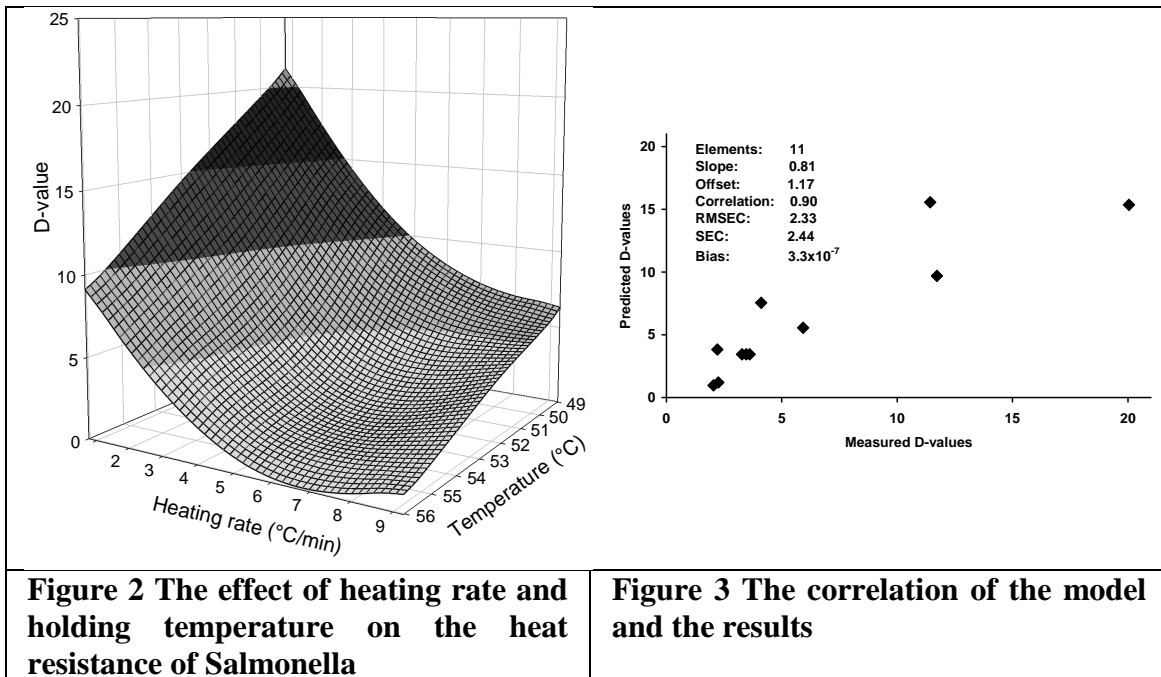
Test	n	R <sup>2</sup>	Stand. error	D-value	
				Mean	Conf. Interval (95%)
1	9	0.993	0.125	11.05	10.87 - 11.23
2	5	0.978	0.326	2.34	2.12 - 2.56
3	5	0.940	0.195	1.88	1.65 - 2.11
4	5	0.989	0.403	2.32	1.97 - 2.67
5	6	0.995	0.080	6.54	6.23 - 6.85
6	9	0.992	0.261	19.23	18.77 - 19.69
7	5	0.972	0.340	2.42	2.13 - 2.71
8	9	0.989	0.218	9.60	9.19 - 10.01
9	5	0.957	0.267	2.10	1.94 - 2.26
10	6	0.985	0.386	3.29	3.01 - 3.57
11	5	0.968	0.177	2.35	2.11 - 2.59

#### Model development

Based on the statistical analysis of the data we can conclude that the heating rate has a significant ( $P < 0.05$ ) effect on the heat resistance of *Salmonella* cells in the studied temperature range. The above mentioned heat shock effect (Mañas *et al.*, 2003; Cebrián *et al.*, 2009) could be the reason for this behaviour so certain microorganisms may increase their resistance toward different preservation technologies like heat treatment if they are incubated under sub lethal conditions.

Figure 2 shows the response surface concerning D-values of different holding temperatures and the heating rates. The decimal reduction time decreases with increasing temperature and with the decreasing heating rate. The statistical analysis established that the studied parameters have a significant effect on the D-value.

The Table 4 shows parameters of the quadratic polynomial model fitted on the results. The model correlated. The model has a relatively good ( $R^2=0.904$ ) correlation with the results.



**Figure 2** The effect of heating rate and holding temperature on the heat resistance of Salmonella

**Figure 3** The correlation of the model and the results

**Table 4.** The regression coefficient of the quadratic polynomial model for the RSM with the coded parameters

Factors	$\beta$ -coefficient
Constant	3.45
H	-1.235
T	-1.358
H <sup>2</sup>	0.5445
T <sup>2</sup>	0.0887
H × T	0.6201
R <sup>2</sup>	0.904
F-rate	4.44
Likelihood of F	$P \leq 0.1$
<i>H</i> -heating rate ( $^{\circ}\text{C}\cdot\text{min}^{-1}$ )	
<i>T</i> - temperature ( $^{\circ}\text{C}$ )	

## CONCLUSIONS

We can conclude that the heating rate and the holding temperature have an effect on the heat resistance of *Salmonella enteritidis* in liquid egg white. This should be considered particularly in case of technologies where the refrigerated liquid egg white is heated to heat treatment temperature for a relatively long time.

In our measurements the samples were heated with linear heating rate in laboratory scale so further studies are necessary to describe the heat resistance changes of *Salmonella enteritidis* under parameters which model the industrial heating circumstances.

## REFERENCES

- ANDRASSY E.; FARKAS J.; SEREGELY ZS.; DALMADI I.; TUBOLY E.; LEBOVICS V., (2006). Changes of hen eggs and their components caused by non-thermal pasteurizing treatments. *Acta Aliment.* 35. 305-318.
- BOARD. R.G.; FULLER. R.. (2008). Non-specific antimicrobial defences of the avian egg embryo end neonate. *Biol. Rev.* 49. 15-49.
- BOX. G.E.P.; DRAPER. N. R.; (1987). *Empirical Model-building and Response Surfaces*. NY: John Willey and Sons Inc.
- CEBRIÁN. G.; CONDÓN. S.; MAÑAS. P., (2009). Heat-adaptation induced thermotolerance in *Staphylococcus aureus*: Influence of the alternative factor  $\sigma^B$ . *Int. J. Food. Microbiol.* 135. 274-280.
- FERREIRA. M.; HOFER. C; RAEMY A., (1997). A calorimetric study of egg white proteins. *J. Therm. Anal. Calorim.* 48. 683-690.
- FRONING. G.W.; PETERS. D.; MURIANA. P.; ESKRIDGE. K.; TRAVNICEK. D.; SUMNER. S.S., (2002). *International egg pasteurization manual*. United Egg Association. Alpharetta. GA
- HAMID-SAMIMI. M. H., (2000). Process for producing pasteurized liquid egg products. US 6024999
- HUMPHREY. T.J., (1994): Contamination of egg shell and contents with *Salmonella enteritidis*: a review. *Int. J. Food. Microbiol.* 21. 31-40.
- JIN. T.; ZHANG. H.; BOYD. G.; TANG. J., (2008). Thermal resistance of *Salmonella enteritidis* and *Escherichia coli* K12 in liquid egg determined by thermal-death-time disk. *J. Food Eng.*, 84. 608-614.
- MCQUESTIN. O.J.;MUSGROVE. M.T; TAMPLIN. M.L., (2010). Kinetics of growth and inactivation of *Salmonella enterica* serotype Typhimurium DT104 in pasteurised liquid egg products. *Food Microbiol.* 27. 396-402.
- MAÑAS. P.; PAGÁN. R.; ALVAREZ. I.; USÓN. S.C., (2003). Survival of *Salmonella senftenberg* 775 W to current liquid whole egg pasteurization treatments. *Food Microbiol.* 20. 593-600
- NÉMETH Cs.; FRIEDRICH L.; BALLA Cs.; SUHAJDA Á., (2010). Effect of changes in heat resistance of *Salmonella spp.* during pasteurization on the efficiency of long term heat treatment at 55 °C. *Acta Agronomica Óváriensis*. 52. 3-10
- PARK. S.-I.; DAESCHEL. M.A.; ZHAO. Y., (2006). Functional properties of antimicrobial lysozyme-chitosan composite films. *J. Food. Sci.* 69. 215-221
- PETRAK. T.; MEDIC. H.; NOVAKOVIC. P.; BOTKA-PETRAK K., (2000). Bacteriological contamination of egg products after thermal preservation processes. *Acta Aliment.* 29. 315-322
- SCHOENI. J.L.; GLASS. K.A.; MCDERMOTT. J.L.; WONG. A.C.L., (1995). Growth and penetration of *Salmonella enteritidis*, *Salmonella heidelberg* and *Salmonella typhimurium* in eggs. *Int. J. Food. Microbiol.* 24. 385-396
- SÖRQVIST. S., (2003). Heat resistance of liquids of *Enterococcus spp.*, *Listeria spp.*, *Escherichia coli*, *Yersinia enterocolitica*, *Salmonella spp.* and *Campylobacter spp.*. *Acta Vet. Scand.*, 44. 1-19
- SWARTZEL. K. R.; PALANIAPPAN. S., (1997). Method for pasteurizing liquid whole egg products. US 5670199

## ISOLATION AND CHARACTERIZATION OF CARBENDAZIM-DEGRADING BACTERIA FROM AGRICULTURAL SOIL SAMPLES.

CS. VÁGVÖLGYI (1), V. NÉMETH (2), E. SAJBEN (1), B. ŠKRBIĆ (3), N. ĐURIŠIĆ-MLADENOVIC (3), J. KRISCH (4), L. MANCZINGER (1)

- (1) Department of Microbiology, Faculty of Science and Informatics, University of Szeged, H-6726 Szeged Közép fasor 52., Hungary, e-mail: csaba@bio.u-szeged.hu  
(2) Department of Physical Chemistry, Faculty of Science and Informatics, University of Szeged, H-6720 Szeged, Rerrich Béla tér 1., Hungary  
(3) Faculty of Technology, University of Novi Sad, Bulevar cara Lazara 1, 21000 Novi Sad, Serbia  
(4) Institute of Food Engineering, University of Szeged, Szeged, Hungary

### ABSTRACT - Isolation and characterization of carbendazim-degrading bacteria from agricultural soil samples.

The use of chemical pesticides in agriculture generates many ecological and human toxicological problems. One of the most frequently used fungicides is carbendazim, however, in spite of its importance, there are only a few reports dealing with its microbial degradation in the environment. It has high acute ecotoxicological effect, as well as a suspected endocrine disruptor potential, so its residues in food and feed are dangerous. Until now, single isolates of *Pseudomonas*, *Rhodococcus* and *Ralstonia* have been found to be able to degrade carbendazim. Among fungi, one isolate of *Alternaria alternata* and *Phanaerochete cryosporium* were described as good carbendazim degraders. Bacterial degradation pathways have been partially explored: the first step is the hydrolysis of the carbamate group, followed by a ring-fission in 2-aminobenzimidazole resulting 1,2-diaminobenzene. This compound is further metabolized via the beta-ketoadipic acid pathway. As part of our studies on pesticide biodegradation, new carbendazim-metabolizing bacteria were isolated from Hungarian agricultural soil samples. These degrader bacteria were isolated from soil samples by microbiological enrichment methods. The molecular analysis revealed that the best isolates belong to the *Variovorax paradoxus* species. The isolate 10/1 was able to use carbendazim as sole carbon and nitrogen source. The pH optimum and temperature optimum for growth were found to be pH 6.3 and 30 °C, respectively. This isolate seems to be an efficient tool for the bioremediation of carbendazim polluted agricultural soils.

**Keywords:** *Variovorax*, carbendazim, biodegradation

## INTRODUCTION

The use of chemical pesticides in modern agriculture generates many ecological and human toxicological problems. One of the most frequently used agricultural fungicide both in Serbia and in Hungary is carbendazim (Fig. 1.). In spite of this, there are only few reports dealing with its microbial degradation. It has high acute ecotoxicological effect, as well as a suspected endocrine disruptor potential in human and animals, so its residues in food and feed are dangerous. Until now, single isolates of *Pseudomonas* (FUCHS and DE VRIES, 1978), *Rhodococcus* (HOLTMAN et al, 1997) and *Ralstonia* strain (GUI-SHAN ZHANG et al, 2005) proved to be able to degrade carbendazim. Taking into account fungi, one isolate of *Alternaria alternata* and *Phanaerochete cryosporium* described as good carbendazim degraders (SILVA et al, 1996: 1999). In case of bacterial degraders the degradation mechanism and pathway was also partially explored. In this process, at first the carbamate group is hydrolyzed to 2-amino-benzimidazole, which is

further degraded by ring fission leading to 1, 2-diamino-benzene. This intermediate is further metabolized via the beta-keto adipic acid pathway. As part of this, an investigation was made to isolate carbendazim-degrader bacteria from agricultural soil samples.

## **MATERIAL AND METHOD**

Soil samples were collected from agricultural fields in Hungary, where carbendazim was regularly used. Isolation of carbendazim-degrading bacteria was carried out via the continuous enrichment culture method. Briefly: 5 g sample of soil was suspended in 50 ml sterilized NaCl solution 1.0 (g/l). From this suspension 0.1 ml was inoculated into the enrichment medium, (g/l): K<sub>2</sub>HPO<sub>4</sub> 1.0, MgSO<sub>4</sub> 7H<sub>2</sub>O 1.0, NaCl 0.5, supplemented with carbendazim (200 mg/l). Carbendazim (purity: 94.6%) was firstly dissolved in 1 M hydrochloric acid at 20 mg/ml concentration. The pH of the medium was about 7.0 after the addition of carbendazim solution. The flasks were incubated in the dark at 20 °C on a rotary shaker at 200 rpm. After 14 days, dilution series were made from each culture and from these dilutions 50 µl aliquots were spreaded onto yeast extract glucose agar plates (YEG: (g/l) yeast extract 2.0, glucose 2.0, Bacto agar 18). Plates were desiccated and incubated for 3 days at 20 °C. The dominant colonies were picked up and tested for their carbendazim degrading ability.

The taxonomical positions of the isolates with best degrading ability were determined by partial sequencing the 16S ribosomal RNA genes. For PCR reaction standard conditions were applied with the following primers: Eub-341f 5'-CCTACGGGAGGC AGCAG-3' and UP-765r 5'-CTGTTTGCTCCCCACGCTTC-3'.

Carbendazim degrading abilities of the isolates were measured in enrichment medium supplemented with 50 mg/l carbendazim and 150 mg/l yeast extract. After incubation, samples from the cultures were diluted to twice fold with ethanol, centrifuged at 10 000 g for 3 minutes and the absorbance of the clear supernatants were determined in a spectrophotometer at 280 nm where both carbendazim and 2-amino-benzimidazole have strong absorbance. The degradation of carbendazim was correlated with the reduced absorbance values measured.

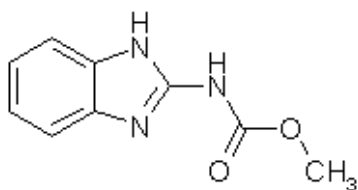
## **RESULTS**

From the ten soil samples collected, eight different bacterium isolates were obtained after the enrichment step where carbendazim was the sole carbon and nitrogen source in the medium.

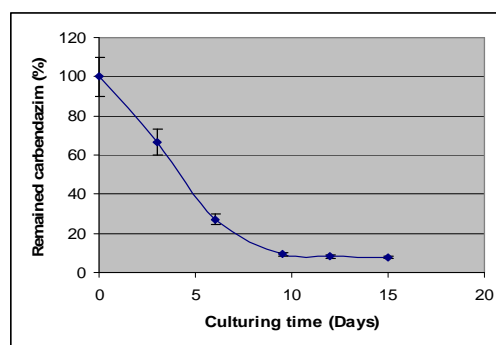
The carbendazim degrading abilities of these isolates are presented in *Table 1*.

**Table 1. Carbendazim degrading abilities of different bacterial isolates obtained from Hungarian soil samples. Incubation time: 14 days.**

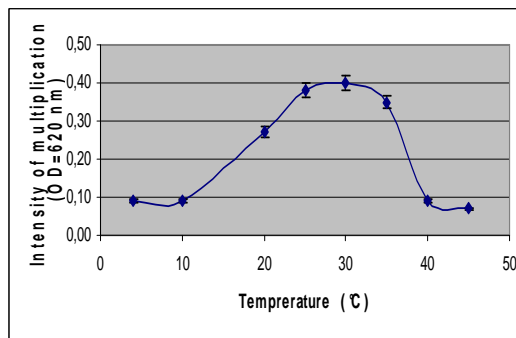
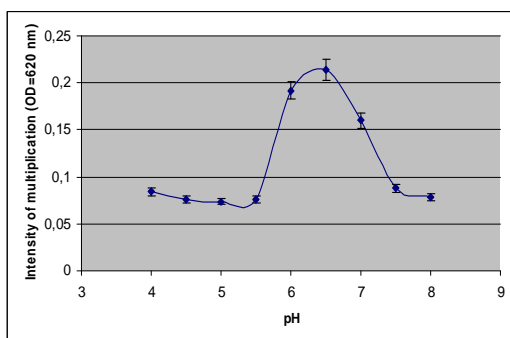
Strain code	Species identity	Residual carbendazim (control 100%)
1/2	<i>Variovorax paradoxus</i>	73 %
6/2	<i>Acidovorax defluvi</i>	69 %
6/3	<i>A. delafieldii</i>	60 %
6/5	<i>Pseudomonas sp.</i>	64 %
6/8	<i>Microbacterium phyllosphaerae</i>	78 %
10/1	<i>V. paradoxus</i>	10 %
10/4	<i>Acidovorax sp.</i>	44 %
10/5	<i>Acidovorax sp.</i>	97 %



**Figure 1. Structure of carbendazim**



**Figure 2. Degradation kinetics of carbendazim by *V. paradoxus* 10/1 isolate.**

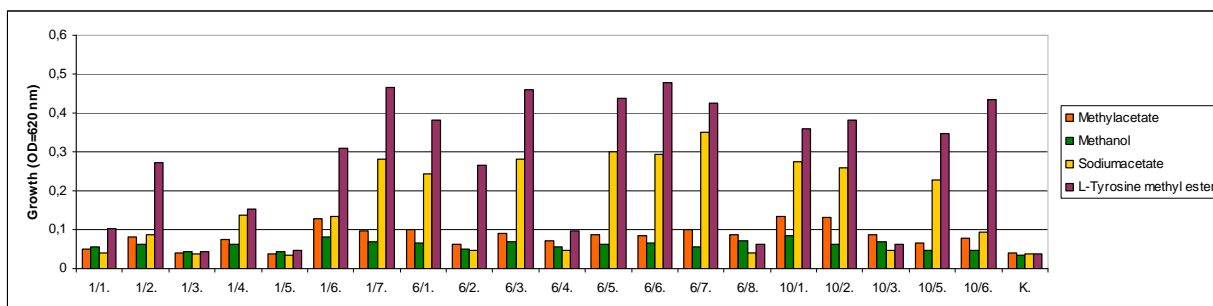


**Figure 3. pH- and temperature-dependence of the growth of *V. paradoxus* 10/1 isolate.**

After preliminary experiments, composition of the enrichment medium has been reformulated: it turned out that in the presence of NH<sub>4</sub>Cl the bacterial isolates were

unable to degrade carbendazim. Further investigations were carried out with the isolate 10/1, which has the best degrading ability. A part of its 16S RNA gene was sequenced and analyzed: web-based similarity searches against the GenBank and Ribosomal Database Project databases revealed that 10/1 shared 100% identity with the 16S rDNA of strains of *V. (formerly Alcaligenes) paradoxus* (*Comamonadaceae*, WILLEMS et al, 1991). Our results show that *V. paradoxus* 10/1 was able to degrade 90% of carbendazim within ten days (Fig. 2.). The isolate was able to grow in ranges pH 5.5-7.5 and temperature 10-40 °C, respectively (Fig. 3.).

The carbon and nitrogen source utilization spectra of this bacterium were also investigated. From the tested 23 carbon sources, D-xylose, D-sorbitol, D-mannitol and some amino acids (L-leucine, L-izoleucine, L-proline, L-phenylalanine and L-tyrosine) supported its growth. In the presence of glucose, galactose and other common mono- and disaccharides, the growth of the strain was poor. From the compounds tested, urea, L-glutamine and L-asparagine (besides other L-amino acids) were the best nitrogen sources. *V. paradoxus* utilized NH<sub>4</sub>Cl and NaNO<sub>3</sub> very poorly. In the carbendazim-degrading strains we detected highly active esterases in the periplasmic space or in the cytoplasm, but never in ferment broths. The same strains intensively used methylacetate and L-tyrosine methyl ester for growth (Fig. 4.). Probably these esterases are also able to hydrolyze the carbamyl-methyl ester group in carbendazim.



**Figure 4. The use for growth of distinct esters by the bacterial strains isolated from carbendazim degrading communities.**

## CONCLUSIONS

Soil samples proved to be excellent sources of bacteria with carbendazim degrading ability. Key parameters of an efficient enrichment technique were optimized. It is proved that besides the ubiquitous soil bacteria *Ralstonia*, *Rhodococcus* and *Pseudomonas*, the *Variovorax* species also have great potential in the biodegradation of carbendazim. Until now only bacteria belonging to the genera *Pseudomonas*, *Rhodococcus* and *Ralstonia* were known as good carbendazim degraders (GUI-SHAN ZHANG et al, 2005). DEJONGHE et al. (2003) described *V. paradoxus* ability to degrade Linuron, a worldwide used herbicide. The molecular structure of Linuron has some common features with carbendazim: it contains an aliphatic carbamyl group and an aromatic ring. This suggests that some steps would be common in their degradation pathway in *V. paradoxus*.

## ACKNOWLEDGEMENTS

The project is co-financed by the European Union through the Hungary-Serbia IPA Cross-border Co-operation Programme (BIOXEN, HU-SRB/0901/214/150).

## REFERENCES

- DEJONGHE W., BERTELOOT E., GORIS J., BOON N., CRUL K., MAERTENS S., HÖFTE M., DE VOS P., VERSTRAETE W., TOP E. M. (2003): “Synergistic degradation of Linuron by a bacterial consortium and isolation of a single linuron-degrading *Variovorax* strain. Applied and Environmental Microbiology **69**, 1532-1541.
- FUCHS A., DE VRIES F.W. (1978): “Bacterial breakdown of benomyl. I. Pure cultures.” *Antonie van Leeuwenhoek* **44**, 283-292.
- GUI-SHAN Z., XIAO-MING J., TIAN-FAN C., XIAO-HANG M., YU-HUA Z. (2005): Isolation and characterization of a new carbendazim-degrading *Ralstonia* sp. strain. *World Journal of Microbiology and Biotechnology* **21**, 265-269.
- HOLTMAN M. A. KOBAYASHI D.Y. (1997). “Identification of *Rhodococcus erythropolis* isolates capable of degrading the fungicide carbendazim.” *Applied Microbiology and Biotechnology* **47**, 578-582.
- SILVA, C.M.M.S - MELO, I.S. MAIA A.H.N. ABAKERLI R.B. (1999). “Isolation of carbendazim degrading fungi.” *Pesquisa Agropecuária Brasileira* **34**, 1255-1264.
- SILVA, C.M.M.S. FAY, E.F. MELO, I.S. (1996). “Degradação do fungicida carbendazim por *Phanerochaete chrysosporium*.” *Fitopatologia Brasileira* **21**, 496-498.
- WILLEMS, A. DE LEY, J. GILLIS, M. KERSTERS, K. (1991) “*Comamonadaceae*, a new family encompassing the acidovorans rRNA complex, including *Variovorax paradoxus* gen. nov., comb. nov., for *Alcaligenes paradoxus*” (Davis) 1969. *International Journal of Systematic Bacteriology* **41**, 445-450.



## ISOLATION AND CHARACTERIZATION OF ETHYLENETHIOUREA-DEGRADING BACTERIA FROM SOIL

CS. VÁGVÖLGYI (1), L. MANCZINGER (1), D. SUGÁR (1), E. SAJBEN (1), A. PALÁGYI (1), J. KRISCH (2), J. ŽIVANČEV (3), B. ŠKRBIĆ B (3)

(1) Department of Microbiology, Faculty of Science and Informatics, University of Szeged, H-6726 Szeged Közép fasor 52., Hungary; e-mail: csaba@bio.u-szeged.hu

(2) Institute of Food Engineering, University of Szeged, Szeged, Hungary

(3) Faculty of Technology, University of Novi Sad, Bulevar cara Lazara 1, 21000 Novi Sad, Serbia

### ABSTRACT - Isolation and characterization of ethylenethiourea-degrading bacteria from soil

Ethylenethiourea (ETU), the spontaneous degradation product of the widely used fungicide mancozeb is more stable in the environment than its parent molecule and has a carcinogenic effect. The accelerated degradation of ETU by soil microbes would be highly desirable. In our study, ETU-degrading bacterial communities from distinct soil and water samples were isolated using ETU as nitrogen source. The isolated strains from these communities were not able to use ETU as sole carbon source but were able to use ETU as sole source of nitrogen. A new colorimetric method was developed and optimized to measure the ETU consumption from the culture media. This method is based on the fact that 2,6-dichloroquinone-chloroimide give with ETU a pinkish-yellow product. The best ETU-degrading strains proved to be *Bacillus subtilis* and *Pseudomonas fluorescens* based on molecular level identification using sequences of their 16S ribosomal RNA genes. More than 40 *Bacillus* and more than 60 *Pseudomonas* strains deposited in our bacterium collection were screened for ETU transforming ability and about 10 % of the investigated strains were able to degrade 100 mg/l ETU within 10 days. However, the growth of all strains was totally inhibited at the ETU concentration of 1000 mg/l.

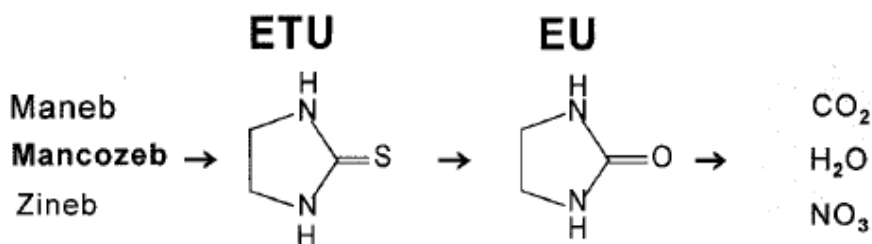
**Keywords:** ethylenethiourea, *Bacillus*, *Pseudomonas*, 2,6-dichloroquinone-chloroimid

## INTRODUCTION

The fungicide mancozeb is very instable in the environment and its aqueous solution decomposes spontaneously within two weeks. The degradation product, ethylenethiourea (ETU) is carcinogenic and more stable than the parent molecule. The accelerated degradation of the fungicide and its derivative by soil microbes would be highly desirable (*Fig.1.*)

ETU degradation was found to be slower in autoclaved soils than in non-sterile soils, and only ethyleneurea (EU) was identified as degradation product. In biologically active soils, ETU was oxidized to carbon dioxide and to four other degradation products, two of which were identified as hydantoin and Jaffe's base (JACOBSEN AND BOSSI, 1997). Degradation of ETU to carbon dioxide in non-sterile soils was reported by LYMAN AND LACOSTE (1975). These results indicate that ETU is oxidized under both biological and non-biological conditions to EU, which considerably more stable than ETU, has less acute toxicity (*Table 1.*) not carcinogenic, and can be considered as the major breakdown product. EU, however, can be oxidized photochemically, using a catalyst, to

give glycine and carbon dioxide or could serve as nitrogen source for soil microbes (ROSS AND CROSBY, 1973),



**Figure 1. The main direction of microbial degradation of some dithiocarbamate fungicides. (from JACOBSEN AND BOSSI, 1997)**

**Table 1. Ecotoxicity of some dithiocarbamate fungicides, ETU and EU.**

Compound	<i>Daphnia magna</i>	<i>Chlorella pyrenoidosa</i>	<i>Photobacterium phosphoreum</i>	<i>Nitrosomonas Nitrobacter</i>
	48-h LC <sub>50</sub> (mg/litre)	96-h EC <sub>50</sub> (mg/litre)	15-min EC <sub>50</sub> (mg/litre)	3-h MIC (mg/litre)
Nabam	0.44	2.4	102	32
Maneb	1	3.2	1.2	56
Zineb	0.97	1.8	6.2	18
Mancozeb	1.3	1.1	0.08	32
Metiram	2.2	1.8	0.37	32
Na-DMDC	0.67	0.8	0.51	26
Ziram	0.14	1.2	0.15	100
Perbam	0.09	2.4	0.20	10
Thiram	0.21	1	0.10	18
Na-DECD	0.91	1.4	1.22	43
Zn-DEDC	0.24	1.1	1.70	> 320
Disulfiram	0.12	1.8	1.21	> 320
ETU	26.4	6600	2100	1
EU	5600	16 000	3300	1000

<sup>a</sup> From: Van Leeuwen (1986).

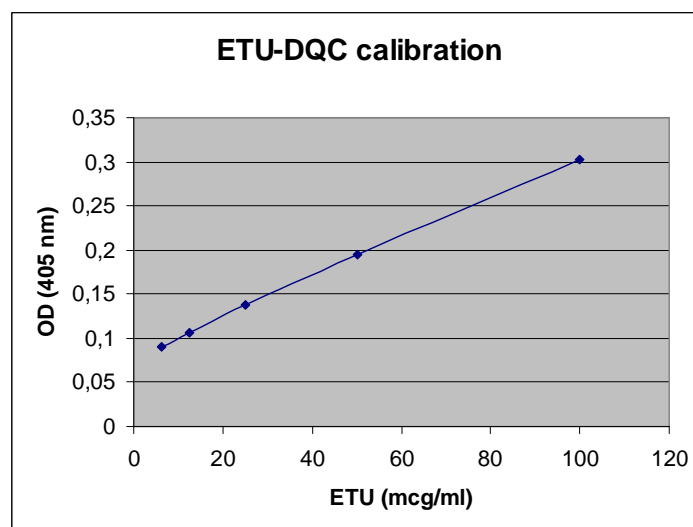
## MATERIAL AND METHOD

Soil samples were collected from agricultural fields in Hungary, where mancozeb was regularly used. Isolation of ETU-degrading bacteria was carried out via the continuous enrichment culture method. Briefly: 5 g sample of soil was suspended in 50 ml sterilized NaCl solution (1.0 g/l). From this suspension 0.1 ml was inoculated into the enrichment medium, (g/l): glucose 1.0, Na<sub>2</sub>HPO<sub>4</sub> 2.0, KH<sub>2</sub>PO<sub>4</sub> 1.0, MgSO<sub>4</sub> 7H<sub>2</sub>O 1.0, NaCl 0.5, supplemented with ETU (100 mg/l). The flasks were incubated in the dark at 20 °C on a rotary shaker at 200 rpm. After 14 days, dilution series were made from each culture and from these dilutions 50 µl aliquots were spread onto yeast extract glucose agar plates (YEG: (g/l) yeast extract 2.0, glucose 2.0, Bacto agar 18). Plates were desiccated and incubated for 3 days at 20 °C. The dominant colonies were picked up and tested for their ETU degrading ability.

The taxonomical positions of the isolates with best degrading ability were determined by partial sequencing of the 16S ribosomal RNA genes. For PCR reaction standard

conditions were applied with the following primers: Eub-341f 5'-CCTACGGGAGGC AGCAG-3' and UP-765r 5'-CTGTTTGCTCCCCACGCTTC-3'.

ETU-degrading abilities of the isolates were measured in the enrichment medium supplemented with 100 mg/l ETU. After incubation, samples from the cultures were centrifuged at 10 000 g for 3 minutes and the remaining ETU in the supernatant was determined with the 2,6-dichloroquinone-chloroimide (DQC) reagent: to 1 ml sample 1 ml 1/15 M phosphate buffer (pH= 8) was added, then 0.1 ml 0.4% DQC (Sigma), dissolved in ethanol, was added to the mixture. After 60 min incubation at room temperature, the colour intensity was measured at 405 nm. The calibration curve regarding the colour reaction for ETU determination is shown on Fig. 2.



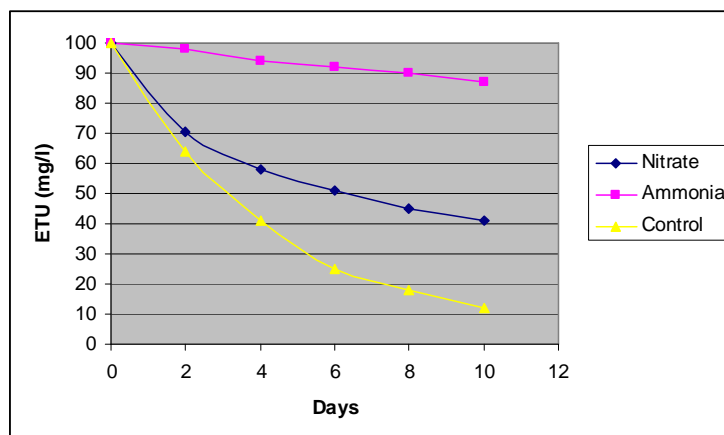
**Figure 2. Calibration curve for determination of ETU with the DQC reagent.**

## RESULTS

We were only able to detect up growing bacterial communities if ETU was used as nitrogen source. The isolated strains from the enriched communities were not able to use ETU as sole carbon source but were able to use ETU as sole nitrogen source.

A new colorimetric method was developed and optimized to measure the ETU consumption from the culture media. This method is based on the fact that 2,6-dichloroquinone-chloroimide give with ETU a pinkish-yellow product. The best strains proved to be *Bacillus subtilis* and *Pseudomonas fluorescens* based on molecular level identification using sequences of their *16S RNA* genes.

The ETU degradation activities of the *Bacillus* and *Pseudomonas* strains were strongly repressed in the present of 0.1% ammonium chloride and were slightly repressed by 0,1% sodium nitrate in the medium (Fig. 3.).



**Figure 3. Effect of ammonia and nitrate on the ETU-degrading activity of the *Bacillus subtilis* B13 strain.**

More than 40 *Bacillus* and more than 60 *Pseudomonas* strains deposited in our bacterium collection were screened for ETU transforming ability and about 10 % of the investigated strains were able to degrade 100 mg/l ETU within 10 days. However, the growth of all strains was totally inhibited at the ETU concentration of 1000 mg/l.

## CONCLUSIONS

We proved that ethylenethiourea-degrading bacteria are frequent in the soil and belong mainly to the *Bacillus* and *Pseudomonas* genera. The best strains are able to degrade 100 mg/l ETU within 14 days of culturing, but 1000 mg/l ETU concentration is inhibitory for all strains. The quality of nitrogen source highly influenced the ETU degradation activities of the strains, ammonium ions strongly; nitrate ions slightly repressed the ETU degrading process.

## ACKNOWLEDGEMENTS

The project was co-financed by the European Union through the Hungary-Serbia IPA Cross-border Co-operation Programme (BIOXEN, HU-SRB/0901/214/150).

## REFERENCES

- JACOBSEN, O. S., BOSSI, R. (1997): "Degradation of ethylenethiourea (ETU) in oxic and anoxic sandy aquifers." *FEMS Microbiology Reviews* **4**, 539-544.
- LYMAN, W. R., LACOSTE, R. J. (1975): "New developments in the chemistry and fate of ethylene-bisdithiocarbamate fungicides." *Environmental Quality and Safety*. Supplement. 3, 67-74.
- ROSS, R. D., CROSBY, D. G. (1973): "Photolysis of ethylenethiourea." *Journal of Agricultural and Food Chemistry* **21**, 335-337.
- VAN LEEUWEN, C. J. (1986): „Ecotoxicological aspects of dithiocarbamates." Utrecht, University of Utrecht (Ph.D. Thesis).

## **STUDY OF SEVERAL FACTORS THAT INFLUENCE THERMAL ANALYSIS FOR MEAT SAMPLES**

**DRÁGHICI OLGA**

The Faculty of Agricultural Sciences, Food Industry and Environmental Protection  
"Lucian Blaga" University, Sibiu  
olga.draghici@ulbsibiu.ro

### **ABSTRACT – Study of several factors that influence thermal analysis for meat samples**

Differential scanning calorimetry is thermal analysis technique that detects and monitors thermally induced conformational transitions and phase transitions as a function of temperature. While denaturation of proteins display endotherms, aggregation of proteins manifest themselves as exotherms. In in this paper the influence of following factors was studied: influence of water evaporation, heating rate (°C/min), influence the mechanical process of grinding meat.

**Keywords:** DSC, myosin, sarcoplasmatic proteins, actin, denaturation

### **INTRODUCTION**

Differential scanning calorimetry (DSC) is a powerful technique to characterise the energetics and mechanisms of temperature-induced conformational changes of biological macromolecules (KURGANOV ET. AL., 1997). This technique allows highlighting different temperatures at which the thermal denaturation of the major structural protein species in porcine muscle: myosin, sarcoplasmatic proteins, collagen and actin.

WENDLANDTG (1985) identified some 16 variables which influence the results from DSC experiments. Whilst many are attributable to the design of the equipment or to the inherent properties of the sample there remains a core of variables where the practitioner is able to exert some control (HAINES, 2000).

### **MATERIAL AND METHOD**

Porcine longissimus dorsi were removed from the carcass at 1 day postmortem and stored into a hermetic package at 4<sup>0</sup>C until analysis.

A TA differential scanning calorimeter (DSC), model SDT Q600, with computer-assisted data acquisition and curve sensitivity analysis function was used for all studies. Small pieces of meat, free from visible traces of fat and connective tissue, were used into alumina pans. At least 3 samples with 10 to 25 mg meat each weighed accurately to 0.001 mg by an electronic balance were used for each individual sample. The samples were scanned at 10°C/min or 5°C/min at 20 to 90°C under dry nitrogen purge of 30 mL/min.

For probe 5, the meat was finely minced and then dispersed in water in the ratio 1:10, using T 25 digital ULTRA-TURRAX (IKA<sup>®</sup> Werke GmbH & Co. KG) with S 25 N - 18G Dispersing element at 20000 rpm

**Table 1. Pans content and heating rate for each samples**

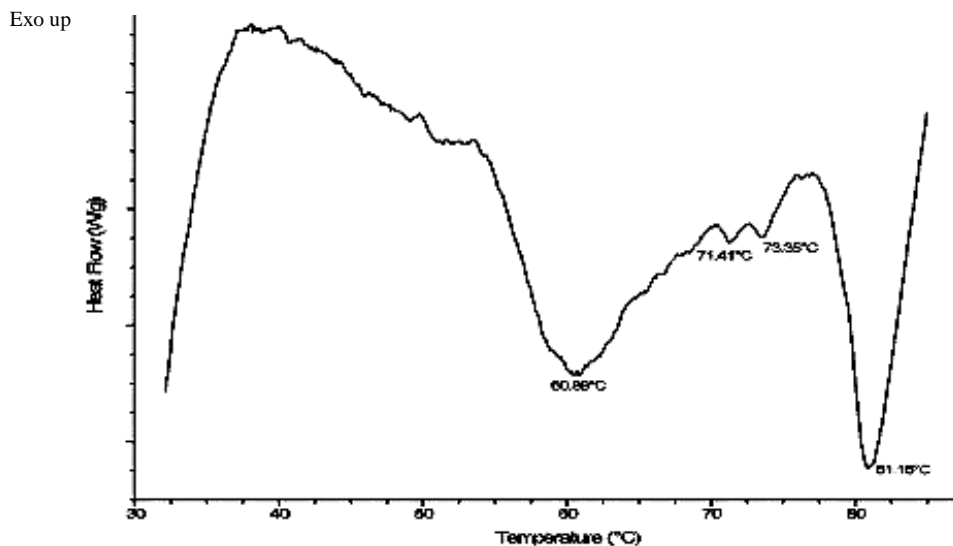
Samples	Sample pan	Reference pan	Heating rate, °C/min
1	piece of meat	water	10
2	piece of meat	–	10
3	piece of meat	–	5
4	piece of meat + water	–	5
5	homogenized meat with water	–	5

Following factors were studied: influence of water evaporation, heating rate (°C/min), influence the mechanical process of grinding meat

## RESULTS

### Influence of water evaporation

If the water was put into the cup of reference in equal quantity of water in the sample was obtained thermograms shown in *Figure 1*. Over 40°C sarcoplasmatic proteins begin to lose their solubility and begin the processes of denaturing which was achieved with energy absorption. (Cross et al., 1986; Sun, 2005). The transition displays at 60.8°C can be attribute to myosin denaturation. In other works, the denaturation temperature for myosin can be found between 54°C and 58°C (Martens and Vold, 1976; Wright, Leach, Wilding, 1977). In this case, the slightly higher temperature, can be explained by the fact that cups were used unclosed hermetic.



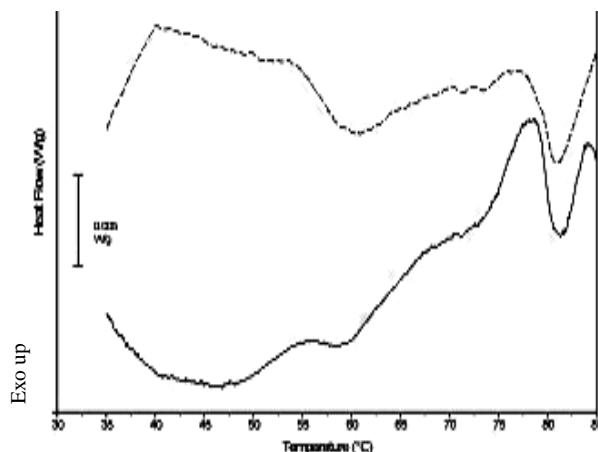
**Figure 1. DSC thermograms of pice of meat with water in reference cup**

As was expected, the transition which occurs between 65<sup>0</sup>C and 67<sup>0</sup>C assigned to collagen (Martens and Vold, 1976; Stabursvik and Martens, 1980) could not see clearly because meat was free from visible traces.

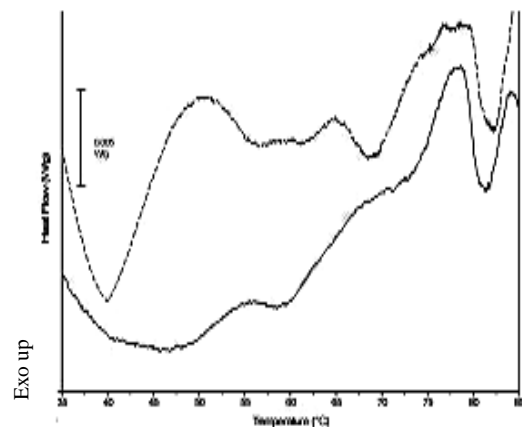
71,41<sup>0</sup>C and 73,35<sup>0</sup>C are the temperatures corresponding sarcoplasmatics proteins denaturation. Salvador et al. (2009) found the denaturation temperature corresponding to porcine hemoglobin concentrates Td = 77.8<sup>0</sup>C. Last transition at 81.16<sup>0</sup>C corresponds to actin denaturation and it occurred after its thermal aggregation. Levitsky et al. (2008) also analyse in vitro data on the heat-induced aggregation of actin, the process that normally accompanies actin thermal denaturation.

If the water was not added in the cups, the endothermic process was observed in the range from 40<sup>0</sup>C to 47.5<sup>0</sup>C. This may correspond to the fat melting process and temperature range is so large due higher heating rate.

Note that unlike the previous analysis, although it was the same meat used, in this case denaturation of myosin is observed at 58.36<sup>0</sup>C. The two peaks corresponding to temperatures 73.35<sup>0</sup>C and 71.41<sup>0</sup>C is not observed, the curve having only a change of the slope. Slope of this region has the lowest value (0,0003548W/g/<sup>0</sup>C) compared with the previous (0,0006462W/g/<sup>0</sup>C) and the subsequent regions (0,001416W/g/<sup>0</sup>C). For actin denaturation, however, similar results were obtained in both cases.



**Figure 2. DSC thermograms of pice of meat (---) with water in reference and (—) without water in reference**



**Figure 3. Influence of heating rate on DSC thermograms (—10<sup>0</sup>C/min; ---5<sup>0</sup>C/min)**

### **Influence of heating rate**

Experimental results of thermal analysis are markedly affected by heating rate. In general, the effect of heating rate can be summarized as follows: a)- the heating rate influences the temperature distribution inside the sample; b)- when a chemical reaction, for example a thermal denaturation is measured by DSC, the initial temperature, peak temperature and final temperature shift to the high temperature side with increasing heating rate; c)- when the heating rate is high, the reaction takes place with greater speed in the higher temperature region. The reaction finishes within a narrow temperature interval, and on this account the derivative curves become sharper. (HATAKEYAMA AND ZHENHAI, 1999).

In this paper influence of heating rate in the analysis of a piece of meat is shown in *Figure 3*. For 5<sup>0</sup>C/min heating rate one of the most significant benefits from high

heating rate is the resultant increase in sensitivity (GABBOTT P. (2007)). As seen, at a lower heating rate is observed two peaks corresponding to temperatures of 56.42°C and 61.19°C, while in the case of higher heating rate is obtained only one peak at 58.69°C, when myosin denaturation occur.

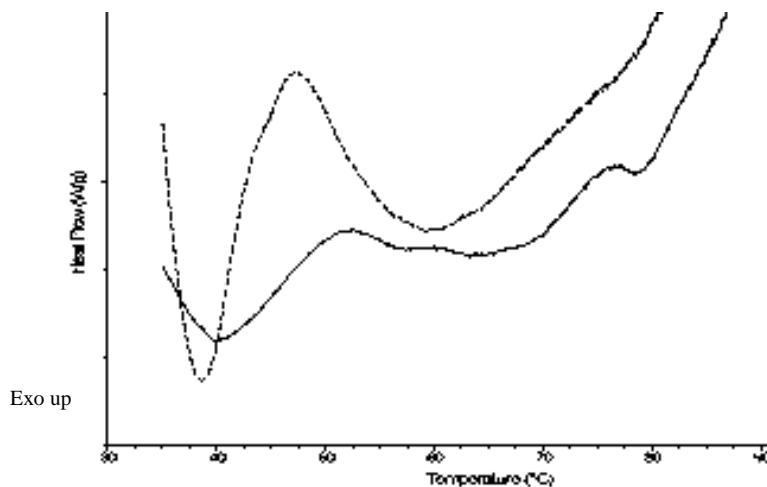
Three endothermic transitions have also been reported in DSC thermograms of rabbit (WRIGHT AND WILDING,1984) and fish myosin (TOGASHI ET AL., 2002). Multiple transitions of myosin imply structural changes in discrete regions of the myosin molecule, namely the hinge, head, and rod regions (WRIGHT AND WILDING,1984). Chicken breast myosin suspended in 0.6 M NaCl at pH 6.5 exhibits four cooperative endothermic transitions (WANG AND SMITH, 1994) and pork and chicken meats were very similar in behaviour (FERNÁNDEZ ET AL., 2000)

Endothermic transition observed at 68,75°C is obvious when the heating rate of 5°C/min, as in *Figure 1.*, and corresponding sarcoplasmatic proteins (KAZEMI ET AL., 2009)

Actin denaturation is observed, that takes place at similar temperatures, the difference being smaller than 1°C.

#### The mechanical process of grinding meat

The results for finely minced meat and dispersed in water were compared with those obtained for a piece of meat over which water was added so that in both samples to have a similar ratio between meat and water. The two curves obtained are shown in *Figure 4.*



**Figure 4. DSC thermograms of (----) finely minced meat and dispersed in water sample and (—) piece of meat over which water was added sample**

For ungrounded meat three transition states were obtained which correspond to 56.7°C, 63.2°C and 78.5°C temperatures, respectively for the distortion of myosin, sarcoplasmatic proteins and actin. These values are closer to those of literature (ZHU ET AL., 2004; KAZEMI, 2009) and on the other hand note that, denaturation enthalpy are lower than in the above cases. After fine mincing of meat and its dispersion, the resulting curve shows a transition with a peak at 59,3°C and a change in slope at 78.8°C.



## CONCLUSIONS

It is very important to ensure a good contact between the sample and crucible and between the crucible and the thermocouple or other measuring sensor. Evaporation of water influences the enthalpy of protein denaturing, but the temperatures at which transitions occur can be pointed with computer-assisted data acquisition and analysis sensitivity function curve. Moreover, if necessary, water may be added in the cup of reference, in quantity equal to that of the sample.

The factor that most influences the thermograms, is the speed of heating. According to this peaks of the curve may appear/disappear and consequently the transitions can be more or less visible.

## ACKNOWLEDGEMENTS

This work was co-financed from the European Social Fund through Sectoral Operational Programme Human Resources Development 2007-2013, project number POSDRU/89/1.5/S/63258 "Postdoctoral school for zootechnical biodiversity and food biotechnology based on the eco-economy and the bio-economy required by eco-san-genesis"

## REFERENCES

- CROSS H.R., DURLAND P.R., SEIDEMAN S.C. (1986): Sensory qualities of meat. In: P.J. Bechtel, Ed. *Muscle of Food*. Orlando: Academic Press, pp. 279–320.
- FERNÁNDEZ-M. F., FERNÁNDEZ PALOMA, CARBALLO J., JIMÉNEZ-COLMENERO F. (2000): DSC study on the influence of meat source, salt and fat levels, and processing parameters on batters pressurisation, *European Food Research and Technology*, Volume 211, Number 6, 387-392.
- GABBOTT P. (2007): *Principles and Applications of Thermal Analysis*, Wiley-Blackwell.
- HAINES P.J. (2000): *Principles of Thermal Analysis and Calorimetry RSC Paperbacks*.
- HATAKEYAMA T., ZHENHAI LIU (1999): *Handbook of Thermal Analysis*, Wiley-Blackwell.
- KAZEMI S., NGADI M.O., GARIÉPY C. (2009): Protein Denaturation in Pork Longissimus Muscle of Different Quality Groups, *Food and Bioprocess Technology*, Volume 4, Number 1, 102-106.
- KURGANOV B.I., LYUBAREV A.E., SANCHEZ-RUIZ J.M., SHNYROV V.L. (1997), Analysis of differential scanning calorimetry data for proteins. Criteria of validity of one-step mechanism of irreversible protein denaturation. *Biophys. Chem.*, Dec 1; 69(2-3):125-35.
- LEVITSKY D.I., PIVOVAROVA A.V., MIKHAILOVA V.V., NIKOLAEVA O.P. (2008): Thermal unfolding and aggregation of actin; *Federation of European Biochemical Societies Journal*; 275(17):4280-95.
- MARTENS, H., VOLD, E. (1976): DSC studies of muscle protein denaturation. In *Proceedings of the 22nd European meeting of meat research workers, Malmo, Sweden* (p. J 9.3).
- SALVADORA P., TOLDRÀA M., PARÉSA D., CARRETEROA C., SAGUER E. (2009): Color stabilization of porcine hemoglobin during spray-drying and powder storage by combining chelating and reducing agents, *MeatScience*, 83, 328–333.

- STABURSVIK, E., MARTENS, H. (1980): Thermal denaturation of proteins in post rigor muscle tissue as studied by differential scanning calorimetry. *Journal of Science Food and Agriculture*, 31, 1034–1042.
- SUN DA-WEN (2005): *Thermal Food Processing: New Technologies and Quality Issues*, CRC Press.
- TOGASHI, M., KAKINUMA, M., NAKAYA, M., O., T., WATANABE, S. (2002). “Differential scanning calorimetry and circular dichroism spectrometry of walleye Pollack myosin and light meromyosin, *Journal of Agricultural and Food Chemistry*, 50, 4803–4811.
- WANG S. F. AND SMITH D. M. (1994): Dynamic rheological properties and secondary structure of chicken breast myosin as influenced by isothermal heating, *J. Agric. Food Chem.* 42:1434.
- WENDLANDT W. W. (1985): *Thermal Analysis*, Wiley-Interscience, New York, 3rd ed.
- WRIGHT, D. J., WILDING, P. (1984): Differential scanning calorimetric study of muscle and its proteins: myosin and its subfragments, *Journal of the Science of Food and Agriculture*, 35, 357–372.
- WRIGHT, D. J., LEACH, I. B., WILDING, P. (1977): Differential scanning calorimetric studies of muscle and its constituents. *Journal of Science Food and Agriculture*, 28, 557.
- ZHU, S., LE BAIL, A., CHAPLEAU, N., RAMASWAMY, H. S., DE LAMBALLERIE-ANTON, M. (2004). Pressure shift freezing of pork muscle: Effect on color, drip loss, texture, and protein stability, *Biotechnology Progress*, 20, 939–945.

**FOR OUR ANCESTORS NATURAL,  
FOR OUR DESCENDANTS NECESSITY – SUSTAINABLE WATER USAGE**

**EÖRDÖGHNÉ MIKLÓS MÁRIA,**

PTE TTK Doctoral School of Earth Sciences, Pécs

The way people have related to water throughout the history, have greatly changed by the development of technology. Ever since we do not have to use buckets to carry water from the well, and the shower have been moved inside the house, we do not appreciate water as much as we should. Water is always available and it can be easily consumed, therefore we use it wastefully. This tendency was somewhat stopped by the increasing water prices (EÖRDÖGHNÉ 2010). Although even today there are certain places where we use expensively produced drinking water for purposes, that could be solved with reused water or with water from alternative water sources (*1. figure*).

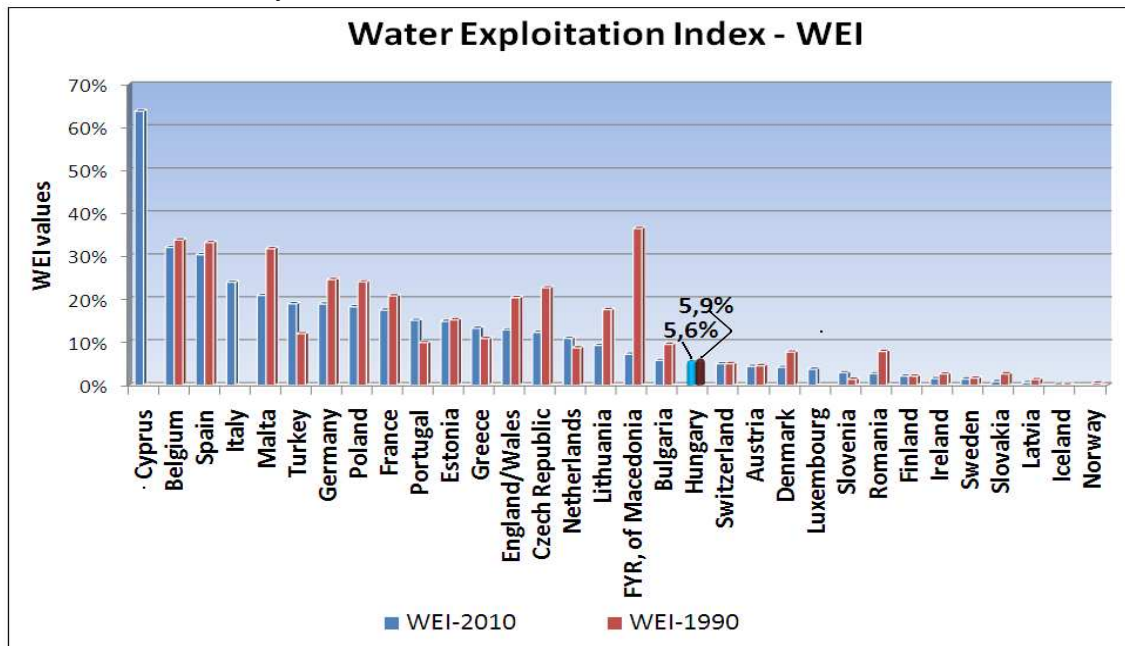


**Fig. 1. Structure of household drinking water consumption, replaceable and non replaceable water demand**  
(own picture, based on BDEW data)

To save enough suitable water for the next human generations, we must protect our water resources regarding both quantity, and quality. But our limited water resources are not the only one reason why water consumption should be lowered. Transporting the water uses energy, thus reducing the water-consumption will also reduce the energy that is used in pumping.

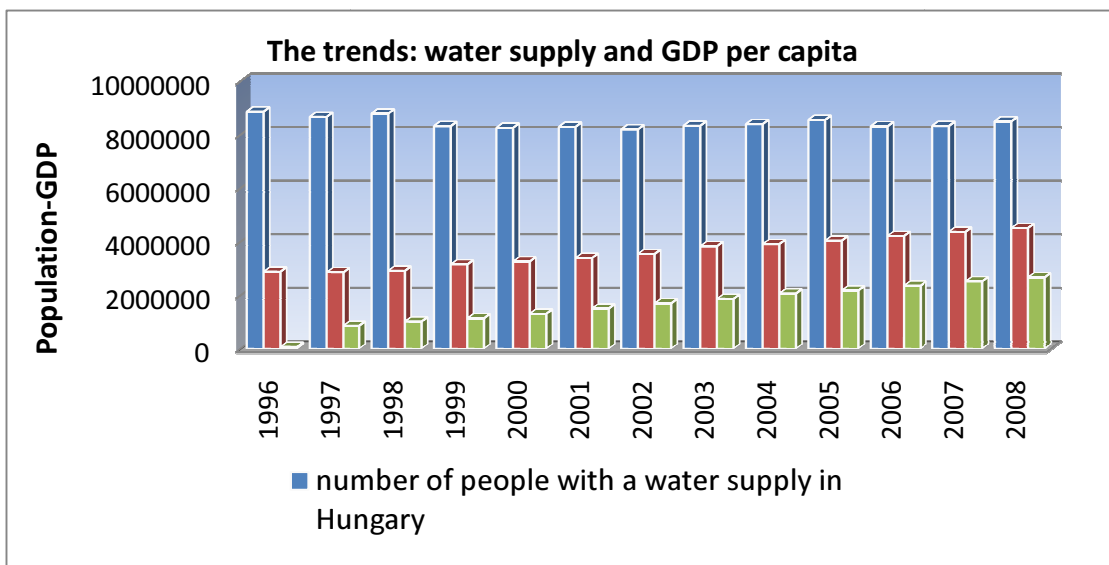
In the rapidly growing cities the water services cannot develop their infrastructure as fast as they would have to, in order to keep up with the consumers needs. This usually leads to the pollution of the underground waters and their use over the limits. Water

exploitation index shows the ratio of the available amount of water and the quantity that has been consumed, in a certain country or region (2. figure) If the WEI is over 20% that means the scarcity of water.



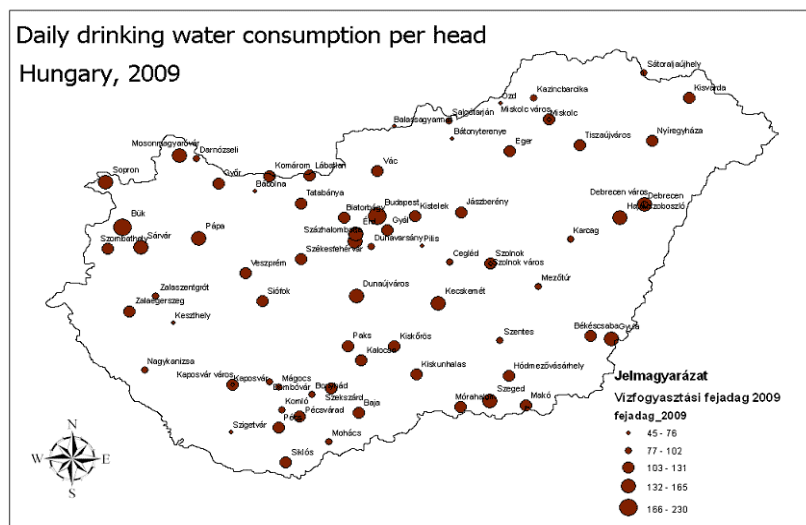
**Fig. 2. Water exploitation index**  
(own picture, based on EEA data)

The sustainable water consumption should be achieved by handling ecological and economical issues together. The water supply -through pipelines- has become today as on of our essential needs. Despite the infrastructural development of the pipe system in Hungary was always behind the economic growth (3. figure). The development of the water supply and the canalisation was done in different speed this resulting a gap between the two area’s development (3. figure). This gap have started to decrease in last couple years.



**Fig. 3. The economic development compared to the development of public water works** (own picture, based on data from KSH and Papp Mária 1996-2008)

If the sewage gets back to the nature (soil, natural waters) even after filtration, it will disturb the balance of nature because of its large quantity and its pollutive ingredients. The flow of matter should be in a completed cycle, so the lack of canalisation will not result excess of certain elements, molecules and ions - primarily phosphate and nitrate – in unwanted places. The organic components of the sewage could be used to produce fertilizers thus reducing the amount that is made by synthesis. This closed cycle would be more beneficial from the water use's point of view (GAYER, J. LIGETVÁRI, F. 2007). If we could reuse the once used less polluted waters locally where they are produced (ex. gray-water, rainwater) the amount of water that needs to be exploited would be also less (primary water exploitation). The drinking water consumed per capita in Hungary is lower than the European average - in 2005: 157 l/cap., day (EWA, 2005) - (4. figure).



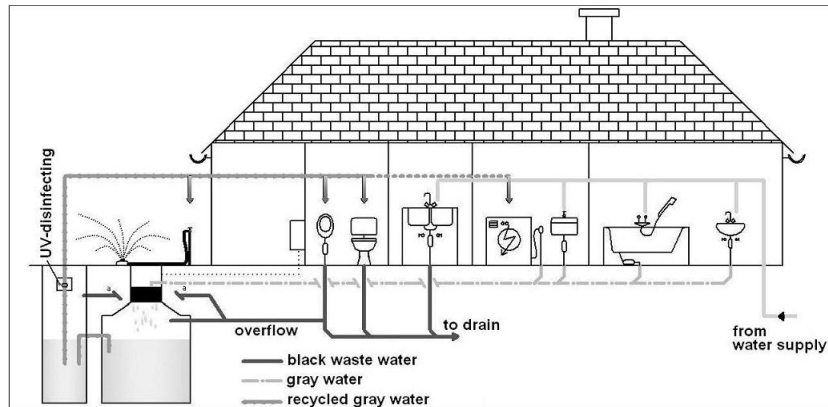
**Fig. 4. Water consumption in a variety of different settlements in Hungary (own picture, based on data from Papp Mária 2010)**

Although the amount of water could be even more reduced. The possible ways to reduce water consumption in the public area.

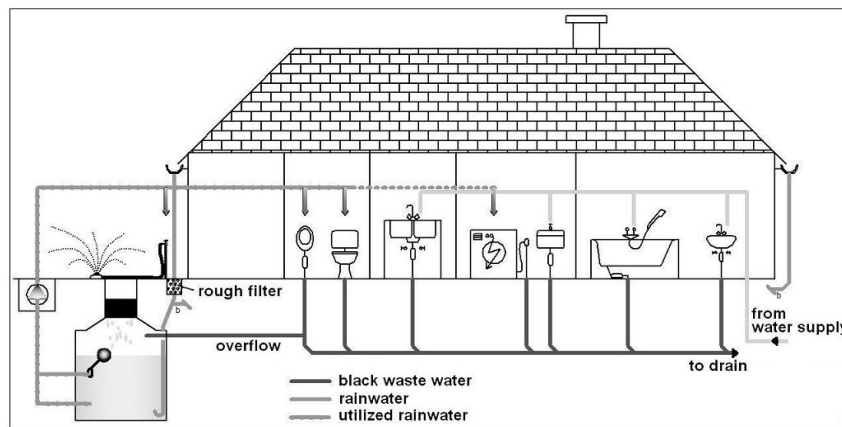
- changing habits of water consumption
- applying technical solutions that save more water
- using alternative water sources
- using alternative sanitary equipment

These possibilities can be especially effective if they are used together.

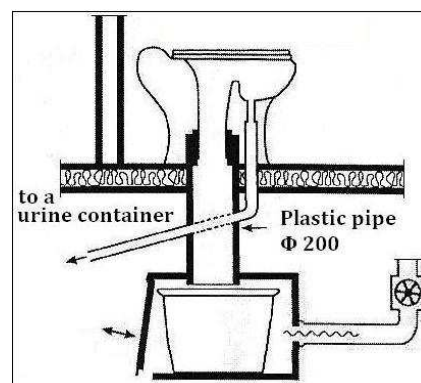
Couple examples:



**Fig. 5. Grey water utilisation in a family house**  
(own picture, based on BULLERMANN, M. et al. 2001)



**Fig. 6. Rainwater utilisation in a family house**  
(own picture, based on BULLERMANN, M. et al. 2001)



**Fig. 7. WC with separated sewage disposal**  
(own picture, based on SAUER, S. et al. 2009)

## REFERENCES

- BDEW - Bundesverband-der-Energie-und-Wasserwirtschaft
- BULLERMANN, M. – LÜCKE, F. K. – MEHLHART, G. – KLAUS, U. (2001): Grau- und Regenwassernutzung Kassel-Hasenhecke Hygienische und betriebstechnische Begleituntersuchungen, Band 7 Schriftenreihe der fbr e.V., Darmstadt  
<http://www.aquaplaner.de/GW-Kurzfassung0503.pdf> (utolsó letöltés: 2011. 03.10.)
- EÖRDÖGHNÉ MIKLÓS MÁRIA (2010): A vízfogyasztás területi jellemzői Magyarországon, Geográfia 2010 Konferencia, Pécs
- EWA YEARBOOK 2005 - European Water Association (EWA)
- GAYER JÓZSEF – LIGETVÁRI FERENC (2007): Települési vízgazdálkodás –csapadékvíz elhelyezés - Környezetvédelmi és Vízgazdálkodási Kutató Intézet Kht.  
[http://www.kvvm.hu/cimg/documents/0314\\_k\\_nyv\\_c\\_mlappal.pdf](http://www.kvvm.hu/cimg/documents/0314_k_nyv_c_mlappal.pdf)
- GLATZ FERENC (1997): A 21. század stratégiai kérdése: a víz In. A hazai vízgazdálkodás stratégiai kérdései, Somlyódy László, MTA, Budapest 2002.
- KOZIOL, M. – VEIT, A. – WALTHER, J. (2006): Stehen wir vor einem Systemwechsel in der Wasserver- und Abwasserentsorgung? Forschungsverbund netWORKS, Berlin, pp. 8-11
- PAPP MÁRIA (1997-2010): Évkönyv(ek) 1996 –  
2009 – Tények, adatok, a víz- és csatornaszolgáltatásról, Víz- és Csatornaművek Országos Szakmai Szövetsége, Budapest
- SAUER, S. ET AL. (2009): Neuartige Sanitärsysteme – Lehrmaterial der Bauhaus-Universität Weimar, pp. 21-30.  
<http://www.eea.europa.eu/data-and-maps/figures/water-exploitation-index-wei-4>

## THE ROOTSTOCK EFFECT IN WATERMELON PRODUCTION

BALÁZS GÁBOR, KAPPEL NOÉMI, FEKETE DÁVID

Corvinus University of Budapest, Department of Vegetable and Mushroom Growing  
H-1118 Budapest, Villányi út 29-43.  
balazs.gabor@uni-corvinus.hu

### ABSTRACT - The rootstock effect in watermelon production

Watermelon production has a great tradition in Hungary. The experiment was set up at Medgyesegyháza Békés county in 2010, in cooperation with the company TЭСZ-ЭСZ Nonprofit Kft. Combination of 4 container watermelon varieties *Lonci*, *Crimstar*, *Sprinter* and *Early Beauty* and squash rootstocks of 2 different variety groups (*Lagenaria* and interspecific) were tested. Non-grafted and grafted plants, in accordance with the commonly used method of production, were planted out at different plant spacings in 4 repeats, meaning that non-grafted transplants were placed at a row width and plant spacing of 2.7 x 0.5 m (0.74 plants per m<sup>2</sup>) while grafted plants at 2.7 x 1 m (0.37 plants per m<sup>2</sup>). Using the results obtained, average yield per m<sup>2</sup> was determined, as well as average fruit weight and yield per plant. At the pickings it was seen that the extremely wet and cool growing season had produced different effect on the disease susceptibility of the different graft combinations. On July 31st 2010, each graft combination was surveyed for its foliage using a scale ranging from 1 to 5 where the value 1 represented the greatest foliage loss. In the trial the container varieties were found to be preferably grafted onto rootstocks belonging to the *Lagenaria* type. The variety *Argentario*, tested also in the trial, is recommended.

**Keywords:** watermelon, grafting, yield, varieties, foliage

## INTRODUCTION

Watermelon production has a great tradition in Hungary. Descriptions on its cultivation appeared as early as the 18th century, which show that at that time it was one of the most important articles of provision. By the present days, the grafting of watermelon has gained in importance. Due to the extreme weather characteristics of the country, a further considerable increase in the area of grafted plants is expected.

In order to select the suitable combination of rootstock and scion variety it is necessary to know the characteristics of the rootstock: the type of root system, resistance, its effect on growth vigour and its effect on fruit ripening etc. As many as 6 to 7 varieties can be considered for melon rootstock. In Asia, grafted vegetables had already been brought into cultivation several centuries ago (LEE-ODA 2003). In Korea and in Japan grafted watermelon transplants were produced on a large scale already in 1920 (LEE 1994), but their use in production in the Western world started only from 2005 onwards (RISTAINO, THOMAS 1997). The reason for using grafted transplants consisted in the protection against soil borne pests and diseases, as chemical and genetic methods had failed to reach the desired effect (ODA 2002). Grafted transplants show a better reaction to novel diseases besides offering a cheaper and more flexible solution compared to the development of a resistant variety by breeding. Simultaneously, it can assist in the improvement of quality and yields (LEE-ODA, 2003, NISINI ET AL., 2002, ODA, 2002, RIVERO ET AL., 2003, ROMERO ET AL., 1997, SHIMADA-MORITANI 1977; YETISIR-SARI, 2003; TRAKA-MAROVNA ET AL., 2000).



Nowadays, many other reasons exist for the use of grafting, e.g. to make use of the resistance of grafted plants to low and high temperatures, of the increased salt tolerance, of the increased absorption and of the more efficient use of water (COHEN-NOAR, 2002). Due to the importance of the subject, the aim of the experiment was to study the quantitative and qualitative changes in response to grafting. Besides measuring the quantitative and qualitative parameters we also wanted to see what differences could be observed between the interspecific and *Lagenaria* types.

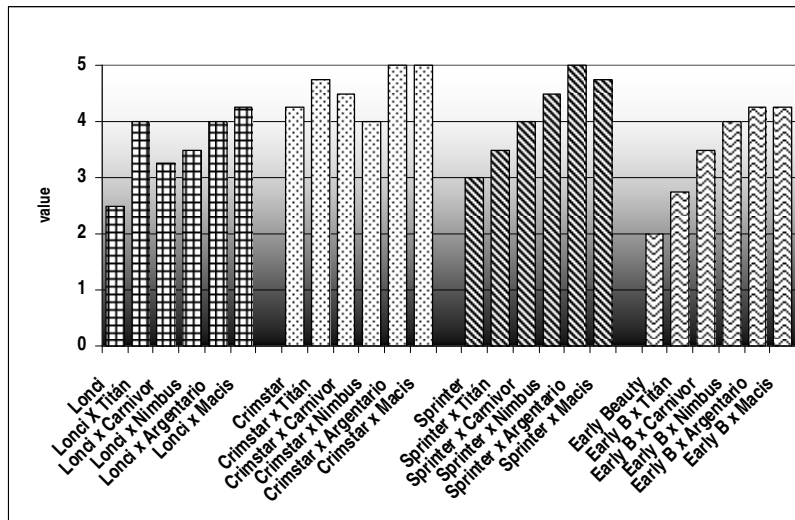
## MATERIAL AND METHOD

The experiment was set up at Medgyesegyháza Békés county in 2010, in cooperation with the company TÉSZ-ÉSZ Nonprofit Kft. Combination of 4 container watermelon varieties *Lonci*, *Crimstar*, *Sprinter* and *Early Beauty* and squash rootstocks of 2 different variety groups (*Lagenaria* and interspecific) were tested. The interspecific squash rootstock was represented by the varieties *Nimbus*, *Carnivor* and *Titán*, while the Bottle gourd (*Lagenaria*) variety type by the varieties *Argentario* and *Macis*. Seeds of the non-grafted melon used as the control and those of the rootstocks were sown on March 16th and grafting took place on April 13th. Outplanting in the field was carried out on April 30th using an intensive technology (soil mulch, dripping tube, readily water soluble fertilizer, small plastic tunnel). Non-grafted and grafted plants, in accordance with the commonly used method of production, were planted out at different plant spacings in 4 repeats, meaning that non-grafted transplants were placed at a row width and plant spacing of 2.7 x 0.5 m (0.74 plants per m<sup>2</sup>) while grafted 2.7 x 1 m (0.37 plants per m<sup>2</sup>). In the phase of intensive development, growth vigour was recorded on June 17th 2010, where the growth vigour of the different grafted plants was compared to one another. After ripening, using a digital scale, the fruits were weighed individually for each treatment and for each repeat in the treatment. Using the results obtained, average yield per m<sup>2</sup> was determined, as well as average fruit weight and yield per plant. At the pickings it was seen that the extremely wet and cool growing season had produced different effect on the disease susceptibility of the different graft combinations. On July 31st 2010, each graft combination was surveyed for its foliage using a scale ranging from 1 to 5 where the value 1 represented the greatest foliage loss.

## RESULTS

On June 17th 2010 the growth vigour of all the plants was measured using a scale ranging from 1 to 5. Of the grafted plants the graft combinations *Crimstar* x *Argentario*, *Crimstar* x *Macis* and *Sprinter* x *Argentario* had the same growth vigour.

Based on the results, it can be seen that the rootstocks belonging to the *Lagenaria* type had stronger growth vigour than the ones belonging to the interspecific group. Except for the own-rooted *Crimstar*, all the three non-grafted varieties are characterized by weaker growth vigour than the grafted variants. In the case of the *Crimstar* the plants grafted onto the rootstock *Nimbus* showed weaker growth vigour than the non-grafted plants (*Figure 1*).



**Figure 1: Growth vigour of grafted watermelon (2010)**

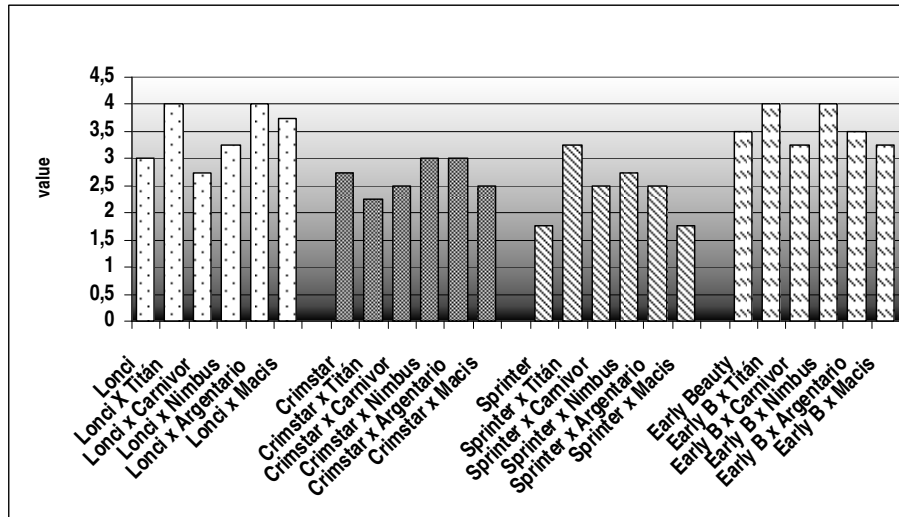
Fruits were harvested with 5 pickings (July 26th, July 29th, August 3rd, August 10th and August 18th). In the case of the varieties *Lonci*, *Sprinter* and *Early Beauty* it was seen that grafting had increased yields per m<sup>2</sup> in all the cases. With each combination tested the highest value was measured for the variety *Argentario* belonging to the *Lagenaria* genus. In the case of *Crimstar*, grafting had no yield increasing effect in most of the cases, except when grafted onto the rootstock *Argentario*. In the case of the varieties *Lonci*, *Crimstar* and *Early Beauty* the bottle gourd rootstocks are capable of producing higher yields than the interspecific squash varieties. Grafting had a yield enhancing effect on average fruit weight in all of the cases, as well as increasing yields per plant (*Table 1*).

**Table 1. Yield parameters of grafted watermelons (2010)**

Varieties and graft combinations	Average yield kg/m <sup>2</sup>	Average weigh kg/pc	Yield pc/plant
<b>Lonci</b>	3,55	3,99	1,15
Lonci x <i>Titán</i>	9,25	<b>7,42</b>	3,43
Lonci x <i>Carnivor</i>	8,21	5,82	3,73
Lonci x <i>Nimbus</i>	9,08	6,84	3,62
Lonci x <i>Argentario</i>	<b>12,35</b>	6,70	<b>4,97</b>
Lonci x <i>Macis</i>	10,45	6,90	4,10
<b>Crimstar</b>	10,29	5,31	2,70
Crimstar x <i>Titán</i>	7,49	5,82	3,56
Crimstar <i>Carnivor</i>	7,94	5,38	3,92
Crimstar x <i>Nimbus</i>	8,11	5,93	3,78
Crimstar x <i>Argentario</i>	<b>12,70</b>	<b>6,13</b>	<b>5,70</b>
Crimstar x <i>Macis</i>	8,22	6,00	3,67
<b>Sprinter</b>	3,24	3,90	1,13
Sprinter x <i>Titán</i>	8,13	<b>7,31</b>	3,00
Sprinter x <i>Carnivor</i>	9,31	6,42	3,89
Sprinter x <i>Nimbus</i>	9,14	6,58	3,83
Sprinter x <i>Argentario</i>	<b>11,47</b>	6,14	<b>5,02</b>
Sprinter x <i>Macis</i>	6,93	5,83	3,24
<b>Early Beauty</b>	3,84	4,78	1,09
Early Beauty x <i>Titán</i>	6,58	<b>5,86</b>	3,00
Early Beauty x <i>Carnivor</i>	7,50	5,02	3,92
Early Beauty x <i>Nimbus</i>	8,33	5,32	4,27
Early Beauty x <i>Argentario</i>	<b>11,36</b>	5,78	<b>5,29</b>
Early Beauty x <i>Macis</i>	10,56	5,85	4,86

During the growing season (July 31st 2010) we recorded the health state of the foliage of the non-grafted and grafted combinations.

Of the graft combinations tested the ones preserving their foliage best were *Lonci* x *Titán*, *Lonci* x *Argentario*, *Early Beauty* x *Titán* and *Early Beauty* x *Nimbus*.



**Figure 2: State of health of the foliage of grafted watermelons (2010)**

The variety *Lonci*, in the grafted form, preserved the foliage in a better state of health than when growing on its own roots, except for the rootstock *Carnivor*. The foliage of *Crimstar* showed almost the same value when grafted and when growing on its own roots. In the case of the variety *Sprinter* every grafting combination had healthier foliage than the non-grafted ones from this variety. The variety *Early Beauty* showed no significant differences between the different rootstocks (*Figure 2*).

## CONCLUSIONS

The study of the growth vigour of grafted plants revealed that the variety *Argentario* belonging to the *Lagenaria* type was the best in most of the cases. In accordance with the descriptions in the literature grafting is characterized by higher yields in case of almost each combination than the non-grafted variants, except for the variety *Sprinter*. Higher yields are an opportunity for a greater income for growers, though the distribution of the yield over the picking season should be taken into consideration.

As a result of the rainy and cool weather it was seen that non-grafted plants showed a greater loss of foliage than the grafted ones. Descriptions in the literature also mention the fact that grafted plants can be characterized by a higher level of resistance, which was confirmed also by our trial. Based on the aspects studied the following rootstock varieties are recommended for the container varieties tested:

1, **Lonci**: Grafting is recommended on the rootstocks *Argentario* and *Macis*. Based on sensory qualification, again the rootstock *Argentario* is to be highlighted. It is to note that good results can be achieved also on the rootstock *Titan* recommended by the company selling the seeds.

2, **Crimstar**: The rootstock *Argentario* belonging to the *Lagenaria* type achieved the best results. If it was nonetheless grafted onto an interspecific rootstock, the variety *Nimbus* would be recommended.

3, **Sprinter**: Again, the bottle gourd rootstock is recommended, and more specifically the variety *Argentario*. Of the interspecific rootstocks the varieties *Carnivor* and *Nimbus* seem to be suitable.

4, **Early Beauty**: It is recommended to be grafted onto the rootstock *Argentario* in order to achieve higher yields.

In the trial the container varieties were found to be preferably grafted onto rootstocks belonging to the *Lagenaria* type. The variety *Argentario*, tested also in the trial, is recommended.

### ACKNOWLEDGEMENT

Research work was supported by the grant TAMOP-4.2.1/B-09/1/KMR-2010-0005.

### REFERENCES

- COHEN, S., A. NOAR. (2002): The effect of three rootstocks on water use canopy conductance and hydraulic parameters of apple trees and predicting canopy from hydraulic conductance. *Plant Cell Environ.* 25: 17-28.
- LEE, J. M. (1994): Cultivation of grafted vegetables I. Current status, grafting methods and benefits. *HortScience.* 29: 235-239.
- LEE, J. M., ODA, M. (2003): Grafting of herbaceous vegetable and ornamental crops. *Hortic. Rev.* 28: 61-124.
- NISINI, P. T., COLLA, G., GRANATI, E., TEMPERINI, O., CRINO, P., AND SACCARDO, F. (2002): Rootstock resistance to fusarium wilt and effect on fruit yield and quality of two muskmelon cultivars. *Sci. Hortic.* 93: 281-288.
- ODA, M. (2002): Grafting of vegetable crops. *Sci. Rep. Agric. Biol. Sci., Osaka Pref. Univ.* 53: 1-5.
- RISTAINO, J. B., THOMAS, W. (1997): Agriculture, methyl bromide and the ozone hole, can we fill the gap? *Plant Dis.* 81: 964-977.
- RIVERO, R. M., RUIZ, J. M., AND ROMERO, L. (2003): Role of grafting in horticultural plants under stress conditions. *Sci. Technol.* 1: 70-74.
- ROMERO, L., BELAKBIR, A., RAGALA, L., AND RUIZ, M. (1997): Response of plant yield and leaf pigments to saline conditions: Effectiveness of different rootstocks in melon plants (*Cucumis melo* L.). *Soil Sci. Plant Nutr.* 43: 855-862.
- SHIMADA, N., MORITANI, M. (1977): Nutritional studies on grafting of horticultural crops. (2) Absorption of minerals from various nutrient solutions by grafted cucumber and pumpkin plants. *J. Jpn. Soc. Soil Sci. Plant Nutr.* 48: 396-401.
- TRAKA-MAVRONA, E., KOUTSIKA-SOTIRIOU, M., PRITSA, T. (2000): Response of squash (*Cucurbita* spp.) as rootstock for melon (*Cucumis melo* L.). *Sci. Hortic.* 83: 353-362.
- YETISIR, H., SARI, N. (2003): Effect of different rootstock on plant growth, yield and quality of watermelon. *Austr. J. Exper. Agric.* 43: 1269-1274.

## VEGETABLE GROWING ON EXPANDED CLAY

SLEZÁK KATALIN, TERBE ISTVÁN, KIS KRISZTIÁNNÉ

Department of Vegetable and Mushroom Growing, Faculty of Horticultural Science,  
Corvinus University of Budapest, Villányi út 29-43, Budapest, Hungary  
katalin.slezak@uni-corvinus.hu

### ABSTRACT – Vegetable growing on expanded clay

As soilless gardening is becoming more popular, the broadening of knowledge on growing media with low environmental burden is continuously of interest. In the experiment we investigated the applicability of Liapor Hydro clay pebble products in greenhouse production of sweet pepper, tomato, eggplant and cucumber, using rockwool as the control medium (sweet pepper, tomato, eggplant) and peat-perlite mix (cucumber). The volume of substrate per plant was 5 liters in the case of pepper and tomato, 10 liters in the case of cucumber and 7.5 or 15 liters in the case of eggplant. Experimental results demonstrate the suitability of expanded clay as growing medium for the soilless greenhouse production of all four vegetables. In the case of eggplant, results relative to growing medium quantity, showing that the greater root volume produces greater yields, are an indication of the importance of making the choice of the volume in accordance with the growing medium.

**Keywords:** cucumber, eggplant, Liapor, sweet pepper, tomato

## INTRODUCTION

An ever greater number of farms are compelled to change their production technology as a result of the monocultural production system characteristic in greenhouse vegetable growing, of the spread of soil-born pathogens and root-knot nematodes and of the unfavorable changes in the physical and chemical properties of soils (TERBE, PAP, 2008). The area of soilless production is ever greater in the whole world. Owing to the great number of new plant physiology knowledge applicable also in the practice of production, to the ever deeper knowledge of substrates and to technical inventions the annual growth of this production system can be estimated to be approximately 5% (VERDONCK, 2007).

Expanded clay has been used in horticultural production since 1936 (RAVIV ET AL., 2002), but the large-scale production in expanded clay pellets started in 1950 in Switzerland (FISCHER, MEINKEN, 1991).

Clay pellets are divided in several size ranges between 1 and 20 mm, but in the case of a few products also the 10-30 mm fraction is known (VERDONCK ET AL., 1980). According to shape, distinction is made between whole (round) balls and crushed clay pellets, but types containing a mixture of the two are also known (SLEZÁK, PAP, 2008), though generally the shapes close to sphere are in use (VERDONCK, 2007).

In the early 90s IMRE carried out a series of experiments with pepper on the substrates of production systems isolated from the soil. Based on the results of the experiments he concluded that expanded clay was suitable for cultivation if accompanied with the elaboration of a suitable fertigation system (IMRE, 1993, 1994). Italian researchers gathered favorable experiences with the use of the product in the size range of 2-4 mm in greenhouse tomato production in expanded clay pebbles (CALABRETTA ET AL., 1994).

In greenhouse cucumber cultivation, in the two-year experiment of BÖHME (1995) expanded clay pellets produced higher yields compared to rockwool, while used in the second year produced ones significantly lower.

At the Department of Vegetable and Mushroom Growing of Corvinus University of Budapest the research of substrates has great traditions. The present publication is a summary of some of technology development researches on production in expanded clay pellets (Liapor Hydro 4/8, Liapor Hydro 4/8 KK) and a synthesis of the results.

## MATERIAL AND METHOD

We studied the applicability of Liapor Hydro clay pebble products in hydroponic production of **sweet pepper**, using rockwool for control medium. In the treatments containing the clay pellets, the white plastic bags serving for covering the rockwool slabs were filled with 15 liters of clay pellets. In plant nutrition, we used the formula and nutrient solution concentration recommended for rockwool pepper production. Irrigation frequency and length were set to accord with plant development. The fruits were divided into the following quality categories: extra (>100 g), 1st class (80-100 g), 2nd class (60-80 g), 3rd class (40-60 g), substandard and tiny fruits (including the strongly deformed or blotched ones, mainly with Ca deficiency, and the ones under 40 grams).

In greenhouse **tomato** production we also used the plastic bag cultivation, with rockwool control. In irrigation and fertigation, for all three treatments we used the formula and nutrient solution concentration recommended for rockwool tomato cultivation, with as many as 15-20 irrigations per day. As the nutrient solution amount optimal for rockwool grown plants proved to be insufficient for the plants planted in expanded clay pellets, two additional drippers were pricked into each bag filled with the clay pellets, into the part between the rockwool cubes. At the pickings the number and total weight of the fruits collected from the 12 plants were registered.

In the case of **eggplant**, using the same plant spacing, the plastic bags with a filling length of 1 meter were planted with one or two plants because of the 66 cm spacing (2 plastic bags were planted with 3 plants). As a result, in the analyses, separate investigations could be carried out on the effect of 7.5 and 15 liters root volume per plant. In the experiment the two different 4/8 size expanded clay pellets were compared with rockwool in an irrigation-fertigation system for rockwool grown plants. Each plant was considered to be a separate plot. As yield results of the plants were different with the two planting types, their results were compared separately and also the effect of the growing media volume was studied.

Experiment on greenhouse **cucumber** production was set up in Mórahalom (South Hungary) in a plastic tunnel of Filclair type. Prior to planting, 10-10 buckets were filled with expanded clay pellets in the plastic tunnel, and further 10 buckets filled with peat containing soil mix were assigned to be control plots. Irrigation and fertigation were carried out in accordance with the requirements of the plants planted in peat containing soil mix (2-10 times a day). Two pickings per week were carried out and at the pickings, divided into classes we measured the number and total weight of the fruits collected from the 10 plants on each plot.

Detailed technological parameters of the experiments are reported in *Table 1*.

**Table 1. Technological data of trials**

Species	Sweet pepper	Tomato	Eggplant	Cucumber		
Location of trials	Budapest, Corvinus Univ.	Szentes	Budapest, Corvinus Univ.	Mórahalom		
Variety	Hó	Annet	Madonna	Ceres		
Site of trials	plastic greenhouse of Filclair type	10 m long plastic tunnel	plastic greenhouse of Filclair type	plastic greenhouse of Filclair type		
Method of cultivation	plastic bag	plastic bag	plastic bag	container		
Expanded clay product tested	H4/8KK	H4/8, H4/8KK,	H4/8, H4/8KK,	H4/8, H4/8KK		
Control substrate	rockwool	rockwool	rockwool	90% peat + 10% perlite		
Seedling growing medium	rockwool	rockwool	rockwool	peat		
Date of planting	March 30th	Feb 28th	May 9th	Feb 23rd		
Plant density	4 plants/m <sup>2</sup>	3.8 plants/m <sup>2</sup>	2 plants/m <sup>2</sup>	1.95 plants/m <sup>2</sup>		
Pickings	date	first	May 17th	Apr 26th	June 17th	Apr 5th
		last	Oct 18th	June 12th	Oct 16th	July 27th
	number (total/early)	15 / 1-5.	7 / 1-3.	18 / 1-5.	33 / 1-11.	

## RESULTS

### Sweet pepper

The higher total yields were characteristic to the plots with expanded clay pellets (*Table 2*), though no statistical difference was detectable between the two media and almost all over the growing season the best result was produced by the rockwool. The proportion of substandard fruits was very low in all of the treatments.

**Table 2. Sweet pepper yields with plastic bag cultivation**

Treatment	Yield weight [kg/m <sup>2</sup> ]				Fruit number [fruits/m <sup>2</sup> ]			
	Total	Early	Extra + 1 <sup>st</sup> class	Subst.*	Total	Early	Extra + 1 <sup>st</sup> class	Subst.*
H4/8KK	18.36	3.85	9.66	0.28	231.20	53.67	90.53	4.13
Rockwool	17.76	4.05	9.97	0.64	216.01	51.94	93.84	8.58

\*Substandard

### Tomato

The yields of the plants grown in rockwool were approximately 0.76 kg higher per m<sup>2</sup> than those of the plants grown in expanded clay (*Table 3*). Of the two different expanded clay pellet types the H4/8KK produced somewhat better results than the H4/8. In the case of the former the fruiting graph had almost the same pattern as that of the plants grown in rockwool.

**Table 3. Tomato yields [kg/m<sup>2</sup>]**

Treatment	Total	Early
H4/8	26.82	8.52
H4/8KK	27.04	11.65
Rockwool	28.09	12.41

### Eggplant

Considering total yields it can be seen (Table 4) that in the case of planting one plant per slab the rockwool was the most favorable but the treatment H4/8 was only slightly inferior. The H4/8KK on the other hand produced yields that were almost 30% inferior (5.18 kg) to that produced by the rockwool. When two plants were planted on the same slab, the difference between the three treatments was less than 0.30 kg. In the case of the rockwool and the expanded clay H4/8 the greater root volume per plant was significantly superior to the smaller one.

**Table 4. Eggplant yields**

Treatment	Total	Early	Marketable	Substandard
<b>Yield weight [kg/m<sup>2</sup>]</b>				
<i>1 plant / plastic bag</i>				
H4/8	17.70 <sup>aA</sup>	3.56 <sup>abA</sup>	13.85 <sup>abA</sup>	3.85 <sup>aA</sup>
H4/8KK	12.61 <sup>bA</sup>	2.45 <sup>bA</sup>	10.48 <sup>bA</sup>	2.13 <sup>aB</sup>
Rockwool	17.96 <sup>aA</sup>	5.26 <sup>aA</sup>	15.35 <sup>aA</sup>	2.61 <sup>aA</sup>
<i>2 plants / plastic bag</i>				
H4/8	13.70 <sup>aB</sup>	4.59 <sup>aA</sup>	9.97 <sup>aB</sup>	3.73 <sup>aA</sup>
H4/8KK	13.76 <sup>aA</sup>	2.71 <sup>aA</sup>	9.97 <sup>aA</sup>	3.79 <sup>aA</sup>
Rockwool	13.68 <sup>aB</sup>	3.85 <sup>aA</sup>	10.80 <sup>aB</sup>	2.88 <sup>aA</sup>
<b>Two factor variance analysis results</b>				
Planting method	p<0.05	-	p<0.05	-
Growing medium	p<0.05	p<0.05	p<0.05	-
Planting method x growing medium	p<0.05	-	-	-
<b>Fruit number [fruits/m<sup>2</sup>]</b>				
<i>1 plant / plastic bag</i>				
H4/8	62.00 <sup>aA</sup>	20.00 <sup>abA</sup>	40.00 <sup>abA</sup>	22.00 <sup>aA</sup>
H4/8KK	39.00 <sup>bA</sup>	12.00 <sup>bA</sup>	29.00 <sup>bA</sup>	10.00 <sup>bB</sup>
Rockwool	54.00 <sup>aA</sup>	22.00 <sup>aA</sup>	42.00 <sup>aA</sup>	12.00 <sup>abA</sup>
<i>2 plants / plastic bag</i>				
H4/8	48.80 <sup>aB</sup>	20.00 <sup>aA</sup>	29.80 <sup>aA</sup>	19.00 <sup>aA</sup>
H4/8KK	49.50 <sup>aA</sup>	16.50 <sup>aA</sup>	29.30 <sup>aA</sup>	20.20 <sup>aA</sup>
Rockwool	50.00 <sup>aA</sup>	19.50 <sup>aA</sup>	34.50 <sup>aB</sup>	15.50 <sup>aA</sup>
<b>Two factor variance analysis results</b>				
Planting method	-	-	-	-
Growing medium	p<0.05	p<0.05	-	p<0.05
Planting method x growing medium	p<0.05	-	-	-

Note: The different small letters next to the numbers in the columns indicate the statistical difference at p<0.05 level of the effect of the media, and the capitals that of the planting method (root volume)



In terms of total fruit number the two planting methods showed difference again. In the investigation of the plants grown singularly the best result was produced by the expanded clay H4/8, while in the case of planting in pairs the rockwool. In the case of the former the H4/8KK treatment produced an almost 40% lower result than the H4/8, while a result between the two was reached in the rockwool. In the second case the lowest number of fruits were harvested from the plants of the treatment H4/8, but it was only 13% inferior to the rockwool. Comparing the two planting methods, significant difference occurred only in the case of the medium H4/8, for the advantage of the greater root volume.

The level of the Ca-deficient, damp and soft (substandard) fruits was relatively high in each treatment, but the planting of two plants per bag (i.e. the lower root volume per plant) resulted in a higher proportion of substandard fruits.

### Cucumber

The highest numbers of fruits were produced by the plants planted in the peat containing mix, though the yield weight of the plants grown in the expanded clay pellets was only 15-20% lower and their fruit number only 10-12% lower (Table 5). In terms of the total yields no significant difference was found between the two different expanded clay types. Considering the qualitative distribution of fruits it can be seen that the proportion of the 1st class fruits (over 90%) was very favorable in each treatment.

**Table 5. Cucumber yields**

Treatment	Yield weight [kg/m <sup>2</sup> ]			Fruit number [fruits/m <sup>2</sup> ]		
	Total	Early	1 <sup>st</sup> class	Total	Early	1 <sup>st</sup> class
H4/8	18.40	7.16	17.25	49.45	19.18	44.93
H4/8KK	17.59	7.32	16.19	47.95	19.59	42.88
Peat + Perlite	21.58	8.81	20.36	54.66	23.15	50.14

## CONCLUSIONS

Experimental results show the suitability of expanded clay pellets for root medium in the soilless greenhouse production of sweet pepper, tomato, eggplant and cucumber. With the refinement of the irrigation-fertigation system probably the yields of each species can be increased. In the case of the eggplant the results on the amount of the growing medium, according to which the greater root volume increases yields, show that choosing the volume in accordance with the substrate can also have great significance.

## ACKNOWLEDGEMENT

Here we express our acknowledgements for Liabau Építőipari Kft. for the support to the experiment.

Publication was supported by the grant TAMOP-4.2.1/B-09/1/KMR-2010-0005.

## REFERENCES

- BÖHME, M. (1995): Evaluation of organic, synthetic and mineral substrates for hydroponically grown cucumber. Acta Horticulturae 401: International Symposium on Growing Media & Plant Nutrition in Horticulture. Naaldwijk, Netherlands. p. 209-218.
- CALABRETTA, C., NUCIFORA, M.T., FERRO, B., DI NATALE, V. (1994): New techniques for the cultivation and defence of tomato crops in cold greenhouse in the area of Ragusa (Sicily). Acta Horticulturae 361: International Symposium on New Cultivation Systems in Greenhouse. Cagliari, Italy. p. 530-544.
- FISCHER, P., MEINKEN, E. (1991): Blähtone für die Hydrokultur. Deutscher Gartenbau. 27: 1678-1679.
- IMRE, Cs. (1993): Paprika hidrokulturás termesztése zeolitban és égetett agyaggranulátumban. Kertgazdaság. 25(5-6): 1-7.
- IMRE, Cs. (1994): Gyökérrögzítő közegek hatása a paprika (*Capsicum annuum* L.) növekedésére, terméshozamára és a bogyók minőségi jellemzőire. Candidate's thesis. Kertészeti és Élelmiszeripari Egyetem, Budapest. Manuscript. 132 p.
- RAVIV, M., WALLACH, R., SILBER, A., BAR-TAL, A. (2002): Substrates and their analysis. In: SAVVAS, D., PASSAM, H. (ed.) Hydroponic Production of Vegetables and Ornamentals. Embryo Publications, Athens. p. 25-102.
- SLEZÁK K., PAP Z. (2008): A talaj nélküli termesztésben használatos közegek jellemzése. In: Terbe I. Slezák K. (ed.): Talaj nélküli zöldségajtatás. Mezőgazda Kiadó, Budapest. p. 89-105.
- TERBE I., PAP Z. (2008): Bevezetés. In: Terbe I. Slezák K. (ed.): Talaj nélküli zöldségajtatás. Mezőgazda Kiadó, Budapest. p. 9-19.
- VERDONCK, O. (2007): Status of soilless in Europe. Acta Horticulturae 742: International Conference and Exhibition on Soilless Culture: ICESC 2005. Singapore, Singapore. p. 35-39.
- VERDONCK, O., DE VLEESCHAUWER, D., DE BOODT, M. (1980): Growing ornamental plants in inert substrates. Acta Horticulturae 99: Symposium on Substrates in Horticulture other than Soils In Situ. Auchincruive, Scotland. p. 113-118.

## **FUNCTIONAL DIVERSITY INVESTIGATION OF BACTERIAL COMMUNITIES IN DISTINCT SOIL TYPES WITH RISA AFTER PRECULTURING (RISA-APC) METHOD.**

**E. SAJBEN, L. MANCZINGER, Cs. VÁGVÖLGYI**

University of Szeged, Faculty of Science and Informatics, Department of Microbiology  
Közép fasor 52, H-6726 Szeged, Hungary  
sajben@gmail.com

### **ABSTRACT – Functional diversity investigation of bacterial communities in distinct soil types with RISA after preculturing (RISA-APC) method.**

Microorganisms play a leading role in soil development and preservation; moreover, they could indicate the soil health and conditions. In this study, we analyzed the bacterial composition of three different soil types with a newly developed RISA-APC method. A novelty of this method is the pre-culturing step: this preculturing of the bacterial communities were performed on solid media supplemented with different carbon sources (e.g.: carboxy-methyl cellulose, xylan, chitin, starch, tributyrin, casein and protocatechuic acid). For the investigation of heavy metal tolerant bacteria, a preculturing on YEG media containing CuSO<sub>4</sub> or CdCl<sub>2</sub> were used. The mini-colonies developed after a short incubation time was investigated. This RISA-APC method proved to be a useful tool for the comparison of different soil types, and for the examination of changes in the soil bacterial community structure. It was clearly shown that the most diverse functional diversity values occurred in the forest soil and the less diverse bacterial community was detected in sandy soil samples.

**Keywords:** bacterial community analysis, soil quality, soil type, preculturing, RISA-APC

## **INTRODUCTION**

Soil is a very complex and dynamic biological system; microorganisms adapt to microhabitats and live there together in consortia. The extent of the diversity of microorganisms in soil seems to be critical to the maintenance of soil health and quality (RANJARD ET AL., 2001). Despite the relatively small biomass of the bacteria and fungi present in the soil, they play a key role in the carbon, nitrogen, sulphur and phosphorus cycle (PANKHURST ET AL., 1997). Microbes affect the physical properties of the soil, for example the water holding capacity and soil structure (ELLIOTT ET AL., 1996). The chemicals, pesticides and heavy metals are significantly affecting the microbiological activities and through this way, the soil health. The microbes respond very quickly to the external influences, so the investigation of the communities could refer to the different changes of the environmental factors (PANKHURST ET AL., 1995). For the rapid comparing studies of bacterial communities the most useful are the 16S rDNA genes. A large database of 16S rDNA sequences exists in the gene bank ([www.ncbi.nlm.nih.gov](http://www.ncbi.nlm.nih.gov)) (NIELSEN AND WINDING, 2002). The region of the rRNA gene cluster between the small (16S) and large (23S) ribosomal RNA genes in bacteria is called the intergenic spacer region (ITS), which may encode tRNAs depending on the bacterial species, and displays significant heterogeneity in both length and nucleotide sequence. Both types of variation have been extensively used to distinguish bacterial strains and closely related

species. The ITS length polymorphism could be visualized with gelelectrophoresis, and the resulted fingerprint of fragments is characteristic, such as a barcode and indicates the composition of the investigated bacterial community. In this study, we combined the RISA method with pre-culturing of the soil bacteria, and get a simple and reliable method for analyse and for compare different soil types.

## MATERIAL AND METHOD

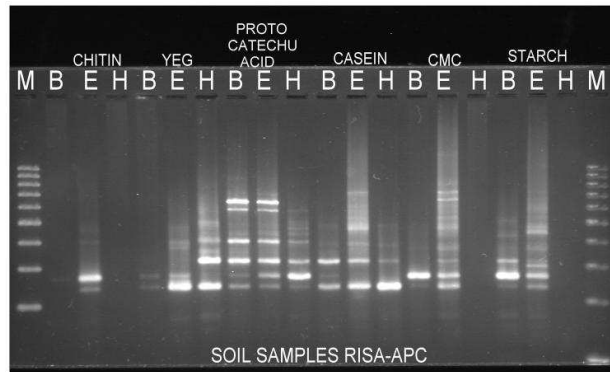
**Sampling, culture conditions:** Soil samples (top soils in all cases) were collected in Hungary from different areas, one from a wheat field, one from forest and one from sandy soil. The pre-culturing was performed on solid media containing ( $l^{-1}$ ): agar 20 g,  $KH_2PO_4$  5 g,  $MgSO_4$  1 g,  $(NH_4)_2SO_4$  1 g, supplemented with different carbon sources (2 g; carboxy-methyl cellulose, xylan, chitin, starch, tributyrin, casein and protocatechuic acid). As a control, a complex medium was used ( $l^{-1}$ ): glucose 2 g, yeast extract 2 g, and agar 20 g. For the investigation of the heavy metal tolerance of bacteria,  $CuSO_4$  or  $CdCl_2$  were added to the complex medium. Fifty grams of the soil sample were diluted and homogenised in 50 ml isotonic NaCl solution (0.9%), and 50  $\mu$ l aliquots were spreaded onto the agar plates. After desiccation, they were incubated at 20 °C for 20 hours. Isotonic NaCl solution (2 ml) was used to washed-down mini-colonies from the plates. The suspensions were centrifuged and the pellets were resuspended in 0.5 ml isotonic NaCl solution.

**DNA isolation:** The DNA isolation was carried out with Aqua Genomic Solution™ kit, according to the manufacturer's instructions.

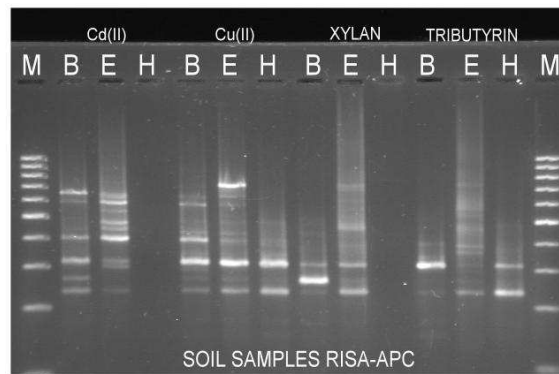
**PCR reaction, RISA:** For the amplification of the bacterial ITS region, the Eub\_ITSF as forward and Eub\_ITSR as reverse primer were used. PCR was carried out in a final volume of 50  $\mu$ l containing 5  $\mu$ l of *Taq* polymerase 10x puffer, 1.6 mM  $MgCl_2$ , 200  $\mu$ M for each of the dNTPs, 10 pM primers, 5  $\mu$ l of template DNA (app. 100 ng) in distilled water and 1 U *Taq* DNA polymerase (Fermentas). The PCR product was visualized with gelelectrophoresis, and the DNA fragments in the gels were stained with SYBR Green and analyzed under UV light.

## RESULTS

RISA-APC profiles revealed different complexity resulted in by the different number and different relative intensity of their bands. From bacteriological point of view, the less complex habitat was the sandy soil (marked H). In many cases we did not get any bands after the PCR reaction, while culturing on complex medium resulted 9 bands. These sandy soil samples did not contain bacteria which could utilize the specific carbon sources tested. Forest soil sample (marked E) showed high diversity values on several carbon sources. The soil of wheat field (marked B) showed some similarity to soil sample of forest. However, substantial differences were observed in the number of the bands on carboxy-methyl cellulose, xylan and chitin (*Figure 1.*). This suggested the presence of bacteria with cellulose, xylan and chitin degrading potential. The estimated number of heavy metal resistant bacteria was nearly similar in forest and in wheat field samples (*Figure 2.*). A potential explanation is that both habitats can be exposed to these pollutants.



**Figure 1. RISA-APC profiles from different soils: B-wheat field soil, E-forest soil, H-sandy soil. The preculturing was performed on different carbon sources.**



**Figure 2. RISA-APC profiles from different soils. B-wheat field, E-forest soil, H-sandy soil. Cd(II) and Cu(II): the lines of metal resistant bacterial communities.**

Fingerprint experiments showed high reproducibility, no difference were detected between replicates of RISA profiles obtained from amplifications of triplicate DNA extracts. The RISA-APC profiles were manually compared. The number of bands observed is summarized in *Table 1*.

**Table 1. Comparison of RISA profiles (number of bands after PCR reaction).**

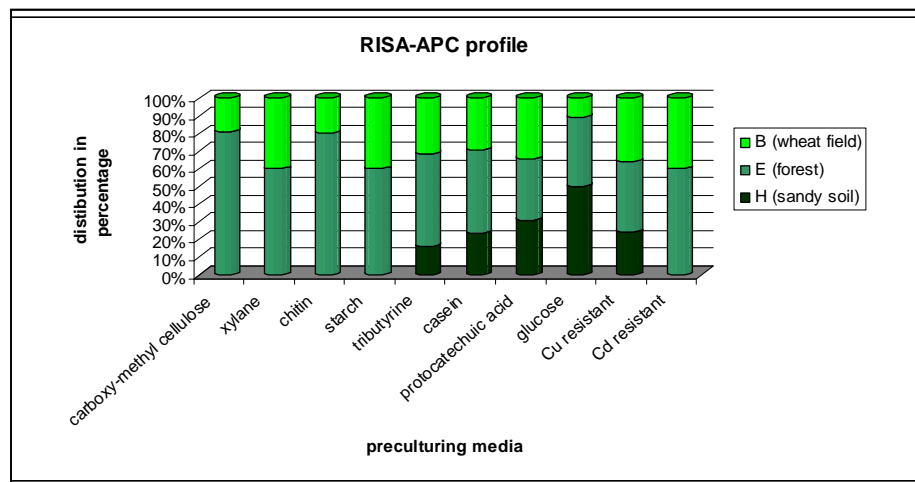
Carbon source/heavy metal	H (sandy soil)	E (forest)	B (wheat field)
carboxy-methyl cellulose	0	13	3
xylan	0	9	6
chitin	0	4	1
starch	0	12	8
tributyryn	3	10	6
casein	4	8	5
protocatechuic acid	8	9	9
glucose	9	7	2
Cu (II)	6	10	9
Cd (II)	0	9	6

## CONCLUSIONS

The results of RISA-APC clearly correlated, as regards the complexity of RISA-fingerprints, with the expected basic taxonomical complexity of various soil types. These results showed that the highest functional diversity values occurred in the forest soil, while the lowest were present in the sandy soil.

The distribution of the band number is similar in the case of preculturing on protocatechuic acid, a product of lignin biodegradation. The greatest differences were detected on carboxy-methyl cellulose, xylan and chitin carbon sources (Figure 3). The background of this result could be the high microbial diversity of forest surface soils. Dead plant material mostly consists of cellulose and xylan, which explains the presence of these types of degraders in high numbers. Similarly, the high incidence of chitin degrading bacteria in the forest soil could be explained with the presence of insects and fungi in this habitat.

The RISA-APC method developed in our study proved to be a useful tool for the comparison of different soil types, and for the examination of changes in the soil bacterial community structure. Furthermore, this approach could be combined with various statistical methods to analyse these correlations in detail. The main disadvantage of this approach is that the results do not provide bases for a precise species or genus identification (FISHER AND TRIPLETT 1999; JENSEN ET AL., 1993).



**Figure 3.** The diagram shows the number of the resulted bands with RISA-APC after preculturing on the different carbon sources or in the presence of heavy metals.

## ACKNOWLEDGEMENTS

The project is co-financed by the European Union through the Hungary-Romania Cross-Border Co-operation Programme 2007-2013 (SOILMAP, HURO/0901/058/2.2.2).

## REFERENCES

- ELLIOTT L., LYNCH F.J.M., PAPENDICK R. I. (1996): The microbial component of soil quality. *Soil Biochemistry*. Stotzky G., Bollag J.-M, (eds.). Marcel Dekker Inc., New York, p.1-21.
- FISHER M.M., TRIPLETT E.W, (1999): Automated approach for ribosomal intergenic spacer analysis of microbial diversity and its application to freshwater bacterial communities. *Applied and Environmental Microbiology* **65**, 4630-4636.
- JENSEN MA., WEBSTER JA., STRAUS N, (1993): Rapid identification of bacteria on the basis of polymerase chain reaction amplified ribosomal DNA spacer polymorphism. *Applied and Environmental Microbiology* **59**, 945-952.
- PANKHURST C.E., DOUBE B.M., GUPTA V.V.S.R, (1997): Biological indicators of soil health: Synthesis. *Biological Indicators of Soil Health*. Pankhurst, C. E., Doube, B. M., Gupta, V. V. S. R. (eds.). CAB International, p.419-435
- PANKHURST C.E., HAWKE B.G., McDONALD H.J., KIRKBY C.A., BUCKERFIELD J.C., MICHELSEN P., O'BRIEN K.A., GUPTA V.V.S.R., DOUBE B.M, (1995): Evaluation of soil biological properties as potential bioindicators of soil health. *Australian Journal of Experimental Agriculture* **35**, 1015-1028.
- RANJARD L., POLY F., LATA J.-C., MOUGEL C., THIOULOUSE J. NAZARET S, (2001): Characterization of bacterial and fungal soil communities by automated ribosomal intergenic spacer analysis fingerprints: biological and methodological variability. *Applied and Environmental Microbiology* **67**, 4479-4487.

## CHARACTERISTICS OF SOIL IN RELATION TO GRAPEVINE NUTRITION

FLORIN SALA, COSMIN BLIDARIU

Banat University of Agricultural Sciences and Veterinary Medicine Timișoara,  
Calea Aradului, 119, 300645, Timisoara, Romania  
florin\_sala@yahoo.com

### ABSTRACT - Characteristics of soil in relation to grapevine nutrition

The studies and research on which the present paper is based aimed at assessing the soil in the grapevine plantation of the Didactic Station in Timisoara as a nutrition environment for grapevine whose goal was to supply a fertilisation variant that ensures nutrient bio-availability and optimal nutrition to the plants. Taking into account the biology of the grapevine, we can say that soil is, on grapevine plantations, of great interest for nutrition due to the large edaphic volume distributed over two soil horizons: 0-20 cm and 20-40 cm. This is why we have characterised the soil over the two levels of interest in water and nutrient supply for grapevine plants. The soil on the grapevine plantation can be characterised as a heterogeneous nutrition environment if we take into account the two levels of supply of nutrients. Nutrients have different physical-chemical features due to the factors and conditions that impact them. The horizon 0-20 cm has a higher content in organic matter; it is worked, aerated, more oxygenated, and more subjected to more significant chemical and reaction changes as a result of applying organic and mineral fertilisers. From the point of view of the reaction, the studied soil can be characterised as a neuter reaction medium over the horizon 0-20 cm (pH = 6.85) and as low acidic over the horizon 20-40 cm (pH = 6.30). Humus content (H) is 1.85% over the horizon 0-20 cm and 1.70% over the horizon 20-40 cm. Total nitrogen content  $N_t$  is 1.141% and 1.30%, respectively. Mobile phosphorus supply is 28.55 ppm over the upper horizon and 23.41 ppm over the horizon 20-40 cm. Available potassium ranges between 155.05 ppm over the upper horizon 0-20 cm and 141.2 ppm over the horizon 20-40 cm. The value of the nutrition environment pH is neuter to low acidic which results in a relatively good macro-element bio-availability. As for phosphorus, there is the possibility of lower-mobility calcium phosphate development, but fertilisation makes possible a proper nutrition. Soil supply in nutrients and organic matter ensures a proper nutrition environment.

**Keywords:** soil, nutrition environment, soil fertility, soil – plant relationship, grapevine

## INTRODUCTION

Soil as a nutrition environment for grapevine should be analysed at two levels or depths (0-20 cm and 20-40 cm) because of the developed root system that explores and supplies water and nutrients to the plants from a larger volume of soil.

Therefore, soil characterisation as a nutrition environment for grapevine should be done over the two horizons through the prism of specific agro-chemical indices such as pH, humus content,  $N_t$ , mobile P, and assailable K.

Grapevine nutrition state depends largely on the way the soil ensures the necessary nutrient requirements and their bio-availability correlated with other vegetation and technological factors (EPSTEIN & BLOOM, 2005, GRECU V., 2006).

The amounts of nutrients that grapevine consumes are determined by such factors as genetic, soil and climate, and technological ones. Depending on these factors, grapevine consumes annually the following amounts of nutrients: 92-154 kg N, 21-45 kg  $P_2O_5$ , and 91-129 kg  $K_2O$  per ha (CONDEI 1987).

Besides these basic macro-elements, grapevine also consumes the following: 100-160



kg CaO, 10-15 kg MgO, 1-2 kg Fe, 80-150 g B, 80-240 g Mn, 60-120 g Cu, 100-120 g Zn, and 2-3 g Mo per ha (ȚARDEA et DEJEU 1995, ȚARDEA et CHIVU 2004).

Nutrient consumption also differs depending on the grapevine cultivars (DOBREI et al. 2010), as follows:

- wine grapevine cultivars have higher consumption levels, i.e. 210-267 kg NPK/ha, particularly in high-quality wines. Of the total consumption of nutrients, N represents 40-52%, P represents 14-17%, and K represents 34-41%;

- table grapevine cultivars have lower consumptions, i.e. only 129-234 kg NPK/ha, with the lowest consumption in extra-early and early maturation cultivars and with the highest consumption in late maturation cultivars. Of the total consumption of nutrients, N represents 50-54%, P represents 15%, and K represents 30-36% (CONDEI, 1974).

As for the specific consumption of nutrients in kg/t of grapes, it reaches 4.9 kg N, 0.5 kg P, and 2.6 kg K in table grape cultivars, 6.0-14.8 kg N, 1.0-3.7 kg P, and 3.8-15.2 kg K in wine grape cultivars (IONESCU & IONESCU, 1985 quoted DOBREI et al. 2005).

Another factor that impacts macro- and micro-elements consumption in grapevines is the rootstock. Rootstock grapevines have the capacity to absorb nutrients selectively with differences from one type of rootstock to another (ȚARDEA ET CHIVU 2004).

Upon fertilisation, one should take into account the mobility of the elements in the fertilisers. Less mobile elements (P, K) should be administered before the consumption requirements of the grapevine through incorporation in the soil, close to the roots or outside the roots with quick efficacy and with high valorisation coefficient.

On grapevine areas that are homogeneous from the point of view of soil and climate conditions, grapevine has almost the same nutrient consumptions year after year, thus easing their monitoring and assessment based on nutrient balance. Starting from all this and taking into account the soil reserve, one can establish guiding rates for grapevine plantations.

## **MATERIAL AND METHOD**

Research aimed at investigating the soil as a nutrition environment depending on grapevine nutrient requirements.

We studied agro-chemical parameters of importance for the soil in the nutrition of grapevine: pH, H, N<sub>total</sub>, P<sub>mobile</sub>, K<sub>assailable</sub>, the measurements being made through current laboratory methods (colorimetry, atomic absorption spectrophotometry). Researches were conducted in 2009-2010, vine plantation was in the seventh year of production.

The study of the soil and of the relationship between the soil and the plants, i.e. grapevine, allows the assessment of the nutrient balance and of the nutrient requirements per vegetation pheno-phases and per nutrition phases.

The grapevine cultivars cultivated at the Didactic Station in Timisoara are wine cultivars, i.e. Muscat Ottonel, Burgund, and Sylvania. The Didactic Station and the Fruit-tree and Grapevine Centre are in the Banat Plain, a plain with specific features.

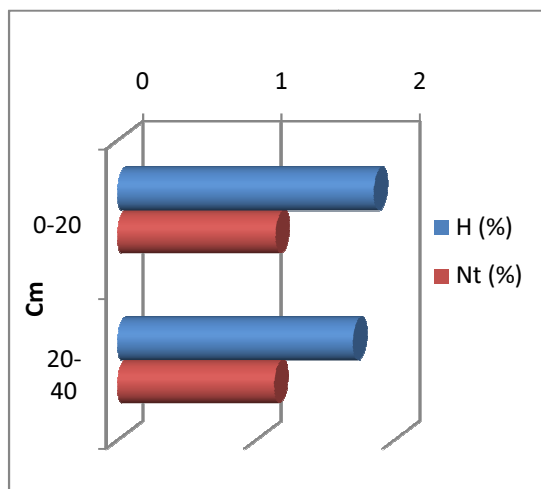
## **RESULTS AND DISCUSSION**

Soil as a nutrition environment has certain features in relation to grapevine. We differentiated 2 levels (horizons) of water and nutrient supply over 0-20 and 20-40 in correlation with the specific feature of the grapevine root system. As a consequence, we

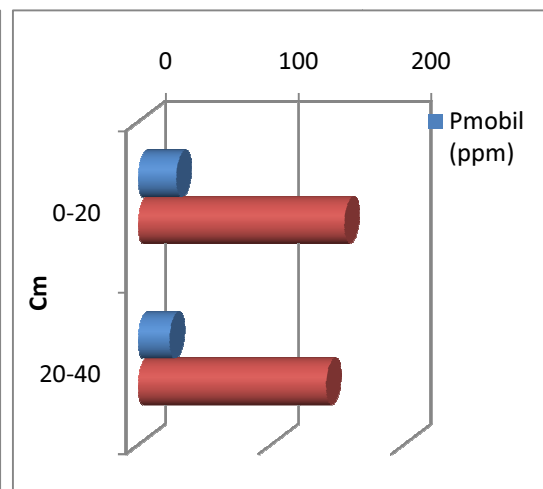
also made measurements of the agro-chemical indices presented above and the characterisation of the soil at two levels. The values obtained are presented in Table 1 and in *Figures 1 and 2*.

**Table 1. Value of soil agro-chemical parameters on the grapevine plantation of the Didactic Station in Timisoara**

Depth (cm)	Agro-chemical parameters				
	pH	Humus (%)	Nt (%)	P <sub>mobile</sub> (ppm)	K <sub>assailable</sub> (ppm)
0-20	6.85	1.85	1.141	28.55	155.00
20-40	6.30	1.70	1.130	27.00	140.00



**Fig. 1. Humus and total nitrogen contents (%).**



**Fig. 2. Mobile phosphorus and available potassium supplies (ppm)**

The grapevine cultivars cultivated at the Didactic Station are wine cultivars (Muscat Ottonel, Burgund, and Silvania) whose nutrition requirements range as follows: 6.0-14.8 kg N, 1.0-3.7 kg P, and 3.8-15.2 kg K as reference values.




Taking into account the normative limits concerning the necessary nutrients in grapevine cultivars and the soil supply in nutrients, we estimate that their bio-availability is medium in nitrogen and phosphorus and good in potassium.

Nutrition specificity in grapevine is given by the plant's biology. Thus, there are three different periods of consumption: a critical period, during the pheno-phase of bud opening; a period of maximum consumption, during the pheno-phase of blooming; and a period of decreased consumption, during the pheno-phase of grape maturation and reserve accumulation in the stems (*Figure 3*).

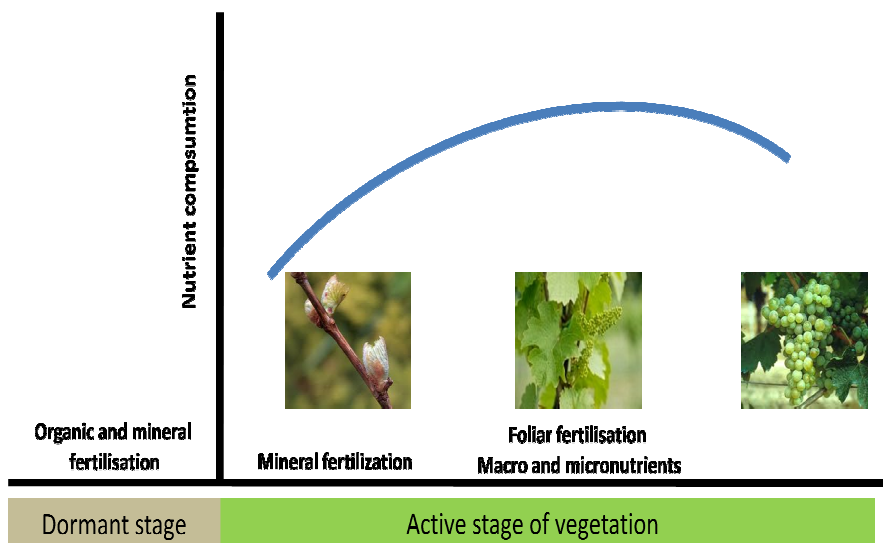
Well knowing the specific nutrient requirements and consumption of grapevine and correlating them with its vegetation periods allow a proper guidance of nutrition through a fertilisation system differentiated for each nutrient depending on soil and climate conditions, estimated yields, plant requirements, and period or pheno-phase of maximum consumption.

Applying fertilisers depending on sequential (physiological and technological) requirements on the grapevine plantation we studied ensures a more efficient and economic use of fertilisers and a diminution of the pollution hazards, and allows the development of a sustainable exploitation.

To do so, we developed a fertilisation plan to ensure nutrients gradually, to ensure the bio-availability of nutrients in correlation with the vegetation pheno-phases, and to ensure a proper nutrition for the plantation (*Figure .4*).

	Critical period of consumption	Maximum consumption period	Low consumption period
	Bud opening	Blooming start	Grape ripening
Vegetation phases and nutrition requirements in grapevine			
	Lack of, excess of, or imbalance between nutrients has a negative impact on the entire vegetation period	Nutrients are assimilated at a higher rate and in larger amounts	Nutrient consumption decreases gradually and ceases during this period

**Fig. 3. Nutrient requirements in grapevine**



**Fig. 4. Fertilisation diagramme of the research field**

Given the supply of soil minerals and nutritional requirements of the vines have established the plantation system of fertilization. Organic fertilizer at 20 t / ha provide

100 kg N, 50 kg P<sub>2</sub>O<sub>5</sub> și 120 kg K<sub>2</sub>O. Availability is different in time, 20-25% in the first year for nitrogen, 30-40% for phosphorus and 60% for potassium. Fertilization with complex fertilizers provides the necessary macro-nutrients in the first period. Microelements are provided in foliar fertilization during the growing season.

## CONCLUSIONS

As far as grapevine plantation soil is concerned, it is a differentiated nutrition environment that supplies water and nutrients over two horizons with different features from the point of view of their bio-availability.

Soil reaction is low acidic over the horizon 20-40 cm, and neuter over the horizon 0-20 cm, which supports the development of calcium phosphates and the low bio-availability of the soil phosphorus in amounts of 23-28.55 ppm P. Nitrogen and potassium are present in good amounts.

Grapevine necessary nutrients are ensured by a system of fertilisation correlated with the level of supply in the soil and by the pheno-phases of vegetation to ensure optimal nutrition.

## ACKNOWLEDGEMENTS

This work was partially supported by the grant POSDRU /21/1.5/G/38347.

## REFERENCES

- CONDEI GH. (1974) Consumul de elemente nutritive ale vitei de vie in conditiile pedoclimatice ale Podgoriilor Murflatar, Dragasani si Minis, Analele I.C.V.V., vol. V, Bucuresti.
- CONDEI GH. (1987) Abordarea ecologică a sistemului integrat de întreținere și fertilizare a solului în plantațiile viticole, Buletin ICVV, nr. 4., Bucuresti.
- DOBREI A., SALA F., ALINA GHIȚĂ, MIHAELA MĂLĂESCU (2010), The usage of small volume fertilizers and biostimulators for increasing the bioproductivity of the vine growing system, Research Journal of Agricultural Sciences, 42 (3) 1 (908) 2010, p. 102-107, Editura Agroprint, ISSN. 2066-1843.
- DOBREI A., LILIANA ROTARU, MUSTEA M. (2005) Cultura viței de vie, p. 135-142, Ed. Solness, Timisoara.
- EPSTEIN E., BLOOM A. J. (2005) Mineral Nutrition of Plants: Principles and Perspectives, Second edition, Sinauer Associates, Inc. Publishers, SUA.
- GRECU V. (2006), Dereglările de nutriție la vița-de-vie, p. 40-42, 47-52, Editura Ceres, București.
- ȚÂRDEA C., DEJEU L. (1995), Viticultura, p. 27-32, Ed. Didactică și Pedagogică București.
- ȚÂRDEA C., CHIVU D. (2004), Carențeși dezechilibre fiziologice de nutriție la vița-de-vie, Ed. S.C. Vinia S.A. Iași.

## **AGROCHEMICAL PROPERTIES: SOIL FERTILITY PARAMETERS IN RELATION TO PLANT NUTRITION**

**FLORIN SALA, DANIELA PÎSLEA**

Banat University of Agricultural Sciences and Veterinary Medicine Timișoara,  
Calea Aradului, 119, 300645, Timisoara, Romania  
florin\_sala@yahoo.com

### **ABSTRACT - Agrochemical properties: soil fertility parameters in relation to plant nutrition**

Soil is an environment with a high degree of heterogeneity from the point of view of the content of nutritious elements and of the mobility and bioavailability of these elements for the crops. The studies and research on which the present paper relies aimed at assessing the level of fertility of the agricultural land in the Banat Plain area on which they practice conventional agricultural systems. Research was carried out at the Didactic Station of the Banat University of Agricultural Science and Veterinary Medicine in Timisoara (Romania), in the soil and climate conditions specific to the area of the Banat Plain. The soil within the Didactic Station is a cambic chernozem (cambic phaeozem), poorly gleyed, with a considerable share of the general area (about 85%). Climate conditions can be characterised through multiannual average values, the most important of which are: 603.3 mm precipitations and temperatures reaching 10.9°C. Agro-chemical parameters defining soil fertility and that were studied are: pH, humus content (H), nitrogen index (NI), total nitrogen (N<sub>t</sub>), mobile phosphorus (P<sub>AL</sub>) and available potassium (K<sub>AL</sub>). The methods with which we determined the studied agro-chemical and fertility indicators are the current ones (colorimetry, atomic absorption spectrophotometry). In order to process the results, we used reference standards for each agro-chemical indicator we studied. Results were characterised within the context of land valorisation through crop rotation with no vegetable crops, which recommends certain reference values in the processing of the results. Soil reaction is within the neuter range, i.e. pH = 7.02. The relatively high degree of saturation in basic cations (V = 85-87%) ensures a good buffering for the pH. Soil stable organic matter content represented by humus has a medium level, i.e. H = 3.2, while the value of the nitrogen index (NI), as a representation of the interaction between H x V, is 2.72. Both values reflect medium soil fertility. The level of mobile phosphorus supply is 23.55 ppm, and the level of assailable potassium is 154.56 ppm. On the whole, among the agro-chemical indicators we studied, soil fertility has a medium level, which asks for fertilisation measures to ensure a high balance between soil and plants allowing high, constant agricultural crops.

**Keywords:** soil fertility, mineral fertilisers, fertilizer systems, agro-chemical indicators

## **INTRODUCTION**

Plant nutrition is a complex physiological process that involves the taking over, transporting, and metabolising mineral nutrients and some organic compounds necessary for the plant's growth and development (EPSTEIN AND BLOOM, 2005).

Soil is the main medium of plant growth and nutrition, soil minerals representing the main nutritious sources with variable mobility and bioavailability for the crops (MENGEL & KIRKBY, 2001; HAVLIN *et al.*, 2005; BARKER AND PILBEAM, 2007).

Compared to the atmospheric or aquatic environment, soil is a very complex environment. As support and nutrient medium for the plants, soil is a heterogeneous system made up of three phases: solid, liquid, and gaseous and its main agricultural feature is fertility (ELIADE *et al.* 1983; EPSTEIN AND BLOOM, 2005).

The soil features that are important for plant nutrition and that are expressed as different indicators can have rather wide variations in space and time depending on both natural or technological factors (DUMITRU 2002; SALA *et al.* 2010). For instance, soil nitrogen content can have wide variations over a few centimetres and along a single day

(EPSTEIN AND BLOOM, 2005).

Studying and characterising the soil as a nutritious environment for the plants through the prism of soil reaction, soil nutrient content, and nutrient bioavailability is a permanent must in the development and achievement of sustainable agricultural systems (DAVIDESCU AND VELICICA DAVIDESCU, 1972; SANCHEZ *et al.*, 1982; SALA, 2008).

## MATERIAL AND METHOD

Within our study and research, we assessed soil fertility and soil nutrition potential as a nutritional environment for wheat, maize, and sunflower crops.

The indicators we studied were represented by pH, humus content (H), nitrogen index (NI), total nitrogen (N<sub>t</sub>), mobile phosphorus (P<sub>AL</sub>) and available potassium (K<sub>AL</sub>).

The methods with which we determined the studied agro-chemical and fertility indicators are the current ones (colorimetry, atomic absorption spectrophotometry).

In order to process the results, we used reference grids for each of the studied agro-chemical indicator.

Result characterisation was done from the perspective of valorising the land through wheat, maize, and sunflower crops that have specific nutrient needs to yield properly. These crops are part of crop rotations with no vegetables, which recommends certain reference values in result interpretation.

The study and research area is specific to the Banat Plain, and the soil is a cambic chernozem sharing about 85% of the entire area.

Climate conditions can be characterised through multi-annual average values: 603.3 mm precipitations and temperatures of 10.9°C.

## RESULTS AND DISCUSSION

The studies and research were carried out on a cambic chernozem, poorly gleyed, with a water table located at about 3 to 3.5 m deep in the ground.

Agricultural systems in the area are of the conventional type, i.e. based on cereal crops and on oily technical plants on smaller areas; fertilisation is done with mineral fertilisers.

Soil reaction is neuter (pH = 7.06), which points to a soil with a good buffering capacity that can overtake relatively well the mineral fertilisers applied (*Table 1.*).

**Table 1. Soil fertility parameters depending on plant nutrition**

	Analysed agro-chemical parameters					
	pH	H (%)	IN (%)	Nt (%)	P <sub>AL</sub> (ppm)	K <sub>AL</sub> (ppm)
Values of soil indicators	7.06	3.2	2.72	0.127	23.55	154.56
Reference intervals		< 3	< 2	< 0.10	< 8	< 100
		3-6	2-4	0.11-0.15	8.1-18	101-150
		> 6	> 4	0.16-0.20	18.1-36	151-200
				0.21-0.25	36.1-72	201-350
			> 0.25	> 72.1	> 350	
Significance of soil indicators	Neuter reaction	Average humus content	Average nitrogen index value	Total nitrogen low supply	Average mobile phosphorus supply	Average available potassium supply

The soil reaction was not in a stable balance: there were permanent variations of the pH as a result of the application of substances that hydrolyse acidly or basically, as well as of chemical, physic-chemical, and biological processes in the soil resulting in acids or bases that tend to change soil reaction.

Basic cation saturation degree ( $V = 85-87\%$ ) and total cation exchange capacity (T) make up the buffering capacity of the studied soil which, from an agro-chemical point of view, represents the soil component and specific relationships opposition to the changing of ion concentration in the soil solution ( $H^+$ ,  $-OH$ ,  $H_2PO_4$ ,  $K^+$ ,  $NH_4^+$ ,  $NO_3^-$ ) as a result of outer action – in his case, mineral fertilization.

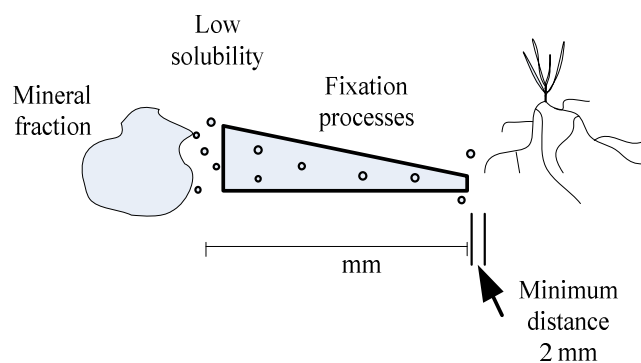
Humus content ( $H = 3.2\%$ ), a potential nitrogen reserve for the crops, has a medium significance as indicator of the soil fertility level. This reflects in general the cultivation technology and, in particular, the fertilisation system based almost exclusively on mineral fertilisers, soil organic matter supply being minimally represented only by the crop debris.

The high value of the soil basic cation content (85-87%) determines, together with the humus content, the value of the nitrogen index  $IN = 2.72$  which, on the interpretation scale of the indicator, also points to an average soil fertility level. The value of these indicators provides the soil with good buffering capacity for the pH and for the nutritious ions.

Total nitrogen supply ( $N_t$ ) reaches 1.12%, which reflects an average supply of the soil with this macro-nutrient. With a low supply of organic matter and with a C/N balance in favour of the carbon (the cellulose matter in the plant debris), the balance between decomposition and mineralisation of the organic matter was lower and plant nutrition was based almost exclusively on the mineral fertiliser supply.

Mobile phosphorus content (P) reached 33.5 ppm, and assailable potassium reached 132.5 ppm.

The movement of phosphate ions is slow because the procedures for fixing versify and low solubility of phosphorus compounds in soil. The maximum distance that can be taken root phosphate ion is 2 mm (*Figure 1*). The mechanism of diffusion of phosphate ions is crucial for supply to the root phosphorus.



**Figure 1. The mobility of phosphate ions in soil - schematic representation.**

Most phosphorus in the soil (and faster) is absorbed by plants as a primary ion orthophosphoric  $H_2PO_4^-$  and to a lesser extent and reduced speed, the secondary ion orthophosphoric  $HPO_4^{2-}$ . These values represent medium supplies with the two macro-

elements; compared to the plant nutrient needs, we need to add differentiated fertilization.

The indicators used in characterising the soil from the point of view of fertility are used both at national and international levels and reference standard values for each of the fertility indicators analysed and presented are national level reference ones.

## CONCLUSIONS

Research carried out pointed out the fertility level of the cambic chernozem in a reference area in the Banat Plain where they apply conventional agricultural systems. Assessment indices of the fertility level and of the yielding potential are the indices usually used in characterising soil fertility. The values recorded for the indicators analysed reflect the soil fertility state under agricultural conditions.

The value of the pH is within the neuter range (7.02). The relatively high basic cation saturation degree ( $V = 85-87\%$ ) ensures a good buffering for the pH.

Soil stable organic matter content was  $H = 3.2$ , and the value of the nitrogen index NI as a representative of the interaction  $H - V$ , was 2.72. both values reflect medium soil fertility.

Mobile phosphorus content reached 23.55 ppm, and assailable potassium reached 154.56 ppm. The supply state in these two elements is medium.

## ACKNOWLEDGEMENTS

This work was partially supported by the grant POSDRU /21/1.5/G/38347.

## REFERENCES

- BARKER A. V., PILBEAM D. J. (2007): Handbook of Plant Nutrition. p. 21-23. 51-55. 92-97. CRC Press. SUA.
- ELIADE GH., GHINEA L., STEFANIC GH. (1983): Bazele agrochimice ale fertilității solului. p. 15-23. Editura Ceres. Bucuresti.
- DAVIDESCU D., VELICICA DAVIDESCU (1972): Testarea stării de fertilitate prin plantă si sol. 45-49. 63-65. 285-295. Editura Academiei. Bucuresti.
- DUMITRU M. (2002): Mineral fertilizers and sustainable crop production in Romania. CIEC Proc. Suceava. Bucarest p. 63-75.
- EPSTEIN E., BLOOM A. J. (2005): Mineral nutrition of Plants: Principles and Perspectives. p. 243-247. Sinauer Associates. Inc. Publisher. SUA.
- MENGEL K. & KIRKBY E. A. (2001): Principles of Plant Nutrition. p. 15. 34. 64. 93. Kluwer Academic Publisher. London.
- HAVLIN J. L., BEATON JAMES D., TISDALE S. L., NELSON W. L. (2005): Soil fertility and fertilizer. Seventh Edition. p. 298-300. 324-330. Pearson Prentice Hall. SUA.
- SANCHEZ PEDRO A., COUTO WALTER., BUOL STANLEY W. (1982): The fertility capability soil classification system: Interpretation, applicability and modification. Geoderma. Volume 27. Issue 4. p. 283-309.
- SALA F. (2008): Agrochimie. p. 301-306. 320-326. Ed. Eurobit. Timisoara.
- SALA F., RADULOV ISIDORA., CRISTA F., BERBECEA ADINA (2010): The modification of some Agrochemical Soil Indices under the Influence of Mineral Fertilization. Research Journal of Agricultural Sciences. 42 (3) 1 908 (2010). p. 302-305 Editura Agroprint.



## COMPARISON OF CHANGES IN THE LIVELWEIGHT AND BODY COMPOSITION OF A NEWLY DEVELOPED COCK LINE AND TETRA-H CHICKS DURING THE REARING PERIOD

MILISITS GÁBOR<sup>1</sup>, SÜTŐ ZOLTÁN<sup>1</sup>, DONKÓ TAMÁS<sup>1</sup>, ORBÁN<sup>2</sup> ATTILA,  
UJVÁRI<sup>1</sup> JOLÁN, PŐCZE<sup>1</sup> OLGA, REPA<sup>1</sup> IMRE

<sup>1</sup>Kaposvár University, Faculty of Animal Science, Guba Sándor u. 40, 7400 Kaposvár, Hungary

<sup>2</sup>Bábolna Tetra Ltd., Petőfi Sándor u. 18, 9651 Uraiújfalu, Hungary  
milisits.gabor@ke.hu

### **ABSTRACT - Comparison of changes in the liveweight and body composition of a newly developed cock line and TETRA-H chicks during the rearing period**

The aim of this study was to follow the changes in the liveweight and in the muscle and fat tissue development of 60 chicks originated from a newly developed cock line and from the TETRA-H genotype. Changes in the body composition of these birds were examined by means of computer tomography (CT) *in vivo*. CT examinations were performed bi-weekly between 4 and 12 weeks of age. Overlapping 8 mm slice thickness measurements were performed covering the whole body of the chicken using a Siemens Somatom Emotion 6 multislice CT scanner. Using the images obtained so-called muscle and fat indices were calculated by determining the ratio of number of pixels with X-ray density values of muscle or fat to the total number of pixels with density values of muscle, water and fat, i.e. the range between -200 to +200 on the Hounsfield-scale. Based on the results, it was established that the liveweight of the chicks in the newly developed cock line was significantly higher at all examination days than that of the TETRA-H chicks. The difference between the two examined genotypes was more than 1 kg in the case of cocks and almost 1 kg in the case of pullets at 12 weeks of age. The ratio of muscle in the bird's body was higher, while the ratio of fat lower in the case of the TETRA-H chicks at the end of the experiment in both sexes. Based on the results it was concluded that the use of the new cock line for improving the liveweight and meat production of the TETRA-H chicks can cause unfavourable changes in the body composition of the TETRA-H birds, which should be taken into consideration in the breeding programme of the TETRA-H hybrid in the future.

**Keywords:** broiler, chicken, body composition, computer tomography

## INTRODUCTION

The three-line hybrid TETRA-H was developed in the beginning of the 1980's by the Bábolna Poultry Breeding Company. Thanks for its calm temperament and balanced production it was capable of replacing the traditional free-range poultry breeds. However, out of the dual-purpose characteristics, the egg-production of these birds is the dominant one (180-200 pieces under extensive circumstances) and therefore the aim of its further development is the increase of the final liveweight and the meat production capacity. The target parameters of the development are the current results of the Redbro genotype and therefore a comparison of changes in the liveweight and body composition of TETRA-H and Redbro chicks was already done in a previous study (MILISITS et al., 2010). In the meantime a new cock line was developed from the Golden Plymouth genotype by selecting birds for weight gain and plumage colour, which is planned to use as parental line in the further development of the TETRA-H genotype. The aim of this study was the comparison of changes in the liveweight and body composition of this newly developed cock line and TETRA-H chicks during the rearing

period by means of computer tomography (CT), which was already effectively used in a lot of former experiments in the *in vivo* examination of changes in the body composition of different animal species (ROMVÁRI et al., 1998; MILISITS et al., 1999; MILISITS et al., 2000; ANDRÁSSY-BAKA et al., 2003).

## MATERIAL AND METHODS

The experiment was carried out with chicks from the newly developed cock line and TETRA-H genotype in the Test Station of the Kaposvár University, Faculty of Animal Science. Animals were reared on deep litter in pens (9.2 m<sup>2</sup> basic area), in a closed building, separated according to sex and genotype (cocks: 110 birds/pen, pullets: 129 birds/pen). Chicken were fed *ad libitum* with commercial diets during the whole experimental period (starter between days 0 and 10, growing between days 11 and 24 and finisher from the 25<sup>th</sup> day on (Table 1). Drinking water was also continuously available from self-drinkers.

**Table 1: Composition of the diets used in the experiment**

Component	Starter	Growing	Finisher
Dry matter (%)	91.4	91.3	90.0
Crude protein (%)	20.9	18.8	17.1
Crude fat (%)	5.7	6.5	6.8
Crude fibre (%)	2.4	2.7	3.0
Crude ash (%)	4.9	4.4	4.4
N-free extract (%)	57.5	58.9	58.7
Starch (%)	39.2	48.5	48.5
ME Poultry (MJ/kg dry matter)	13.64	15.54	15.27
Calcium (g/kg)	7.34	6.11	6.47
Phosphorous (g/kg)	5.70	5.80	5.40

Animals for the CT examinations – 15 according to sex in both genotypes – were chosen randomly at 4 weeks of age. These birds were then assigned individually with wing tags and they were scanned by CT at every examination days thereafter. Before the CT measurements the liveweight of these birds was always recorded.

CT examinations were carried out at the Institute of Diagnostic Imaging and Radiation Oncology of the Kaposvár University bi-weekly, between 4 and 12 weeks of age. During the measuring procedures birds were fixed with belts in a special plexi-glass container, without using any anaesthetics. Three animals were scanned simultaneously. The CT measurements consisted of overlapping 8 mm thick slices covering the whole body using a Siemens Somatom Emotion 6 multislice CT scanner. Using the images obtained so-called muscle and fat indices were calculated by determining the ratio of number of pixels with X-ray density values of muscle or fat to the total number of pixels with density values of muscle, water and fat, i.e. the range between -200 to +200 on the Hounsfield-scale:

$$\text{Muscle index} = \frac{\Sigma(+20)-(+200)}{\Sigma(-200)-(+200)} \times 100$$

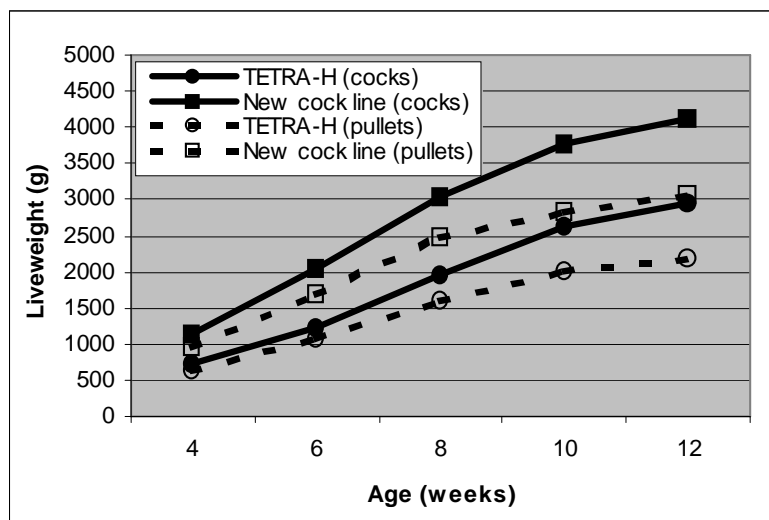
$$\text{Fat index} = \frac{\Sigma(-200)-(-20)}{\Sigma(-200)-(+200)} \times 100$$

The differences in the liveweight and in the muscle and fat indices between the examined genotypes were evaluated statistically by the Independent Samples t-test. The

statistical analysis was carried out by the SPSS statistical software package, version 10.0 (SPSS FOR WINDOWS, 1999).

## RESULTS

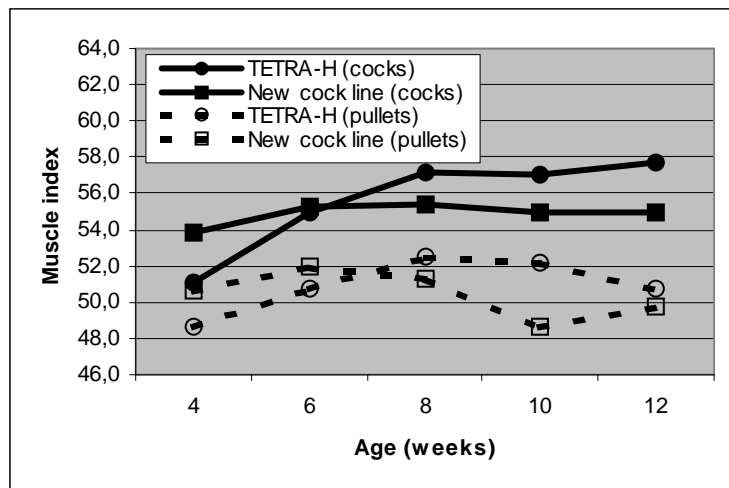
Examining the changes in the liveweight during the rearing period it was established that that of the chicks in the newly developed cock line was significantly higher at all examination days in both sexes than that of the TETRA-H chicks (*Figure 1*).



**Figure 1: Changes in the liveweight of TETRA-H chicks and chicks of the newly developed cock line between 4 and 12 weeks of age**

The difference between the two examined genotypes was more than 1 kg in the case of cocks (1181g) and almost 1 kg (877g) in the case of pullets at the end of the experiment. It was very interesting to see that the liveweight of cocks in the TETRA-H genotype did not reach the liveweight of pullets in the new cock line at the end of the rearing period (2950g vs. 3064g).

The ratio of muscle tissue in the bird's body was continuously increasing in the TETRA-H chicks till 8 week of age in both sexes, while it remained almost the same in the case of cocks and it decreased in the case of pullets thereafter (*Figure 2*).



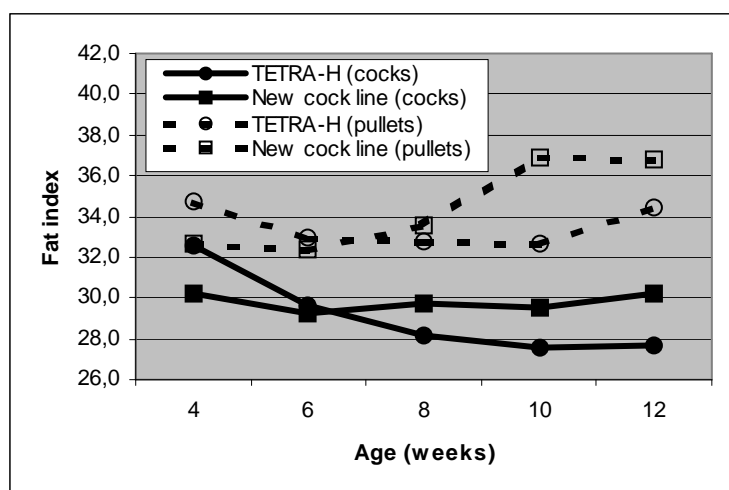
**Figure 2: Changes in the muscle index of TETRA-H chicks and chicks of the newly developed cock line between 4 and 12 weeks of age**

While the muscle index increased from 51.1 to 57.7 in the case of TETRA-H cocks between 4 and 12 weeks of age, it just varied between 53.8 and 55.4 in the case of chicks of the new cock line during the whole experimental period.

In the case of pullets the muscle index varied between 48.6 and 52.5 in both genotype and it reached its maximum level at 8 weeks of age in the case of the TETRA-H genotype (52.5) and two weeks earlier in the case of the new cock line (52.0).

It was also observed that in spite of the observation at 4 weeks of age, when the ratio of muscle in the body was higher in the chicks of the new cock line in both sexes, the ratio of muscle in the body was higher in the TETRA-H chicks at 12 weeks of age. The change was observed between 6 and 8 weeks of age in both sexes.

Examining changes in the body fat content it was established that its ratio in the body decreased continuously in the TETRA-H cocks during the whole experimental period (Figure 3).



**Figure 3: Changes in the fat index of TETRA-H chicks and chicks of the newly developed cock line between 4 and 12 weeks of age**

In spite of this the fat index did not show any changes in the cocks of the new cock line, because its value remained always the same during the whole examined period.

In the case of the pullets the body fat content decreased till 10 weeks of age in the TETRA-H genotype, while it was increasing in the new cock line during the same time. In the last two weeks of the experiment it was increasing in the TETRA-H pullets, while it remained at the same level in the new cock line.

At the end of the experiment the fat indices were higher by more than 20% in the case of the pullets than in the case of cocks in both genotypes (21.9% in the case of the new cock line and 24.2% in the case of the TETRA-H birds).

## CONCLUSIONS

Based on the results it was concluded that the liveweight of the chicks of the new cock line is significantly higher at 12 weeks of age than that of the TETRA-H chicks, but their body composition changes are more unfavourably during the whole rearing period. Therefore, while increasing the liveweight of the TETRA-H birds using this new cock line as parental line in the breeding programme, it should be taken into consideration that it is important to preserve the favourable changes in the body composition of the TETRA-H birds.

## ACKNOWLEDGEMENT

This research project was supported by the National Office for Research and Technology (TETRAKAP-TECH\_08\_A3/2-2008-0394).

## REFERENCES

- ANDRÁSSY-BAKA, G. – ROMVÁRI, R. – MILISITS, G. – SÜTŐ, Z. – SZABÓ, A. – LOCSMÁNDI, L. – HORN, P. (2003): Non-invasive body composition measurement of broiler chickens between 4-18 weeks of age by computer tomography. *Archiv für Tierzucht*, 46 (6), 585-595p.
- MILISITS, G. – DONKÓ, T. – SÜTŐ, Z. – ORBÁN, A. – KUSTOSNÉ, P. O. – UJVÁRI, L.-NÉ – REPA, I. (2010): Redbro és TETRA-H csirkék hizlalás alatti testösszetétel változásának in vivo vizsgálata komputer tomográffal. *IX. Wellmann Oszkár Nemzetközi Tudományos Konferencia*, Hódmezővásárhely, 2010. április 22., CD-ROM
- MILISITS, G. – ROMVÁRI, R. – DALLE ZOTTE, A. – SZENDRŐ, Zs. (1999): Non-invasive study of changes in body composition in rabbits during pregnancy using X-ray computerized tomography. *Annales de Zootechnie*, 48, 25-34p.
- MILISITS, G. – ROMVÁRI, R. – SZENDRŐ, Zs. – HORN, P. (2000): Non-invasive study of changes in the body composition of growing rabbits using X-ray computer tomography. *World Rabbit Science*, 8 (Supplement 1, Volume A), 643-649p.
- ROMVÁRI, R. – SZENDRŐ, Zs. – JENSEN, J. F. – SØRENSEN, P. – MILISITS, G. – BOGNER, P. – HORN, P. – CSAPÓ, J. (1998): Noninvasive measurement of body composition of two rabbit populations between 6 and 16 weeks of age by computer tomography. *Journal of Animal Breeding and Genetics*, 115, 383-395p.
- SPSS for Windows (1999): Version 10.0, Copyright SPSS Inc.

## EFFECT OF YOLK RATIO IN HEN'S EGGS ON THE HATCHING WEIGHT AND ON THE HEART AND LIVER RATIO IN CHICKS AT HATCHING

GÁBOR MILISITS<sup>1</sup>, ANDRÁS SZABÓ<sup>1</sup>, TAMÁS DONKÓ<sup>1</sup>, ZOLTÁN SÜTŐ<sup>1</sup>,  
ATTILA ORBÁN<sup>2</sup>, ESZTER SZENTIRMAI<sup>1</sup>, OLGA PŐCZE<sup>1</sup>, JOLÁN UJVÁRI<sup>1</sup>,  
ANTONELLA DALLE ZOTTE<sup>3</sup>, MARCO CULLERE<sup>3</sup>, IMRE REPA<sup>1</sup>

<sup>1</sup>Kaposvár University, Faculty of Animal Science, Guba Sándor u. 40, 7400 Kaposvár, Hungary

<sup>2</sup>Bábolna Tetra Ltd., Petőfi Sándor u. 18, 9651 Uraiújfalu, Hungary

<sup>3</sup>University of Padova, Faculty of Agriculture, Campus di Agripolis, viale dell'Università, 16, 35020 Legnaro (PD), Italy  
milisits.gabor@ke.hu

### ABSTRACT – Effect of yolk ratio in hen's eggs on the hatching weight and on the heart and liver ratio in chicks at hatching

The aim of this study was to examine, whether the yolk ratio of hen's eggs has an effect on the hatching weight and on the heart and liver ratio in chicks at hatching. Altogether 3.500 hen's eggs – originated from a 24 weeks old TETRA-H parent stock – were involved in the examination. The yolk ratio of these eggs was determined by means of computer tomography *in vivo* using a SIEMENS Somatom Emotion 6 multislice CT scanner at the Institute of Diagnostic Imaging and Radiation Oncology of the Kaposvár University. Based on the measured values eggs were separated into three groups: eggs with extreme high, eggs with average and eggs with extreme low yolk content (10-10% in each group). All of these eggs (n=350 per group) were incubated thereafter. After hatching 30 chicks per group (15 males and 15 females) were randomly chosen and their liveweight was measured thereafter. After measuring the liveweight chicks were killed and dissected. The weight of the heart and liver was measured and their ratio to the hatching weight was calculated. Based on the results it was established that the hatching weight of the chicks decreased with increasing the yolk ratio in the eggs in both sexes. In spite of the hatching weight the ratio of the heart to the hatching weight was increasing with increasing the yolk ratio in the breeding eggs in the case of the cocks. In the case of the pullets the opposite tendency was observed. The change in the ratio of liver to the hatching weight showed similar tendency in the case of cocks as it was observed in the case of the heart. In the case of the pullets no clear tendency was observed in this trait. Based on the results it was concluded that – according to some former results – the higher albumen content in the eggs results in higher hatching weight and the higher yolk content in the eggs in better body composition in the chicks.

**Keywords:** egg yolk content, computer tomography, chicken, hatching weight, body composition

## INTRODUCTION

In poultry breeding, it is an old question, whether the size or the composition of the eggs has greater effect on the viability of the offspring. In former studies it was already observed that the mass of the eggs and also that of the egg yolk increases parallel with the age of layers (APPLEGATE et al., 1998; HARTMANN et al., 2000; SILVERSIDES and SCOTT, 2001; OLOYO, 2003). Experiments that followed up the development of embryos and the birds hatched have clearly demonstrated that in eggs laid by young layers the development of embryos is slower than in those laid by older ones (APPLEGATE, 2002). It was supposed that this is partially due to the higher egg yolk ratio of eggs from older birds, which enables a more substantial incorporation of nutrients into the organism of the developing embryo.

Over a long period of time, elucidation of the correlations between the composition of hatching eggs and the development of the birds hatched was hampered by the lack of instruments that would have been capable of determining the composition of eggs without opening them. An attempt for determining the chemical composition of intact eggs was made by WILLIAMS et al. (1997), using the so-called TOBEC (Total Body Electrical Conductivity) method in their study. In this experiment it was demonstrated that there are significant correlations between the so-called E-values measured by the TOBEC method (the electrical conductivity of the eggs) and the water content of the eggs as well as the dry matter content of the albumen in all the four species studied (chicken, duck, guinea fowl and quail).

Relying on the results of WILLIAMS et al. (1997), studies on the examination of correlations between egg composition, hatchability and hatched bird's development have recently been started at the Kaposvár University as well. This study demonstrated that, eggs of different composition – i.e., having dissimilar yolk/albumen ratios – have significantly deviating hatchability, and that the birds hatching from these eggs have significantly different body composition at the time of hatching and significantly different growth rate during rearing and finishing (MILISITS et al., 2008a, 2008b). In spite of the favourable results the biggest disadvantage of the TOBEC method is the only moderate correlation between the electrical conductivity and the composition of eggs and therefore it is not suitable for demonstrating minor changes in egg composition, and is reliable only for distinguishing eggs with extremely divergent composition (MILISITS et al., 2007). Therefore, in this study another technique, namely computer tomography (CT) was used for predicting the egg composition (yolk content) *in vivo* and for examining the effect of egg yolk ratio on the hatching weight and on the heart and liver ratio in chicks at hatching.

## **MATERIAL AND METHODS**

Altogether 3.500 hen's eggs – originated from a 24 weeks old TETRA-H parent stock – were involved in the examination. The yolk ratio of these eggs was determined *in vivo* by means of computer tomography using a SIEMENS Somatom Emotion 6 multislice CT scanner (*Figure 1*) at the Institute of Diagnostic Imaging and Radiation Oncology of the Kaposvár University. Before the scanning procedure all of the eggs were weighed and positioned for the scanning in standing/upright position. During the CT measurements eggs were positioned in egg trays (30 eggs), thus five eggs were scanned simultaneously (*Figure 2*).



**Figure 1: The SIEMENS Somatom Emotion 6 multislice CT scanner**

**Figure 2: Cross-sectional CT image of five simultaneously scanned hen's eggs**

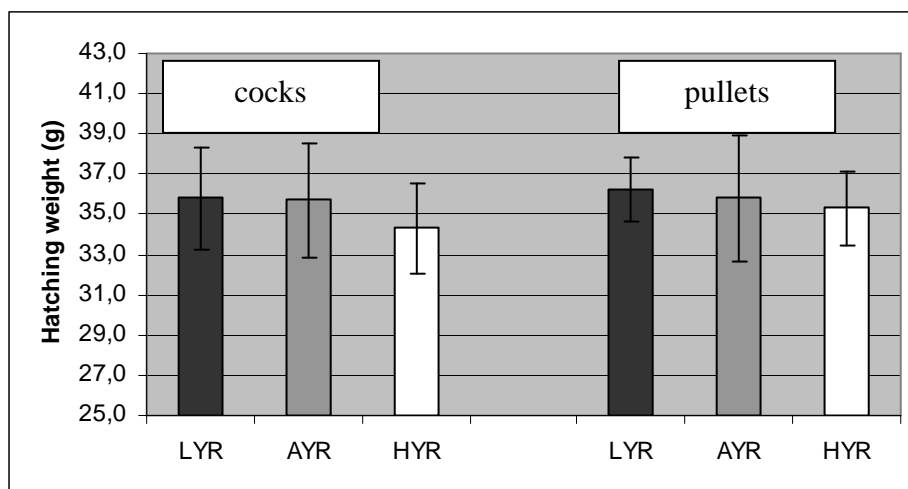
The CT examinations were carried out by using the following technical parameters: tube voltage: 110 kV, X-ray radiation dose: 80mAs, mode: spiral, pitch: 1, field of view: 110 mm. From all of the eggs 3 mm thick overlapping slices were taken. The images obtained were analysed by a new self-developed egg-separation and segmentation software. With the help of this software the border of the shell and albumen and the border of the albumen and yolk was determined and the volume of the yolk was calculated thereafter.

Based on the measured values eggs were separated into three groups: eggs with extreme high ( $28.2 \pm 0.90$  %), eggs with average ( $24.6 \pm 0.15$  %) and eggs with extreme low ( $21.2 \pm 0.86$  %) yolk content (10-10 % in each group). All of these eggs (n=350 per group) were incubated thereafter. After hatching 30 chicks per group (15 males and 15 females) were randomly chosen and their liveweight was measured thereafter. After measuring the liveweight chicks were killed by a lethal dose of pentobarbital, intraperitoneally and dissected thereafter. The weight of the heart and liver was measured and their ratio to the hatching weight was calculated. The differences in the hatching weight and in the heart and liver ratio between the experimental groups were evaluated statistically by using the One-Way ANOVA method. The statistical analysis was carried out by the SPSS statistical software package, version 10.0 (SPSS FOR WINDOWS, 1999).

## RESULTS

Examining the hatching weight of the chicks it was established that it was decreasing with increasing the yolk ratio in the breeding eggs in both sexes (*Figure 3*).

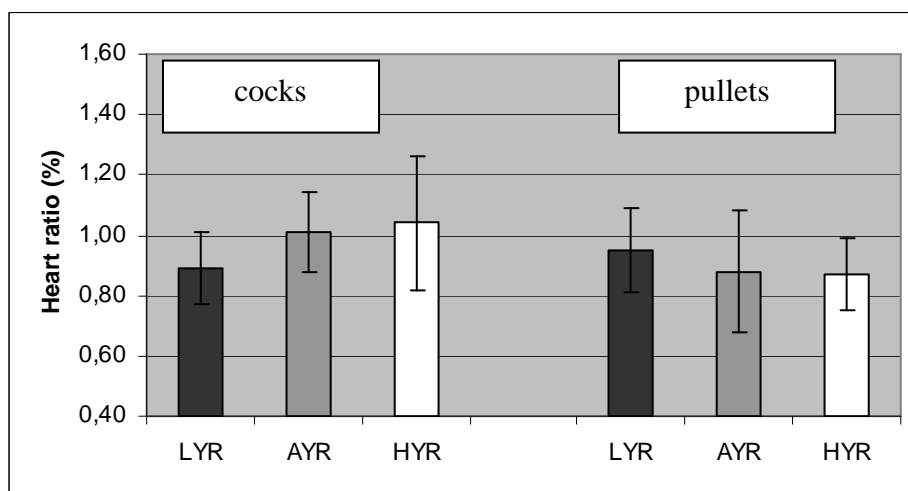




**Figure 3: Hatching weight of TETRA-H cocks and pullets hatched from eggs with low (LYR), average (AYR) and high (HYR) yolk ratio**

The hatching weight of the chicks hatched from eggs with high yolk ratio was lower by 4.2% in the case of cocks and by 2.5% in the case of pullets than that of the chicks hatched from eggs with low yolk ratio. The hatching weight of the chicks hatched from eggs with average yolk ratio was between the hatching weight of chicks hatched from eggs with high or low yolk ratio in both sexes. However, in spite of this clear tendencies the between group differences were statistically not proven neither in the case of cocks nor in the case of pullets ( $P>0.05$ )

In spite of the hatching weight the ratio of the heart to the hatching weight was increasing with increasing the yolk ratio in the breeding eggs in the case of cocks (*Figure 4*).

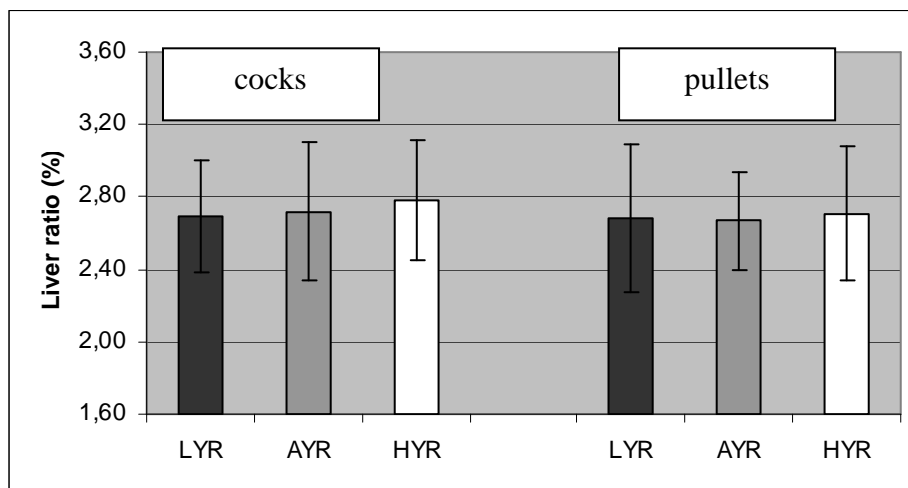


**Figure 4: Heart ratio to hatching weight in TETRA-H cocks and pullets hatched from eggs with low (LYR), average (AYR) and high (HYR) yolk ratio**

The ratio of the heart to the hatching weight in the cocks hatched from eggs with high yolk content was higher by 16.9% than that of the cocks hatched from eggs with low yolk content. The difference observed between these groups was statistically significant at  $P<0.05$  level.

In the case of the pullets the opposite tendency was observed. In these birds the ratio of the heart to the hatching weight was decreasing with increasing the yolk ratio in the breeding eggs. Between the two extreme groups 9.2% difference was observed, but it was not statistically proven ( $P < 0.05$ ) in this case.

The change in the ratio of liver to the hatching weight showed similar tendency in the case of cocks as it was observed in the case of the heart (Figure 5).



**Figure 5: Liver ratio to hatching weight in TETRA-H cocks and pullets hatched from eggs with low (LYR), average (AYR) and high (HYR) yolk ratio**

The ratio of liver to the hatching weight was higher by 3.3% in the cocks hatched from eggs with high yolk content than in those hatched from eggs with low yolk content. The between group differences were not statistically proven in this case ( $P > 0.05$ ).

In the case of the pullets no clear tendency was observed in this trait. The data obtained were very similar in all of the examined groups (2.67-2.71%).

## CONCLUSIONS

Based on the results it was concluded that the yolk ratio in hen's eggs has an influence on the hatching weight and on the heart and liver ratio of the hatched chicks. According to some former results it was established that the higher albumen content in the eggs resulted in higher hatching weight and the higher yolk content in the eggs in better body composition in the chicks. Because the hatching weight and the body composition could have an effect on the further development of the hatched chicks, the further examination of the effect of egg composition on the growth and development of the hatched chicks seems to be necessary.

## ACKNOWLEDGEMENT

This research project was supported by the Norwegian Financial Mechanism and the Hungarian Scientific Research Fund (OTKA NNF 78840).

## REFERENCES

- APPLEGATE, T.J. (2002): Reproductive maturity of turkey hens: egg composition, embryonic growth and hatchling transition. *Avian and Poultry Biology Reviews*, 13 (1), 31-41.
- APPLEGATE, T.J., HARPER, D., LILBURN, M.S. (1998): Effect of hen production age on egg composition and embryo development in commercial pekin ducks. *Poultry Science*, 77 (11), 1608-1612.
- HARTMANN, C., JOHANSSON, K., STRANDBERG, E., WILHELMSON, M. (2000): One-generation divergent selection on large and small yolk proportions in a White Leghorn line. *Poultry Science*, 41 (3), 280-286.
- MILISITS, G., KOVÁCS, E., LOCSMÁNDI, L., SZABÓ, A., ANDRÁSSY-BAKA, G., JEKKEK, G., ROMVÁRI, R. (2007): Applicability of the TOBEC method in selection of hen's eggs based on their composition. *Agriculture*, 13 (1), 209-212.
- MILISITS, G., KOVÁCS, E., PÖCZE, O., UJVÁRI, J., TARASZENKÓ, ZS., JEKKEK, G., LOCSMÁNDI, L., BÁZÁR, GY., ROMVÁRI, R., SÜTŐ, Z. (2008a): Effect of hen's eggs composition on the hatchability and on the hatching weight and body composition of chicks in two meat-type genotypes. *XXIII World's Poultry Congress*, Brisbane (Australia), 30 June - 4 July 2008, CD-ROM.
- MILISITS, G., KOVÁCS, E., PÖCZE, O., UJVÁRI, J., TARASZENKÓ, ZS., JEKKEK, G., LOCSMÁNDI, L., BÁZÁR, GY., ROMVÁRI, R., SÜTŐ, Z. (2008b): Effect of hen's eggs composition on the growth and slaughter characteristics of hatched chicks in two meat-type genotypes. *XXIII World's Poultry Congress*, Brisbane (Australia), 30 June - 4 July 2008, CD-ROM.
- OLOYO, R.A. (2003): Effect of age on total lipid and cholesterol of hen eggs. *Indian Journal of Animal Sciences*, 73 (1), 94-96.
- SILVERSIDES, F.G., SCOTT, T.A. (2001): Effect of storage and layer age on quality of eggs from two lines of hens. *Poultry Science*, 80 (8), 1240-1245.
- SPSS FOR WINDOWS (1999): Version 10.0, Copyright SPSS Inc.
- WILLIAMS, T.D., MONAGHAN, P., MITCHELL, P.I., SCOTT, I., HOUSTON, D.G., RAMSEY, S., ENSOR, K. (1997): Evaluation of a non-destructive method for determining egg composition using total body electrical conductivity (TOBEC) measurements. *Journal of Zoology*, 243 (3), 611-622.

## **FOOD SECURITY – CHALLENGE OF FUTURE GENERATIONS**

**IOAN BORLOVAN, LIVIU SÂMBOTIN, ADRIAN COROIAN**

University of Agricultural Sciences and Veterinary Medicine of the Banat, Faculty of Farm  
Management Timișoara, Romania  
adi\_21mar@yahoo.com

### **ABSTRACT – Food security – Challenge of future generations**

Food security is part of the security of each country in the world and this in turn in global security. Ensuring food security for the population of a state is primarily the obligation. An state must manage its resources efficiently and rationally otherwise jeopardize the very existence of the state and the people concerned. Each country's food security can be ensured primarily from internal resources through the policies applied by each country. Food security is a very dynamic concept that has evolved over time. Thus food security in developing countries has been achieved by creating a sustainable agricultural system by engaging in lengthy and costly policies to support agriculture. Today in these countries the concept has acquired other meanings. Because in these countries managed to provide food in plentiful amounts, place in the forefront of quality, food safety and social protection, so they are concerned about consumer health protection. Hunger is a major problem of food security and overall security in the contemporary era as it involves more or less all countries and affects broad areas of social and economic life. Solving this global problem could be achieved only through international cooperation, to which all countries should participate in both poor and rich. The problem of food security must also analyzed according to national conditions of each country. Thus each state has made the social policy, demographic, complex.

**Key words:** food security, agricultural production, food prices, hunger

## **INTRODUCTION**

Food security is part of the security of each country in the world and this in turn in global security. Ensuring food security for the population of a state is primarily the obligation. An state must manage its resources efficiently and rationally otherwise jeopardize the very existence of the state and the people concerned.

Each country's food security can be ensured primarily from internal resources through the policies applied by each country. Food security is a very dynamic concept that has evolved over time. Thus food security in developing countries has been achieved by creating a sustainable agricultural system by engaging in lengthy and costly policies to support agriculture. Today in these countries the concept has acquired other meanings. Because in these countries managed to provide food in plentiful amounts, place in the forefront of quality, food safety and social protection, so they are concerned about consumer health protection.

Food security in developing countries is more difficult and adverse conditions. In these countries food consumption is very low in terms of both quantity and quality, characterized by a structure in which animal products have very low weight, and this situation is common in many countries of the world. It is very important for these countries to provide food from its own resources, to strengthen its food markets to gain independence from large developed countries producing food. This measure is necessary for Romania is a developing country.

## MATERIAL AND METHOD

The problem of food security, to supply the population with basic food and quality, is a major concern facing to a greater or lesser extent all over the world, but primarily because of the underdeveloped or developing . Paradoxical that the current period, the company is developing a computerized, many states are facing this problem. This is why the food problem created and a factor that can lead to instability in the world. Ensuring food security for all individuals contribute to social peace in each country to stability and prosperity.

Food security is a complex issue and general humanity that all countries are responsible. This was demonstrated by various studies on the diet of the population, changes in agricultural production, changes in population and resource use. A proper diet should be seen both in terms of the appropriate amount of food as their quality and diversity.

It is estimated that the events that will lead to food crises in the near future will be: water scarcity and high temperatures will greatly compromise the crops in all major regions producing agricultural products. Economic indicator to indicate the best food crisis will have on the world market price of wheat that will affect all countries, including Romania. So food is a national security problem as global harvests decline that increasingly more and the water needed for agriculture is becoming less and increasing temperatures.

## RESULTS

### **Romania's agricultural production during 1996-2010-basic for food security. Evolution of cultivated land.**

In the period 1996 - 2010, Romania's agriculture has undergone radical transformation from agriculture to small producers with land has been given land in a predominantly agricultural producers with farms growing individual, this does not radically alter the development of agricultural area, but had great impact on the structure of the main crops and livestock development. "Agriculture is the main source of food for mankind, plus other sources of food. " Even if Romania's agriculture has experienced great difficulties after the war, the country's agricultural area increased from 1950 until 1989 with 705,200 ha. They were attracted to set aside new areas that were unproductive or low productivity on cultivated crops. In the period after 1996 reaching the cultivated area shrank in 2000 to 843,500 ha more than this because of the removal of fallow land or areas concerned because neinsămânțării. In subsequent years the area has increased slightly until 2005 when again started to decline in 2010-8527 reaching thousands ha, 878,000 ha in 1996 ie less than 9.4% less. On such a surface would have obtained 2,969,750 tonnes of wheat.

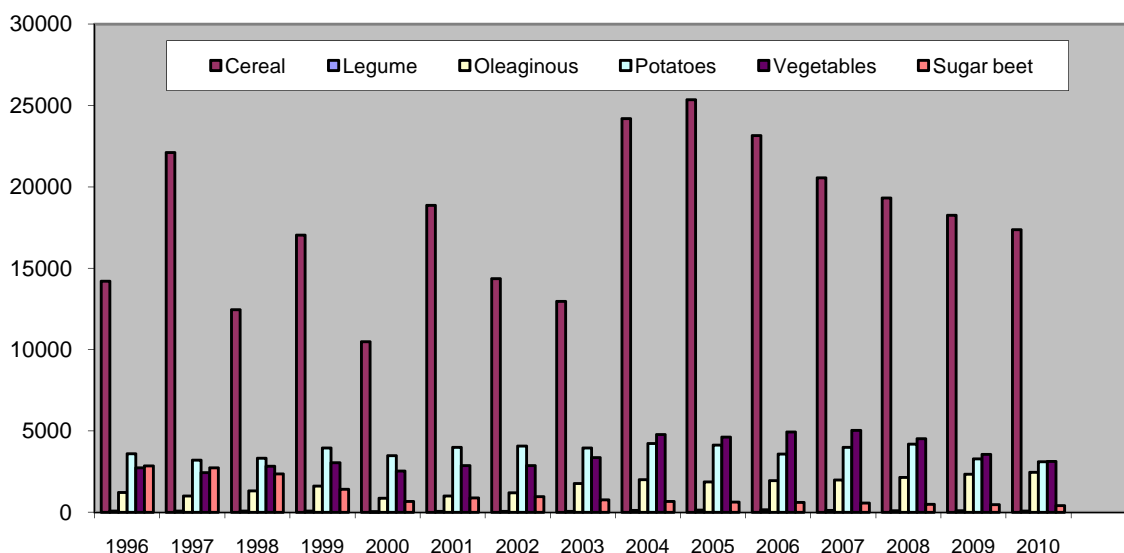
The total area under cereals occupied the largest share of 73% in 2004 with an area of 6265 thousand hectares more than in 1996 but lower than in 2005. If the area planted with wheat showed increases and decreases during the transition when the area planted with legumes has declined sharply from 158,000 hectares planted in 2006 to 78,000 ha in 2010 an extraordinary loss of 70.5%. A slight increase observed for vegetables, the area has increased by 92 thousand ha in the period 2005-2007 recorded the maximum area under cultivation during this period. A decrease in the area planted with potatoes from 289,000 ha in 2004 to just 265,000 ha in 2004. So in 2004 the total cultivated area of cereals held first place with 73.4%, 0.44% legumes, potatoes 3.1%, vegetables 3.61%, 14.3% and 6.5% forage plants crops. So from 1996 to 2010 increased the area planted with wheat, decreased

the area occupied by crops and legumes, potatoes, vegetables and fodder plants maintaining approximately the same weight.

### **Evolution of crop production.**

Crop production created and the consumption, the industries of manufacturing and processing, light industry, being used very well and livestock. Due to the favorable conditions available to Romania, 60% of the land is used for agriculture. In the years that followed the revolution of 1989 that the transition to a market economy structure has been modified crops in line with consumer needs and the changes that took place during this period. An important issue our country is providing people with food so as not to be dependent on imports. The food crisis of 1980-1989 was not due to insufficient agricultural production but also how its distribution by forcing the export. After 1990, production recorded significant reductions in all crops due to difficulties at the beginning of reforms and transition. But lack of food was not due to decreased domestic production but massive imports of products 2-3 times more expensive than the Romanian ones. From the graph it is noted that vegetable production from 1996 to 2010 cycle evolved as registering significant increases and reductions in certain years. Thus in 2005 compared to 1996 occurred more than 7030 million tons of grain, oil plants with 1.256 million tonnes, with 145 million tons of potatoes, with 2.416 million tonnes of vegetables. But a drop in sugar beet production 2.605 million tons. So despite the manifestations of social, economic and natural conditions have created unfavorable agricultural development and poor agricultural structures are observed, since 2005 until now, a trend of decreasing crop production trend observed in the analysis of the chart opposite.

**Chart 1. Evolution of crop production.**



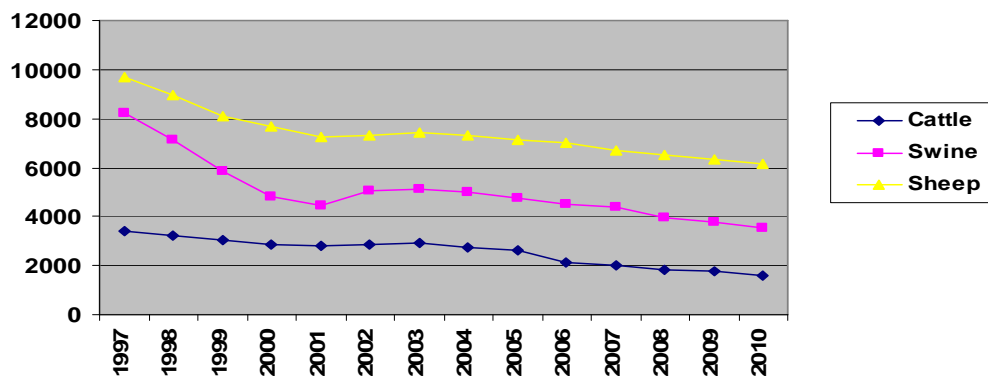
### **Evolution of animal production.**

In the period 1997 - 2010, livestock in Romania have fallen significantly, the reasons for these reductions are very different, of being able to remember them: the abolition of the big cattle and pig farming, the bankruptcy of major agricultural products processing industries, significantly reducing the activities of large slaughterhouses, significantly lower demand from the manufacturing industry. After the Second World War took place restoring livestock largest increases occurring in cattle, sheep and goats and pigs and poultry decreases, and the horses were largely destroyed during the war. After 1997 the livestock

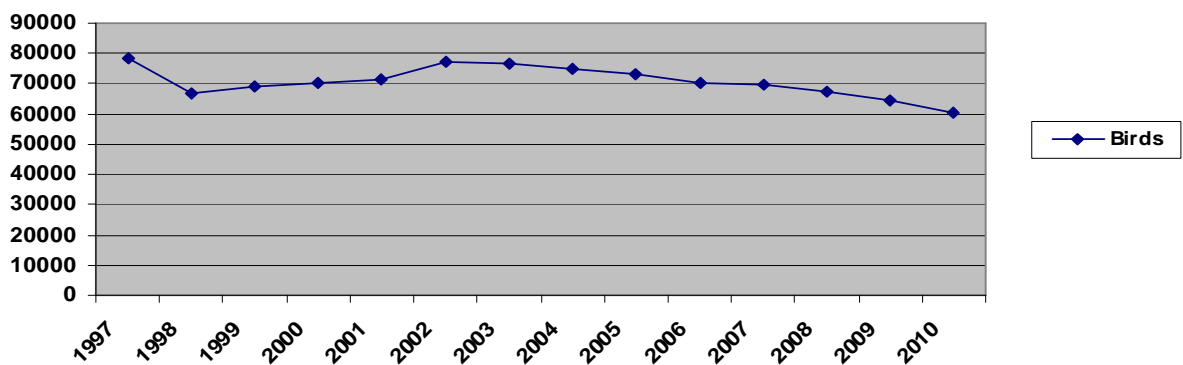
except goats showed a sharp decline, large declines have occurred due to massive slaughter of livestock exports and mortality of animals, livestock farms and demolition. These events resulted in dramatic decrease in the number of animals that from 1996 to 2010 the herd has decreased by:

- 1838 thousand head cattle - the sudden 46% decrease.
- 4706 thousand heads pigs - 42.8%
- 3540 thousand head sheep and goats - 41%
- 18 219 thousand heads poultry - 26.8%

**Chart 2. Evolution of cattle, swine, sheep.**

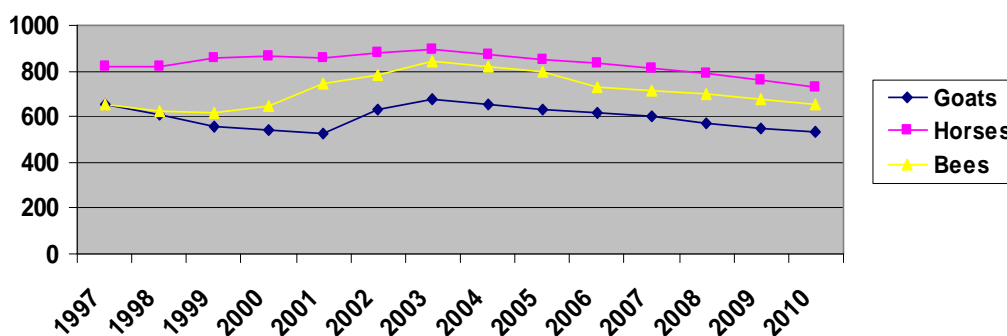


**Chart 3. Evolution of bird heads.**



If birds can be seen from the chart that there has been an increase since 1998 and a decline from 2003 to 2010, leading to a total of 60 259 thousand heads.

**Chart 4. The evolution of the heads of goats, horses, bees.**



## CONCLUSIONS

Meanwhile, soaring food prices around the world alarmed. Japan and African countries have pledged to increase agricultural production to solve food crisis in the world. In International Conference on African economic development that took place in Tokyo under the auspices of the UN, World Bank and Japan, participating States adopted a plan for the next five years to increase agricultural production in African countries. This approach is considered crucial for food security, poverty reduction and economic growth in Africa. The main problem is the increase in food prices, while African countries have committed to allocate at least 10% per year from national budgets to agriculture. Japan and Africa have promised, all at the meeting that will support efforts to reduce by 50% of cases of tuberculosis and mortality.

Experts estimate that food prices in the next decade "will exceed the average levels over the last ten years " and will record "unprecedented prices for almost all agricultural products".

Compared to the average in the period 1998 - 2007, price projections for the period 2008 - 2017 suggests an increase of approximately 20% for beef and pork, with about 30% for brown sugar and white and between 40% and 60% wheat, maize and skimmed milk powder. For the same period, growth will be "more than 60% butter and oilseeds and vegetable oils over 80%".

European Development Commissioner Louis Michel said recently that "rising prices of basic foodstuffs could cause a global humanitarian disaster. Current food programs are subject to strong pressure, because there is less food available for people already at risk of hunger. Other millions, who managed to get by, are now threatened by famine.

Financial Times warns that the world is "dangerously close "to a new food crisis, while the UN biennial report points out: "The international community must remain vigilant to future food supply shocks".

The report gave the UN agency Food and Agricultural Organization (FAO) warns that this year will feel an increase in food prices, particularly the poorest people in the world. The report predicts a growth of 11% for the poorest countries and 20% for countries with food shortage because of low income. Currently, according to UN estimates, one billion people worldwide suffer from hunger. This is the highest number ever recorded in history.



It is estimated that imports of products worldwide will be 15% higher than in 2010 and reached 1,000 billion dollars. It would be the second time in history when that happens, while in 2008 the world food import was 1.031 billion dollars, an absolute record time. By comparison, in the period 1997-2007 was half the value of imports, not exceeding 500 million. "Prices are dangerously close to the 2007-2008 level, " said Abdolreza Abbassian, FAO economist. Thus, people should "be prepared" for higher prices and from next year, says Food Outlook report.

## REFERENCES

- BROWN LESTER "Depășind resursele planetei : problema securității alimentare în epoca resurselor de apa și a încălzirii climei", Editura Tehnică, București, 2005;
- BROWN LESTER "Planul B: salvarea unei planete sub presiune și a unei civilizații în impas", Editura Tehnică, București, 2006;
- BOBOC DAN – "Managementul calității produselor agroalimentare", Ed ASE, București, 2006;
- BULGARU MIRCEA "Dreptul de a manca", Editura Economică, București, 1996;
- Ene Corina "Impactul Securității alimentare în elaborarea politicilor nutriționale și alimentare", Teză de doctorat, 2005;
- MANOLE VICTOR, STOIAN MIRELA, ION RALUCA-"Agromarketing Ediția a II- a", Ed ASE, București, 2003;
- PELIN PETRUTA "Scenarii si tipologii privind securitatea alimentara a Romaniei", Teza de doctorat, 2003;
- ZAHIU LETIȚIA "Politici agroalimentare comparate", Editura Economica, București, 2001;
- \*\*\* faostat.fao.org
- \*\*\* Legea nr 50/2004 privind siguranța alimentară
- \*\*\* Hotărârea nr 545 din 2 08 1991 privind supravegherea calitatii produselor si serviciilor in scopul prevenirii si combaterii faptelor care pot afecta viata sau sanatatea oamenilor, animalelor ori calitatea mediului inconjurator aparuta in MO nr 178 din 2/09/1991;
- \*\*\* Ordin nr 25/474 din 1993 privind serviciile de sanatate preventive ce se asigura de organele sanitare veterinare si sanitare umane pentru prevenirea si combaterea transmiterii bolilor de la animale la om- aparuta in MO nr 98 din 19/05/1993;
- \*\*\* www.gov.ro;
- \*\*\* www.insse.ro;
- \*\*\* www.madr.ro;
- \*\*\* www.revista-piata.ro;
- \*\*\* www.zf.ro;
- \*\*\* www.ansv.ro;
- \*\*\* www.standard\_team.com;
- \*\*\* www.romalinta.ro;
- \*\*\* www.consultanta-certificare.ro
- \*\*\* www.iso.org

## **RESEARCH OF SOLAR ENERGY AT THE FACULTY OF ENGINEERING UNIVERSITY OF SZEGED**

**PETER SZABO ISTVAN, SZABO GABOR**

Department of Process Engineering, Faculty of Engineering, University of Szeged  
H-6724 Szeged, Mars ter 7, Hungary  
e-mail: pszi@mk.u-szeged.hu

### **ABSTRACT - Research of Solar Energy at the Faculty of Engineering University of Szeged**

At the Faculty of Engineering and it's legal predecessor – the College Faculty of Food Engineering – we research the utilizing of solar energy since 2004. In our narrower region – the south of the Great Hungarian Plain – the utilizing of solar energy could be advantageous, therewith in our new building we will be able to study the utilization of geothermal heat. With our new equipment we can measure the efficiency and analyze the transient effects of solar collectors.

**Keywords:** Renewable Resources, Solar Energy, Solar Collector, Collector Efficiency

## **INTRODUCTION**

Hungary has good capabilities for the application of renewable resources. There is a high amount of geothermal energy, and in our narrower region – the south of the Great Hungarian Plain – the utilizing of solar energy could be advantageous: the average annual sunshine is 2000-2200 hours.

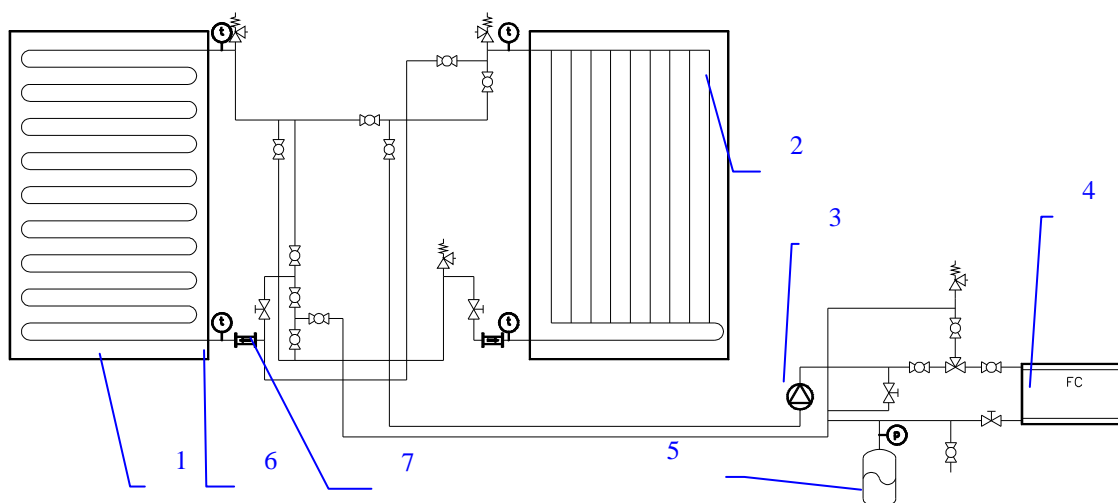
In the period from April to October in Hungary it is absolutely advisable to utilise the solar energy (DEZSŐ FODOR, 2010).

We can conclude that in the south-eastern part of Hungary and in the surrounding areas over our borders there are favourable possibilities for the utilisation of solar energy primarily in the field of thermal use. The potential solar energy enables a significantly more intensive utilisation primarily in those areas where the energy demand coincides with the summer maximum values of the radiance energy, such as fodder drying or solar cooling – air-conditioning (DEZSŐ FODOR, 2010).

In many industrialized countries, including the US, the heating, cooling, ventilation and lighting of buildings represent approximately 40% of the annual nation's energy consumption (HARTKOPF, 1994).

## **MATERIAL AND METHOD**

Using our prior experiences we have designed a newer experimental measuring system in 2010:



**Figure 1. Experimental equipment for measuring the efficiency of solar collectors.**  
**1 – collector with coil-pipe, 2 – collector with parallel pipes, 3 – circulation pump,**  
**4 – fancoil, 5 – expansion tank, 6 – thermometers, 7 – volume flow rate measuring**

We used our own-designed collectors. The covering of these collectors is removable, so we could test the collectors with different polycarbonate sheets and uncovered. With the unit we can operate the collectors in parallel or serial connection. In the serial connection we can change the order of the two collectors. It is possible to lock out either collector.



**Figure 2. Experimental solar equipment**

The equipment transfers the heat output of the collectors to the external air by a fancoil. The cooling fan can be adjusted continuously. The cooling capacity can be decreased further with a bypass pipe.

The circulation pump is adjustable in five steps. In function of the return temperature the pump does further adjusting.

The temperatures were measured by K-type thermocouples with two Testo 177-T4 datalogger. The accuracy of the measuring is  $\pm 0.3$  °C.

We measured the temperature and humidity of the external air and the solar irradiation. The irradiation was measured by a Lambrecht 16131 pyranometer mounted between the collectors in the same plane.

## RESULTS

Fig. 3 represents the results of a diurnal measuring. Fig. 4 shows the results of the efficiency calculations for the same day.

As we can see, the cloudy period between 16:30 and 17:30 does not give correct results of efficiency. It is occurred by the different reaction time of the collectors and the pyranometer. The pyranometer answers the decrease of the solar irradiation more quickly than the collectors. (The mass of the pyranometer is much lower than the collectors, as you can see on the Fig. 2.)

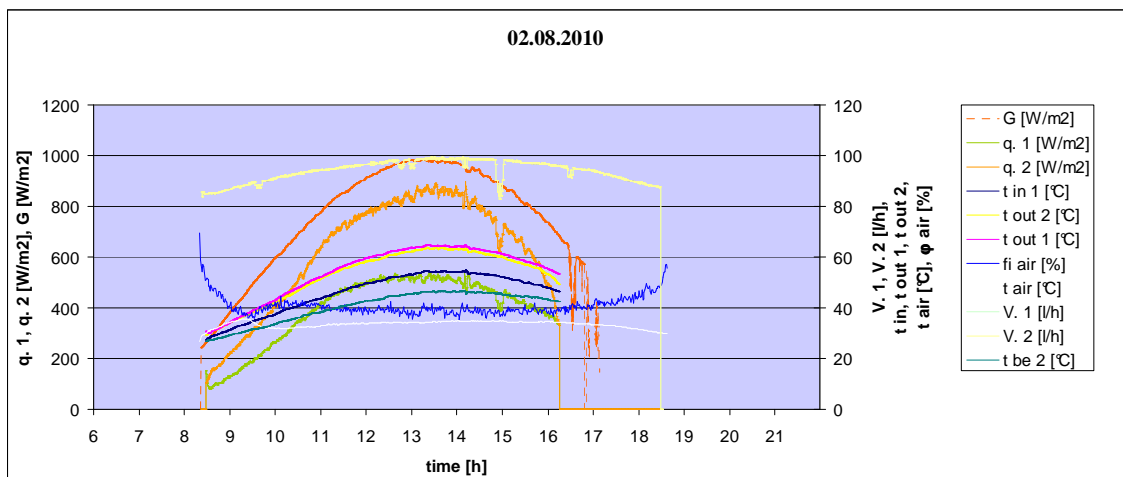


Figure 3. Results of a diurnal measuring

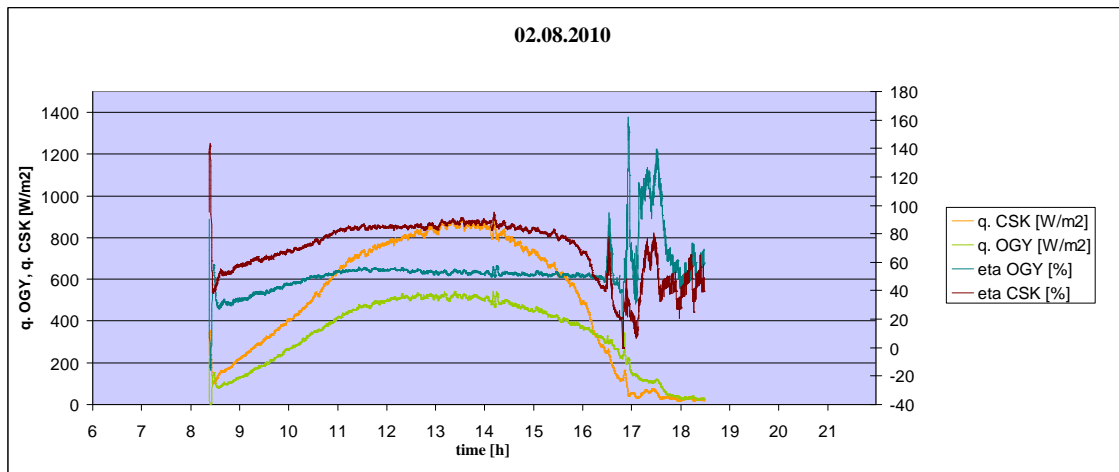
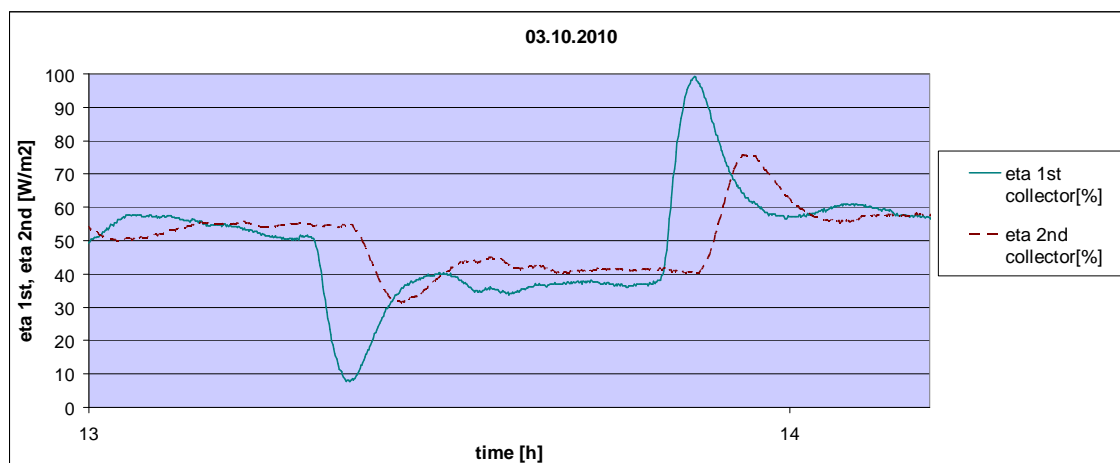


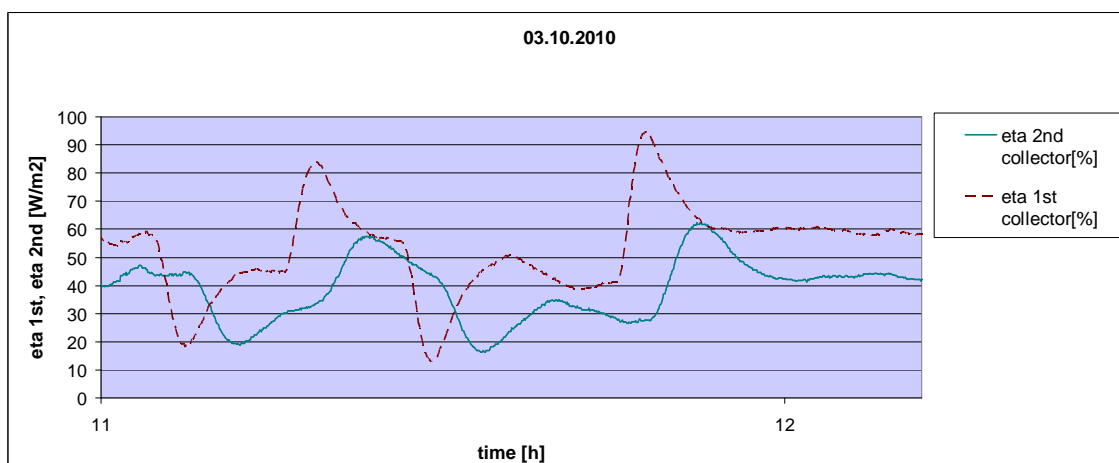
Figure 4. Heat output and efficiency results of a diurnal measuring

During the most of the measuring we have saved the datas by 5 sec. It enables to analyze the transient processes. It results very high amount of datas, so it's processing requires a database management software.



**Figure 5. Efficiency changes of the first and second collector in line**

As we can see in the *Fig. 5*, the appearance of the changes in the heat output is quicker on the first collector and slower on the second collector in line. After the measuring we have changed the order of the two collectors connected in line, and the effect was the same: the reaction of the second collector was slower:



**Figure 6. Efficiency changes of the first and second collector in line**

### **SOLAR COLLECTOR, SOLAR CELL AND GEOTHERMAL HEAT PUMP SYSTEM IN THE NEW BUILDING OF THE FACULTY**

The acceptance of the building was in March, 2011. The heating, the domestic hot water and the lighting system uses renewable resources.

The heat demand is supplied by two geothermal heat pump with blow pipes. The natural gas used only to aid the heating if it is necessary.

The solar collectors join to the domestic hot water system. In summer the collectors can supply the heat demand of the DHW system, in autumn, winter and spring the collector system is a pre-heater of the DHW system.

The lighting and the outer decorative lighting is particularly supplied by the solar cell system.

The controlling system of the building will measure and logging the parameters hereafter:

- temperatures of the blow pipes of the heat pumps,
- temperatures of the heating subsystems,
- temperature and amount of the domestic hot water,
- solar radiation and external air temperature,
- internal temperatures,
- power and efficiency of the solar cells,
- heat output and efficiency of the solar collectors,
- total energy and renewable energy demand of the building.

By the temperature database we will be able to optimize the system. We will be able to analyse the long term environmental effect of the building and confirm the researches of the geothermal heat pumps.

The building and the database from the controlling system will give a unique possibility to improve the practical education for the mechanical engineering, technical manager, materials engineer, bioengineer and environmental engineer students.

## CONCLUSIONS

The measuring data of solar systems are not reproducible, so we have to do many measurements for verification. We use very short intervals to save the results, so we can analyze transient effects and can search repeating effects. In this article we represent two effects.

The cloudy periods are not suitable to measure momentary efficiency, only average efficiency could be calculated.

The behaviour of a collector connected in line with others changes if we change the position of the collector in the system.

## REFERENCES

DEZSŐ FODOR (2010): The characteristics of solar energy utilisable in Hungary. *International Symposium Interdisciplinary Regional Research “ISIRR 2007” HUNGARY – SERBIA – ROMANIA, 2010. CD*

HARTKOPF V, LOFTNESS V, DUCKWORTH S. The intelligent workplace retrofit initiative. DOE Building Studies; 1994.

The Project named „TÁMOP-4.2.1/B-09/1/KONV-2010-0005 – Creating the Center of Excellence at the University of Szeged” is supported by the European Union and co-financed by the European Regional Fund.



[www.nfu.hu](http://www.nfu.hu) [www.okmt.hu](http://www.okmt.hu)

## **SOIL AS NUTRITION ENVIRONMENT IN RELATION TO NUTRITIONAL REQUIREMENTS IN APPLE**

**JIVAN CLAUDIA, SALA FLORIN**

Banat University of Agricultural Sciences and Veterinary Medicine Timișoara,  
Calea Aradului, 119, 300645, Timisoara, Romania  
florin\_sala@yahoo.com

### **ABSTRACT - Soil as nutrition environment in relation to nutritional requirements in apple**

The studies and research on which the present paper relies aimed at assessing the soil in the fruit-tree plantation of the Didactic Station of the Banat University of Agricultural Science and Veterinary Medicine in Timisoara (Romania) as nutrition medium for apple-trees to allow fertilisation schemes that ensure the bioavailability of nutrients and of optimal nutrition. On fruit-tree plantations, soil is of interest in plant nutrition due to its larger edaphic volume over a 0-40 cm depth. Therefore, we carried out the soil analysis and characterisation over the edaphic volume, i.e. over the two levels of interest from the point of view of water and nutrient supply for apple-trees. The soil on the fruit-tree plantation is characterised as a heterogeneous nutrition environment if we take into account the features of the two horizons of nutrient and water supply. The different physicochemical features are due to the acting factors and conditions. Over the horizon 0-20 cm, there is a higher amount of organic matter, higher aeration, and more intense oxidation phenomena; the horizon is subjected to some physicochemical and biological changes. The soil on the fruit-tree plantation is characterized by a neuter reaction in the horizon 0-20 cm (pH = 6.90) and by low acid level over the horizon 20-40 cm (pH = 6.39). Humus content (H) is about 1.95% over the horizon 0-20 cm and 1.73% over the horizon 20-40 cm. Total nitrogen content  $N_t$  is 1.16 % and 1.13%, respectively. Mobile phosphorus supply reaches 32.55 ppm in the upper horizon of the soil and 29.4 ppm in the horizon 20-40 cm. Assailable potassium reaches between 172.0 ppm in the upper horizon 0-20 cm and 161.5 ppm in the horizon 20-40 cm. Soil reaction is neuter to low acid, which makes macro-element bio-availability relatively good. There are good conditions for the development of some low-solubility compounds (calcium phosphates), which recommends the supply of mobile phosphorus through proper fertilization.

**Keywords:** sol, nutrition environment, soil – plant relationship, apple plantation, specific consumption, fertilisation

## **INTRODUCTION**

Soil as nutrition environment on fruit-tree plantations should be analysed and characterised through a larger edaphic volume subdivided into two water and nutrient supply levels (0-20 cm and 20-40 cm). The vast root system of fruit-tree species explores a larger volume of soil, with favourable water and nutrient conditions.

Characterisation of soil as a nutrition environment for apple plantations should be done over two horizons through the prism of specific agro-chemical indicators, with emphasis on soil solution pH since it determines a differentiated bio-availability of the nutrients (BÜNEMANN et al. 1980). Humus content (H) is also of interest, as well as the total nitrogen content (Nt), the mobile phosphorus content, the available potassium content, secondary macro-elements (Ca, Mg, S), and micro-element content.

Soil is a very heterogeneous nutrition environment that supplies water and nutrients to the plants in different ways, depending on the reference levels (ATKINSON et WHITE 1980).

Soil agro-chemical parameters that characterise fertility state on apple-tree plantations are (DAVIDESCU & VELICICA DAVIDESCU, 1992):  $pH_{\text{aqueous extract}} = 5.5-7.0$ ,  $V > 60\%$ ,  $H = 3-4$ ,  $IN = 2-3$ ,  $P_{AL} = 60-80$  ppm,  $K_{AL} = 200-300$  ppm. Other micro-elements are also important

for apple-tree nutrition, with mobility and bio-availability depending largely on the pH, (ROBINSON, 1980)

Mineral requirements in normally-fed apple-trees are determined by genetic, soil and climate, and technological factors. HAVLIN *et al.* (2005) mention as critical values of nutrition in apple-trees the following concentrations of nutrients in the plant (shoot): N 1.9-2.3%, P 0.1-0.4%, K 1.2-1.8%, Ca 0.8-1.6%, Mg 0.25-0.45%, S 0.2-0.4%, Fe 50-200 ppm, B 30-50 ppm, Cu 6-12ppm, Zn 20-50 ppm, and Mn 25-135 ppm.

Upon fertilisation, we need to take into account the specificity of the nutrients in the fertilisers. Low-mobility elements (P, K) shall be applied on the soil earlier than the maximum requirements of the plants, and the supplements during vegetation shall be supplied through phase fertilisation during the periods with higher nutrition requirements.

## MATERIAL AND METHOD

The studies and research carried out aimed at assessing soil as a nutrition environment depending on the nutrition requirements of the apple-trees.

We observed the methodology of sampling over the horizons 0-20 and 20-40 to assess differently the edaphic volume making up the nutrition environment of apple-trees.

The studied agro-chemical parameters of importance in the nutrition process in apple-trees were as follows: pH, H, N<sub>total</sub>, P<sub>mobile</sub>, K<sub>available</sub>, with measurements made through current laboratory methods (colorimetry, atomic absorption spectrophotometry).

The study of the soil and of the soil – plant relationship on a fruit-tree plantation is a good opportunity to assess the nutrition balance of the nutrition environment depending on the plant requirements per phenol-phases of vegetation and nutrition periods in order to develop proper fertilisation systems.

The biological material is the apple varieties: *Florina*, *Prima* and *Generos*. Rootstock is M27, the small force. Plantation is 13-14 years old.

The research site was within the Didactic Station in Timisoara, at the Fruit-tree and Grapevine Centre, on the apple-tree orchard, in full Banat Plain landscape. Research period was 2009-2010.

## RESULTS AND DISCUSSION

Soil has certain features as a nutrition environment for fruit-tree plantations, in general, and for apple-trees, in particular. Taking into account the features of the root system in apple-trees, we differentiated 2 levels (horizons) of water and nutrient supply, i.e. over 0-20 and 20-40 cm. For this reason, we measured agro-chemical indices and we determined soil features at two levels, as shown in *Table 1* and in *Figures 1, 2, and 3*.

Apple-tree has nutrition requirements ranging between 2.3-3 kg N/t, 0.65-0.7 kg P<sub>2</sub>O<sub>5</sub>/t, 3-3.3 kg K<sub>2</sub>O/t, 0.25 kg CaO/t, and 0.17 kg MgO/t. There are also microelements playing an important role in the development and quality of yield, sugar synthesis, vitamins, etc.

Taking into account the normative limits concerning the necessary nutrients in apple-trees and the soil supply on fruit-tree plantations, we can assess the soil fertility level, the yield prognosis, and the fertilisation requirements.

If we take into account the level of the studied soil agro-chemical indices and the average reference values suggested by Davidescu & Velicica Davidescu (1992) – pH<sub>aqueous</sub> extract = 5.5-7.0, V > 60%, H = 3-4, IN = 2-3, PAL = 60-80 ppm, KAL = 200-300 ppm –



we can say that the reaction of the nutrition environment has optimal values of the nutrient bio-availability. Humus content is lower, i.e. about 40% of the reference one, phosphorus content is about 45.7%, and potassium content is about 65-70%.

**Table 1. Soil agro-chemical parameters on the apple-tree plantation of the Didactic Station in Timișoara**

Depth (cm)	Agro-chemical parameters				
	pH	Humus (%)	Nt (%)	P <sub>mobile</sub> (ppm)	K <sub>available</sub> (ppm)
0-20	6.90	1.95	1.16	32.55	172.00
20-40	6.39	1.73	1.13	29.40	161.50




Fig. 1. Soil reaction as a nutrition environment for the apple-tree plantation

Fig. 2. Humus and total nitrogen contents (%)

Fig. 3. Mobile phosphorus and available potassium (ppm)

Therefore, to ensure the necessary nutrients on the apple-tree plantation under the given experimental conditions, we need to supplement nutrients through fertilisation.

In apple-trees, there are 3 different periods of consumption: the critical period of consumption, during the budding-blooming phase; the maximum consumption period, during the fruit development and growth phases; and the low consumption period, during the fruit and shoot maturation phase (*Figure 4.*).

	Critical period of consumption	Maximum consumption period	Low consumption period
	Budding and blooming	Fruit development and growth	Fruit and shoot development
Vegetation phases and nutrition requirements in apple-tree			

**Fig. 4. Nutrition requirements in apple-trees.**

Taking into account these biological features and the specific consumption in the configuration of the yield, the fertilisation system should be adapted to ensure the necessary nutrients for the plants.

Knowing the nutrient requirements specific to an apple-tree plantation correlated to the vegetation and consumption periods allows the proper guidance of plant nutrition through the development of differentiated fertilisation systems in strict correlation with soil and climate conditions, with estimated yield, with type of fertiliser, and with application methods.

Applying fertilisers depending on sequential requirements (physiological and technological) on the fruit-tree plantation ensures a more efficient economically use of fertilisers, a diminution of pollution risks, and the development of a sustainable fruit-tree plantation.

Given the supply of soil minerals and nutritional requirements of the apple, established the plantation system of fertilization.

Complex mineral fertilizers ensure the necessary macronutrients (N, P, K, S) and is administered in the fall and spring. Foliar fertilizers (Fertifol 4-8 l/ha, Bionex 4-5 l/ha, Basfoliar 36 Extra 6-12 l/ha) provide the necessary micronutrients, and apply to vegetation.

## **CONCLUSIONS**

On the fruit-tree plantation, the edaphic volume useful in an apple-tree is represented by 40 cm of soil, where heterogeneity is high, and soil reaction and nutrient bio-availability are variable.

Soil reaction is low in acids over the horizon 20-40 cm (pH = 6.39) and neuter over the horizon 0-20 cm (pH = 6.90), which leads to calcium phosphate development and to low soil phosphorus bio-availability. Average phosphorus content is 28.55 ppm P / 0-20 cm and 23.41 ppm P / 20-40 cm, respectively. Nitrogen and potassium are well represented quantitatively, while potassium is not threatened by temporal retention that diminished bio-availability.

Nutrient requirements in apple-trees are ensured through a system of fertilization correlated with the level of soil supply, with vegetation phases, and with specific consumption to ensure nutrient bio-availability.

## **ACKNOWLEDGEMENTS**

This work was partially supported by the grant POSDRU /21/1.5/G/38347.

## **REFERENCES**

- ATKINSON D., WHITE G. C. (1980) Some effects of orchard soil management on the mineral nutrition of apple trees, ISHS Acta Horticulturae 92, Symposium on mineral Nutrition and Fruit Quality of Temperate Zone Fruit Trees, ISSN 0567-7572.
- BÜNEMANN CHAIR G., K. J. TREHARNE, C. A. PRIESTLEY (1980), General Discussion of the Mineral Nutrition of Fruit Trees, ISHS Acta Horticulturae 92, Symposium on mineral

Nutrition and Fruit Quality of Temperate Zone Fruit Trees, ISSN 0567-7572.

DAVIDESCU D., Velicica Davidescu Agrochimie horticolă, (1992) p. 55-61, Ed. Academiei Române, București.

HAVLIN J. I., BEATON J. D., TISDALE S. L., NELSON L. W. (2005) Soil fertility and Fertilizers, p. 307-309, Seventh edition, Pearson Prentice Hall, SUA.

ROBINSON J. B. D. (1980), Soil and Tissue Analysis in predicting Nutrient Needs, ISHS Acta Horticulturae 92, Symposium on mineral Nutrition and Fruit Quality of Temperate Zone Fruit Trees, ISSN 0567-7572.

## NATURAL PRESERVATIVES OF PLANT ORIGIN – ANTIMICROBIAL ACTION AGAINST FOOD SPOILAGE MICROORGANISMS IN VITRO AND IN FOODSTUFFS

KRISCH<sup>1\*</sup> JUDIT, BADAMKHAND DEMBEREL<sup>2</sup>, TSERENDULAM DUGARSUREN<sup>3</sup>,  
RENTSENKHAND TSERENNADMID<sup>3</sup>, VÁGVÖLGYI<sup>4</sup> CSABA

<sup>1</sup> Institute of Food Engineering, University of Szeged, Szeged, Hungary

<sup>2</sup> Institute of Chemistry and Chemical Technology, Mongolian Academy of Sciences, Ulaanbaatar, Mongolia

<sup>3</sup> Institute of Biology, Mongolian Academy of Sciences, Ulaanbaatar, Mongolia

<sup>4</sup> Department of Microbiology, University of Szeged, Szeged, Hungary  
krisch@mk.u-szeged.hu

### ABSTRACT - Natural preservatives of plant origin – antimicrobial action against food spoilage microorganisms in vitro and in foodstuffs

The in vitro antibacterial and antifungal effect of plant-derived compounds; berry juices, berry extracts and essential oils (EOs); were investigated on selected food-spoilage microorganisms. All compounds showed antimicrobial properties to various extents. In contrast to the insensitivity of yeast against berry juices and extracts, the Gram positive bacteria *B. cereus* and *B. subtilis* proved to be more sensitive to these agents than to EOs. The EO from tarragon showed the best antibacterial and antifungal effect, inhibiting the growth each investigated species. The combination of wild thyme and tarragon EO led to antagonism in the case of *S. cerevisiae* and *B. subtilis* whereas the combination of black currant and yarrow EO resulted in additive effect. All other combinations of the investigated EOs or the EO – bog bilberry combinations showed indifference. The EO of Chinese red pine had no effect on the growth of *S. cerevisiae* in apple juice while the EO of *Ribes nigrum* led to a two-stage growth of the yeast. The investigated plant compounds are potential natural food preservatives.

**Keywords:** berry juices, berry extracts, essential oils, food spoilage

## INTRODUCTION

The growing concern of consumers about artificial compounds in their food has led to a renaissance of application of natural substances as colors, antioxidants and preservatives in foodstuffs. Plants have a natural defense mechanism against microbial infections. Antimicrobial peptides, lectins, phenolic compounds, terpenoids, essential oils and various other compounds are involved in this phenomenon (COWAN 1999). Phenolic compounds present in plants (phenolic acids, flavonoids, stilbenes, lignans and complex phenolic polymers) have antioxidant and antimicrobial activity (KAHKÖNEN et al, 1999). Essential oils (EOs) are hydrophobic liquids extracted mainly by steam distillation from herbs, spices and various other plants. They can contain more than 60 ingredients with 1-3 main compounds (80-95 % of the whole EO). Most EOs has antibacterial, antifungal, antiviral properties and can be successfully used to inhibit or stop microbial growth (BURT 2004). The main target of antibacterial action both for plant phenolics and for EOs is usually the cell membrane where destabilization and/or permeabilisation can occur (COX et al. 2000; BENNIS et al. 2004; PUUPPONEN-PIMIA et al, 2004). Phenolics and EOs can also inhibit extracellular enzymes. Their possible use as food preservatives has been studied from the

eighties and is under intensive research also today. In our experiments the in vitro antibacterial and antifungal effect of sea-buckthorn and bog bilberry extracts, and some selected EOs and their combinations, was investigated against food spoilage bacteria, yeast and molds. The preservative effect of EOs in apple juice was also determined.

## MATERIALS AND METHODS

### Plant extracts and essential oils

Essential oils and berry extracts used in our experiments and their main constituents are summarized in *Table 1*.

**Table 1. Essential oils and berry extracts and their main constituents**

Species	Type of extract	Main constituents (%)
<i>Achillea asiatica</i> yarrow	EO	$\beta$ -pinene (28.8) 1.8-cineole (11.7) myrcene (7.2) $\alpha$ -thujone (6.4),
<i>Artemisia dracunculus</i> tarragon	EO	sabinene (18.6) terpinen-4-ol (14.2) camphene (7.5) p-cymene (7.3)
<i>Hippophae rhamnoides</i> sea-buckthorn	Juice and water extract	carotenoids (16-28 mg%) flavonoids 120-1000 mg%) Vitamin-C (360 mg%)
<i>Juniperus sabina</i> savin juniper	EO	sabinene (39.0) trans-sabinenehydrate (17.5) cedrol (15.8) myrcene (4.2)
<i>Pinus sinensis</i> chinese red pine	EO	$\alpha$ -pinene (17-39) carene (27) terpinolene (18)
<i>Ribes nigrum</i> black currant	EO	Carene (18.67) B-caryophyllene (17.7) Sabinene (11.6) Cis- $\beta$ -ocimene (10.6)
<i>Thymus serpyllum</i> wild thyme	EO	terpinen-4-ol (29) carvacrol (14.94) $\alpha$ -pinene (12.2) thymol (7.39)
<i>Vaccinium uliginosum</i> bog bilberry	Juice and water extract	anthocyanidins (360-500 mg%) flavonols (18 mg%)

### Microorganisms:

Bacteria: The Gram positive *Bacillus cereus* SZMC 0042 and *Bacillus subtilis* SZMC 0209, and the Gram negative *E. coli* SZMC 0582 were grown on T1 medium (10g glucose, 4g beef extract, 4g peptone, 1g yeast extract, 1L H<sub>2</sub>O) at 37 or 30°C.

Yeasts: *Saccharomyces cerevisiae* MB 021, *Pichia anomala* MB 102 were grown on malt extract medium (ME; 0.4% malt extract, 1% glucose, 0.1% yeast extract) at 30°C.

Molds: *Fusarium sporotrichioides* FEIC 06 was grown also on ME medium at 28°C.

**SZMC**: Szeged Microbial Collection, University of Szeged, Department of Microbiology, Szeged, Hungary; **MB**: Microbial Collection, Mongolia Academy of Science, Institute of Biology, Ulaanbaatar, Mongolia; **FEIC**: Food Engineering Institute Collection, University of Szeged, Institute of Food Engineering, Szeged, Hungary.

#### Berries and extraction methods:

Fresh fruits were harvested in Mongolia. Fruit juices were freshly pressed and stored at -20°C. The remaining pomace was dried at 60°C in an oven for 12 h and then ground to powder. One gram of each powdered pomace was extracted 3 times with 10 ml of distilled water per cycle. The extracts were combined and evaporated to dryness at 100°C in an oven. The dry material was redissolved in 4 ml distilled water and frozen in 1 ml aliquots. Juices and extracts were diluted in the appropriate media for the tests.

#### Well test bioassay:

Agar plates were inoculated with suspensions from each bacterium, yeasts and *Fusarium* spores ( $> 10^6$  cells/ml). After drying, 8-mm-diameter wells were cut in the agar with a sterile cork borer. Each well was filled with 100  $\mu$ l of plant extract or EO dissolved in 50 % DMSO. DMSO (50 % v/v) and distilled water was used as controls. After incubation at the appropriate temperature for 24 and 48 h, the size of the inhibition zones formed around each well was measured. Tests were made in triplicate.

#### Checkerboard method

The checkerboard method was performed by macro dilution assay. The twofold dilutions of EOs (or the bog bilberry extract) in the growth medium (from 0.0625  $\mu$ l/ml to 1  $\mu$ l/ml) were combined with each other in all possible combinations. Erlenmeyer flasks containing the combinations were inoculated with 1 ml of  $10^5$  CFU/ml suspensions of the microorganisms, and were incubated for 24 h. The FIC indices were calculated as the sum of  $FIC_A$  and  $FIC_B$  for EO “A” and EO “B”. The FIC for an individual EO was calculated by dividing the MIC for the EO in combination by the MIC of the EO alone. Results were interpreted as synergy ( $FIC < 0.5$ ), addition ( $0.5 \leq FIC \leq 1$ ), indifference ( $1 < FIC \leq 4$ ) or antagonism ( $FIC > 4$ ) (Gutierrez et al., 2008). Experiments were repeated three times.

#### Effect of pine and black currant EO on the growth parameters of yeasts in apple juice

Pasteurized clear apple juice was inoculated with 1 ml of  $10^5$  CFU/ml yeast suspension, and the EO was then added to give a final concentration of 0.25  $\mu$ l/ml. Every 2 h, samples were taken and the CFU was determined by plate count. Lag phases and growth rates were calculated by determining the slopes and intercepts in the logarithmic phase of time versus log CFU growth curves.

## RESULTS AND DISCUSSION

### Antimicrobial effect of berry juices and extracts

In the agar diffusion tests yeasts showed no sensitivity to juices or water extracts. Based on the diameter of inhibition zones, the Gram positive *B. cereus* proved to be more sensitive than *B. subtilis*. The 1/8 dilution was the lowest value with detectable inhibition. Sea-buckthorn showed slightly better antibacterial properties than bog bilberry resulting in broader inhibition zones (Table 2.).

### Antimicrobial effect of essential oils

Best results were achieved with savin juniper and tarragon EO, all of the investigated microorganisms showed sensitivity to them. Wild thyme containing phenolic compounds in medium concentration had only slight inhibitory effect on *B. cereus* and *S. cerevisiae* and no effect on the other microorganisms (Table 3.), although thyme species with carvacrol and thymol as main constituents are among the best growth inhibitors (DORMAN AND DEANS, 2000).

**Table 2. Antibacterial activities of sea-buckthorn and bog bilberry juices and water extracts Inhibition halos ± SD are given in mm.**

		<i>Bacillus cereus</i>				
		1	1/2	1/4	1/8	1/16
<i>Hypophae rhamnoides</i>	Juice	11.0 ± 0.0	8.0 ± 0.0	5.7 ± 0.4	4.0 ± 0.0	-
	Water extract	10.0 ± 0.0	7.3 ± 0.89	3.7 ± 0.4	2.83 ± 0.2	-
<i>Vaccinium uliginosum</i>	Juice	8.83 ± 0.2	6.0 ± 0.0	3.67 ± 0.4	-	-
	Water extract	8.0 ± 0.0	6.0 ± 0.0	3.67 ± 0.4	0.17 ± 0.2	-
		<i>Bacillus subtilis</i>				
<i>Hypophae rhamnoides</i>	Juice	5.0 ± 0.0	3.7 ± 0.4	2.0 ± 0.0	0.17 ± 0.2	-
	Water extract	4.0 ± 0.0	2.0 ± 0.0	0.5 ± 0.0	-	-
<i>Vaccinium uliginosum</i>	Juice	4.0 ± 0.0	3.0 ± 0.0	1.0 ± 0.0	-	-
	Water extract	3.3 ± 0.4	2.0 ± 0.0	1.0 ± 0.0	-	-

**Table 3. Antimicrobial activity of essential oils. Inhibition halos ± SD are given in mm.**

Species/EO	<i>Thymus serpyllum</i>		<i>Juniperus sabina</i>		<i>Artemisia dracunculus</i>		<i>Achillea asiatica</i>	
	24h	48h	24h	48h	24h	48h	24h	48h
<i>B. subtilis</i>	-	-	1.5±0.0	1.0±0.0	5.0±0.0	5.0±0.0	-	-
<i>B. cereus</i>	0.5±0.0	0.5±0.0	2.0±0.0	2.0±0.0	6.0±0.0	3.3±0.4	1.5±0.3	1.0±0.0
<i>E. coli</i>	-	-	1.0±0.0	-	2.7±0.4	2.0±0.0	-	-
<i>S. cerevisiae</i>	0.5±0.0	0.5±0.0	3.0±0.0	3.0±0.0	7.2±0.2	7.0±0.0	-	-
<i>P. anomala</i>	-	-	2.0±0.0	1.0±0.0	7.0±0.0	3.3±0.4	7.0±0.0	-
<i>F. sporotrichioides</i>	-	-	-	2.0±0.0	-	5.0±0.0	-	6.0±0.0

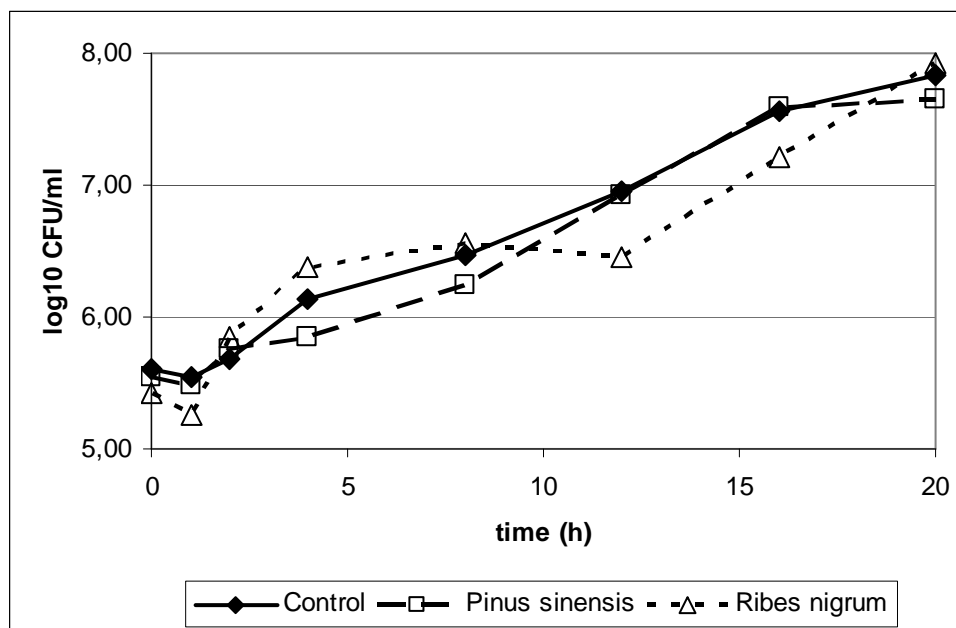
### Effect of essential oil combinations

The combination of wild thyme and tarragon EO led to antagonism in the case of *S. cerevisiae* and *B. subtilis* whereas the combination of black currant and yarrow EO resulted in additive effect. All other combinations of the investigated EOs or the EO – bog bilberry combinations showed indifference (data not shown).

### Growth reduction of *S. cerevisiae* in apple juice

The growth curve of *S. cerevisiae* treated with 0.25 µl/ml Chinese red pine oil showed a similar shape to the untreated control. The growth rates were 0.119/h and 0.147/h, respectively. There was no difference in the length of the lag phase. *S. cerevisiae* treated with black currant oil showed a two-stage growth curve (Fig. 1.). There was a quick

growth in the first log phase with a growth rate of 0.36/h followed by a stationary phase of 8 hours. After this, a new, slower growth occurred with a growth rate of 0.18/h. The maximum viable cell number after 20 hours incubation was almost the same in all cases. It seems that the used concentration was too low to exert real inhibition effect against the proliferation of the yeast in apple juice. In a previous experiment, the lag phase of *S. cerevisiae* in clear apple juice increased more than fivefold in the presence of 0.25 µl/ml lemon EO (TSERENNADMID, 2011).



**Figure 1. Effect of Chinese red pine and black currant EO on the growth of *S. cerevisiae* in apple juice. The EOs were added in 0.25 µl/ml concentration.**

## CONCLUSION

All of the investigated plant-derived compounds showed antimicrobial activity against the food spoilage microorganisms. They are potential candidates for the protection of foodstuffs from microbial deterioration. Used in appropriate concentrations, they can extend the shelf life of various foods and beverages.

## REFERENCES

- BENNIS, S., CHAMI, S., CHAMI, N., BOUCHIKHI, T. AND RENNAL, A., 2004, Surface alteration of *Saccharomyces cerevisiae* induced by thymol and eugenol. Letters in Applied Microbiology 38, 454-458.
- BURT, S., 2004. Essential oils: antibacterial activity and potential applications in foods - a review. International Journal of Food Microbiology 94, 223-253.
- COWAN M. M. (1999). Plant products as antimicrobial agents. Clin. Microbiol. Rev., 12: 564-582.



- COX, S.D., MANN, C.M., MARKHAM, J.L., BELL, H.C., GUSTAFSON, J.E., WARMINGTON, J.R. AND WYLLIE, S.G., 2000. The mode of antimicrobial action of the essential oil of *Melaleuca alternifolia* (tea tree oil). *Journal of Applied Microbiology* 88, 170-175.
- DORMAN, H.J.D. AND DEANS, S.G., 2000. Antimicrobial agents from plants: antibacterial activity of plant volatile oils, *Journal of Applied Microbiology* 88, 308-316.
- GUTIERREZ, J., BARRY-RYAN, C. AND BOURKE, P., 2008. The antimicrobial efficacy of plant essential EO combinations and interactions with food ingredients. *Int. J. Food Microbiol.* 124, 91-97.
- KAHKÖNEN MP, HOPIA AI, VUORELA HJ, RAUHA J-P, PIHLAJA K, KUJALA TS, HEINONEN M (1999) Antioxidant activity of Plant extracts containing phenolic compounds. *J Agric Chem* 47:3954-3962.
- PUUPPONEN-PIMIA R, NOHYNEK L, ALAKOMI, HL, OKSMAN-CALDENTY KM (2004) Bioactive berry compounds - novel tools against human pathogens. *Appl Microbiol Biotechnol* 67:8-18.
- TSERENNADMID R., TAKÓ M, GALGÓCZY L, PAPP T, PESTI M, VÁGVÖLGYI CS, ALMÁSSY K, KRISCH J. (2011) Anti yeast activities of some essential oils in growth medium, fruit juices and milk. *Int. J. Food Microbiol.* 144. 480-486.

## EFFECTS OF SOME FEED ADDITIVES ON BIOPRODUCTIVE AND BIOCHEMICAL INDICES OF BLOOD SERUM IN BROILERS

LAVINA ȘTEF, CALIN JULEAN, DAN DRINCEANU, MARIA NICULA, DRAGOS FOTA, DUCU ȘTEF, IOAN PET

Banat's University of Agricultural Sciences and Veterinary Medicine, Faculty of Animal Science and Biotechnologies, Timisoara, Calea Aradului No. 119, 300645  
lavi\_stef@yahoo.com

### ABSTRACT - Effects of some feed additives on bioproductive and biochemical indices of blood serum in broilers

Previous researches proved the effects exerted by a mixture of mint (*Mentha Piperita*), savory (*Thymus vulgaris*) and sage (*Salvia officinalis*) essential oils on broiler health, due to their antibacterial, antifungal and antiviral action, and also the stimulation of the digestive secretions. To enhance the bioproductive effect of the essential oil mixture 0.05%, we associated to this an acidifying mixture consisted of calcium propionate and calcium formate 0.03% in the experimental variant (V2); in the third experimental variant, beside the same essential oil doses and acidifying substances, we added 0.45% of a probiotic *Bacillus subtilis* and *Bacillus licheniformis*-based preparation. Compared with the reference variant (V1), the association of essential oils with acidifying substances (V2) does not influence the feed ingestion, but we may obtain a significantly bigger body weight ( $p < 0.05$ ), with 8.86%, and the reduction of the specific intake with 6.60%. In the variant V3, where the essential oils were associated with acidifying substances and probiotics, the feed intake has not been obviously changed, but the body weight grew significantly bigger ( $p < 0.05$ ), with 9.97%, and the specific intake got reduced with 6.1% compared with V1. The cholesterol level was not influenced by phyto-additives and neither by the association with acidifying substances and probiotics. The triglycerides got significantly reduced ( $p < 0.05$ ), with 44.45%, successive to the addition of acidifying substances to essential oils, and with 41.53% in the case of addition of acidifying substances and probiotics to the essential oils, compared with the reference variant.

**Keywords:** broiler, phyto-additives, acidifying substances, probiotics

## INTRODUCTION

The researches carried out by ȘTEF LAVINA ET AL. 2007, 2008, 2009, with different phyto-additives, proved the effect of these on the maintenance of animal health status and implicitly on the improvement of animal productivity.

To ensure broiler health status in terms of antibacterial, antifungal and antiviral effect, and also from the viewpoint of digestive secretion stimulation (LEE ET AL. 2003) (MENCINICOPSCI ET AL. 2009), we studied a mixture of essential oils of mint (*Mentha Piperita*), savory (*Thymus vulgaris*) and sage (*Salvia officinalis*), administrated in dose of 0.05% of feed. The medicinal plant utilization and of essential oils in broiler chicken diet stimulates the caecal mucous, generating an hypertrophic process manifested by glandular apparatus development, through capillary net hypertrophy and leucocytic infiltrate stimulation, with role in local defending (ȘTEF LAVINIA ET AL. 2009).

Because the phyto-additives' direct effect on the productive indices is less obvious on the whole, during this research we studied the possibility to enhance this effect by associating it with acidifying substances and probiotics.

Of the acidifying substances, we selected the Calcium propionate and the Calcium formate, which, according to (LUCKSTADT ET AL. 2004) may significantly influence broiler body

weight at 1 week, and also the feed ingestion. Beside the antibacterial effect with the reduction of diarrhoea cases, acidifying substances also improve the digestive utilization of feed by increasing weight growths and reducing the specific intake in broilers (CORCIONIVOSCHNI AND DRINCEANU, 2009).

Probiotics, through *Bacillus subtilis* and *Bacillus licheniformis*, may exert productive effects in broilers on the improvement of growth performances (SANTOSO et al. 2001) and, from this point of view, it was useful to associate them with the phyto-additives studied.

### MATERIAL AND METHOD

The biological material used in this experiment was represented by 90 broiler chickens, belonging to the hybrid ROSS 308, fed with the combined feed (1 - 21 days CP 22.94%, ME 3198 kcal, 22 - 42 days CP 19.97%, ME 3176 kcal) and distributed according to the general organization scheme of the experiment (*table 1*) in three variants, as follows:

- V<sub>1</sub> fed combined feed (CF) including essential oils in dose of 0.05%;
- V<sub>2</sub> fed on CF with incorporation of essential oil mixture 0.05% and acidifying mixture 0.30%;
- V<sub>3</sub> fed CF with incorporation of essential oils and acidifying substances in the same proportion and addition of probiotic preparation 0.45%.

To reveal the productive effect of these feed preparations, we determined the following indices: feed ingestion, body growth and the feed conversion index, at the ages of 3 and 6 weeks old.

At the end of the experimental period, we determined the following biochemical indices of the blood serum: triglycerides and cholesterol. The determinations were performed with the analyzer Fully Vet.

**Table 1. General organization scheme of the experiment**

Specification	Experimental variant		
	V1	V2	V3
n	30	30	30
Experimental period	42 days	42 days	42 days
Basic feed	CF	CF	CF
Nutritional factors of variation: feed additives	<ul style="list-style-type: none"> <li>• <b>Essential oils 0.05%:</b></li> <li>-mint oil</li> <li>-savory oil</li> <li>-sage oil</li> </ul>	<ul style="list-style-type: none"> <li>• <b>Essential oils 0.05%:</b></li> <li>-mint oil</li> <li>-savory oil</li> <li>-sage oil</li> <li>• <b>Acidifying substances 0.03%</b></li> <li>-Ca propionate</li> <li>-Ca formate</li> </ul>	<ul style="list-style-type: none"> <li>• <b>Essential oils 0.05%:</b></li> <li>-mint oil</li> <li>-savory oil</li> <li>-sage oil</li> <li>• <b>Acidifying substances 0.03%</b></li> <li>-Ca propionate</li> <li>-Ca formate</li> <li>• <b>Probiotic: 0.45%</b></li> <li>- <i>Bacillus subtilis</i></li> <li>- <i>Bacillus licheniformis</i></li> </ul>
<b>Indices determined:</b> -bioproductive indices		<ul style="list-style-type: none"> <li>-feed ingestion</li> <li>-body weight</li> <li>-body growth</li> <li>-FCR</li> </ul>	
-sanguine biochemical indices		<ul style="list-style-type: none"> <li>-triglycerides</li> <li>-cholesterol</li> </ul>	

## RESULTS

The first index studied was represented by feed intake evolution, presented in *table 2*. according to this table, we may observe that, during the period 0-3 weeks, in the variants with addition of acidifying substances (V<sub>2</sub>) and acidifying substances and probiotics (V<sub>3</sub>), there was the tendency of increasing the combined feed ingestion (with approximately 5%); this tendency was not available anymore during the growth period 4-6 weeks, so that the values become constant for the entire experimental period, when we may notice that, in V<sub>2</sub>, the CF intake was 1.79% bigger than in V<sub>1</sub>, and in V<sub>3</sub>, 3.46% bigger than in V<sub>1</sub>.

**Table 2. Feed intake evolution in chickens from the experimental variants**

Specification	Experimental variant		
	V1	V2	V3
	<b>Period 1 day -3 weeks</b>		
CF intake/period/chicken (kg/chicken)	1038.55	1097.80	1090.84
Mean daily intake (cmz)(g)	49.45	52.27	51.94
Percentage differences	<b>100</b>	<b>105.70</b>	<b>105.03</b>
	<b>Period 4-6 weeks</b>		
CF intake/period/chicken (kg/chicken)	3326.97	3345.80	3426.12
Mean daily intake (cmz)(g)	158.42	159.33	163.14
Percentage differences	<b>100</b>	<b>100.57</b>	<b>102.97</b>
	<b>Period 1 day -6 weeks</b>		
<i>CF intake/period/chicken (kg/chicken)</i>	<i><b>4365.52</b></i>	<i><b>4443.60</b></i>	<i><b>4516.96</b></i>
<i>Mean daily intake (cmz)(g)</i>	<i><b>103.94</b></i>	<i><b>105.8</b></i>	<i><b>107.54</b></i>
<i>Percentage differences</i>	<i><b>100</b></i>	<i><b>101.79</b></i>	<i><b>103.46</b></i>

*Table 3.* presents the data representing body weight evolution during the two growth periods (0-3 weeks; 4-6 weeks), respectively during the entire experimental period (0-6 weeks).

Until the age of 3 weeks, the association of acidifying substances to essential oils determine in chickens from V<sub>2</sub> a body weight increase with 6.92% bigger than in V<sub>1</sub>, with a significant difference (p<0.05) between the two indices.

Successive to the addition of probiotics to the essential oils and acidifying substances in the feed administrated, in V<sub>3</sub>, the weight of 807.2±15.8g places the group at a significant difference (p<0.05) compared with V<sub>1</sub> and insignificant (p>0.05) compared with V<sub>2</sub>.

The better start of the chickens in V<sub>2</sub> and V<sub>3</sub>, compared with V<sub>1</sub>, as regards the chicken weight during the period 0-3 weeks, is maintained at comparable percentage differences at the end of the experimental period, becoming 8.86% compared with 6.92% in V<sub>2</sub>/ V<sub>1</sub> and 9.97 % compared with 8.27 % in V<sub>3</sub>/V<sub>1</sub>.

**Table 3. Body weight evolution in chickens from the experimental variants**

Specification	Experimental variant		
	V1 (n=30)	V2 (n=30)	V3 (n=30)
Weight at eclosion (g)	39	40	39
	<b>Period 1 day -3 weeks</b>		
Body weight at 3 weeks ( $\bar{x} \pm Sx$ )	745.5 <sup>a</sup> ±16.4	797.1 <sup>b</sup> ±16.9	807.2 <sup>b</sup> ±15.8
Percentage differences	<b>100</b>	<b>106.92</b>	<b>108.27</b>
CV	9.09	8.72	8.29
Total growth/period	706.5	757.1	768.2
smz	33.64	36.05	36.58
	<b>Period 4-6 weeks</b>		
Body weight at 6 weeks ( $\bar{x} \pm Sx$ )	2255.0 <sup>a</sup> ±58.1	2455.0 <sup>b</sup> ±67.1	2480.6 <sup>b</sup> ±60.0
Percentage differences	<b>100</b>	<b>108.86</b>	<b>109.97</b>
CV	10.30	10.93	9.98
Total growth/period	1509.5	1697.9	1712.4
smz	71.88	80.85	81.54
	<b>Period 1 day - 6 weeks</b>		
<b>Body weight at 6 weeks (<math>\bar{x} \pm Sx</math>)</b>	<b>2255.0<sup>a</sup>±58.1</b>	<b>2455.0<sup>b</sup>±67.1</b>	<b>2480.6<sup>b</sup>±60.0</b>
<b>Total growth/period</b>	<b>2216.0</b>	<b>2415.0</b>	<b>2441.6</b>
<b>smz</b>	<b>52.76</b>	<b>57.5</b>	<b>58.14</b>

\*there are not any significant differences between the means with the same index ( $p>0.05$ )

<sup>a,b</sup> - $p<0.05$

The data regarding feed conversion ratio (FCR), expressed as kg CF/kg growth, are presented in *table 4*. The values of this index are differentiated compared with the control variant (V<sub>1</sub>) especially during the second growth period (4-6 weeks), when the specific intake in V<sub>2</sub> is 10.46% more reduced compared with V<sub>1</sub>, and in V<sub>3</sub> it is smaller with 9.10% compared with V<sub>1</sub>.

During the entire experimental period, the specific intake in the reference group (V<sub>1</sub>) was 1.97; in V<sub>2</sub>, fed feed including essential oils with addition of acidifying substances, the index got reduced with 6.60%; in V<sub>3</sub>, whose CF contained essential oils, acidifying substances and probiotics, the index got reduced with 6.10% compared with V<sub>1</sub>.

Of the sanguine biochemical indices, in this experiment we dosed the cholesterol and triglycerides from the serum taken from 6 chickens from each experimental variant.

Regarding the cholesterol, according to the data presented in *table 5.*, we may conclude that neither the phyto-additives, nor in association with acidifying substances or probiotics influence significantly this index's value.

According to the literature (PÂRVU ET AL. 2003), the serum cholesterol level in 7-week old chickens is 105±15; the content means obtained in V<sub>1</sub> and V<sub>3</sub> belong to this interval and the higher level in V<sub>2</sub> is not influenced by the feed ingredients, but especially by individual poultry characteristics.

**Table 4. Specific intake evolution in chickens from the experimental variants**

Specification	Experimental variant		
	V1	V2	V3
	<b>Period 1 day -3 weeks</b>		
CF intake/period/chicken (kg/chicken)	1038.55	1097.80	1090.84
Growth/period/chicken (g)	706.5	757.1	768.2
FCR (kg feed/kg growth)	1.47	1.45	1.42
Percentage differences	<b>100</b>	<b>98.63</b>	<b>96.60</b>
	<b>Period 4-6 weeks</b>		
CF intake/period/chicken (kg/chicken)	3326.97	3345.80	3426.12
Growth/period/chicken (g)	1509.5	1697.9	1712.4
FCR (kg feed/kg growth)	2.20	1.97	2.00
Percentage differences	<b>100</b>	<b>89.54</b>	<b>90.90</b>
	<b>Period 1 day -6 weeks</b>		
<i>CF intake/period/chicken (kg/chicken)</i>	<i>4365.52</i>	<i>4443.60</i>	<i>4516.96</i>
<i>Growth/period/chicken (g)</i>	<i>2216.0</i>	<i>2415.0</i>	<i>2441.6</i>
<i>FCR (kg feed/kg growth)</i>	<i>1.97</i>	<i>1.84</i>	<i>1.85</i>
<i>Percentage differences</i>	<i>100</i>	<i>93.40</i>	<i>93.90</i>

**Table 5. Biochemical indices of blood serum in broilers (mg/100 ml)**

Specification	Reference values	Experimental variant		
		V1	V2	V3
Cholesterol	105±15	104.50 <sup>a</sup> ±1.57	117.50 <sup>a</sup> ±9.17	104.00 <sup>a</sup> ±4.02
Percentage differences		<b>100</b>	<b>112.4</b>	<b>99.52</b>
Triglycerides	60±20	85.50 <sup>a</sup> ±2.91	47.50 <sup>b</sup> ±5.14	50.00 <sup>b</sup> ±8.05
Percentage differences		<b>100</b>	<b>55.55</b>	<b>58.47</b>

\*there are not any significant differences between the means with the same index (p>0.05)

<sup>a,b</sup> -p<0.05

In the case of triglycerides, in the reference variant, their value of 85.50±2.91 overtakes a little the maximal value presented in the literature, respectively 60±20 (PÁRVU ET AL. 2003); on the contrary, by adding acidifying substances in V<sub>2</sub>, triglycerides' concentration significantly decreases (p<0.05) with 44.45%. In the case of the addition of acidifying substances and probiotics, the concentration gets reduced with 41.53% (p<0.05).

## CONCLUSIONS

The association to the mixture of phyto-additives (essential oils) of acidifying substances and probiotics influences the bioproductive indices and the biochemical indices of blood serum in broilers as follows:

\* Compared with the reference value (V1), the association between essential oils and acidifying substances (V2) does not influence feed ingestion, but we may obtain a

significantly bigger body weight ( $p < 0.05$ ), with 8.86%, with the specific intake reduction of 6.60%;

\*In variant V3, where the essential oils were associated with acidifying substances and probiotics, the feed intake did not obviously change, but the body weight was significantly higher ( $p < 0.05$ ), with 9.97%, with the specific intake reduction of 6.1% compared with V1;

\* The cholesterol was not influenced by phyto-additives by themselves and neither in association with acidifying substances and probiotics;

\* The triglycerides got significantly reduced ( $p < 0.05$ ), with 44.45%, successive to the addition of acidifying substances to the essential oils, and with 41.53% successive to the addition of acidifying substances and probiotics to the essential oils, compared with the reference value.

## REFERENCES

- CHEN K.L., KHO W.L., YOU S. H., YEH R.-H., TANG S.- W. AND HSIEH C.W. (2009): Effects of *Bacillus subtilis* var. natto and *Saccharomyces cerevisiae* mixed fermented feed on the enhanced growth performance of broilers *Poult Sci.* 88:309-315
- CORCIONIVOSCHI N., DRINCEANU D. (2009): Probioticele la timpul prezent. Editura Mirton, Timisoara
- LEE K.W., EVERTS H., KAPPERT H.J., FREHNER M., LOSA R., BEYNEN A.C. (2003): Effects of dietary essential oil components on growth performance, digestive enzymes and lipid metabolism in female broiler chickens. *Br Poult Sci.* Jul;44 (3):450-7
- LÜCKSTÄDT, C., SENKÖYLÜ, N., AKYÜREK, H. AND AGMA, A. (2004): Acidifier – a modern alternative for anti-biotic free feeding in livestock production, with special focus on broiler production. *Veterinarija ir Zootechnika* 27: 91–93
- MENCINICOPSCHI GEORGHE, BOJOR OVIDIU, IONESCU-CALINESTI LARISA (2009): Compendiu de terapie naturala, Editura: Medicala Bucuresti
- PARVU GHE., COSTEA MIHAELA, PIRVU MARIUS, NICOLAE BOGDAN (2003): *Tratat de nutritia animalelor*, Editura Coral Sanivet, Bucuresti
- SANTOSO U., TANAKA K., OHANIAND S., AND SAKSIDA M. (2001): Effect of fermented product from *Bacillus subtilis* on feed efficiency, lipid accumulation and ammonia production in broiler chicks. *Asian-Australas. J. Anim. Sci.* 14:333–337
- ŞTEF LAVINIA, DUMITRESCU GABI, DRINCEANU D., ŞTEF D., MOTDANIELA, JULEAN C., TETILEANU RAMONA, CORCIONIVOSCHI N. (2009): The effect of medicinal plants and plant extracted oils on broiler duodenum morphology and immunological profile *Romanian Biotechnological Letters* Volume: 14 Issue: 4 Pages: 4606-4614
- ŞTEF LAVINIA, MARCU ADELA, DRINCEANU DAN, LUCA IOAN, ŞTEF DUCU, JULEAN CĂLIN, GHERASIM VOICHTA, PANDUR COSMIN (2008): Effect of phyto-additives on broiler meat quality *Savremena poljoprivreda*, vol. 57, iss. 1-2, pp. 111-116
- ŞTEF LAVINIA, MOŢ DANIELA, DRINCEANU DAN, LUCA IOAN, ŞTEF DUCU, JULEAN CĂLIN (2007): Immunomodulatory effect of a few phyto-additives used in feeding of meat production chickens, *Savremena poljoprivreda*, vol. 56, iss. 3-4, pp. 264-270,

## EXTRACELLULAR ENZYME SYSTEMS OF ANTAGONISTIC *BACILLUS* STRAINS ISOLATED FROM TOMATO RHIZOSPHERE.

L. MANCZINGER, M. VÖRÖS, E. SAJBEN, A. PALÁGYI, Cs. VÁGVÖLGYI

Department of Microbiology, Faculty of Science and Informatics, University of Szeged, Szeged, Közép fasor 52. Hungary, e-mail: manczing@bio.u-szeged.hu

### ABSTRACT - Extracellular enzyme systems of antagonistic *Bacillus* strains isolated from tomato rhizosphere.

Chitinolytic, proteolytic and lipolytic enzymes could be important in the biological control of soil borne plant-pathogenic microorganisms by antagonistic microbes and in this way besides antibiotic production, the secretion of certain extracellular enzymes also could have great importance in the effectiveness of biocontrol bacilli. Some of these enzymes could directly promote the inhibition processes, while others could help the competition of the bacilli against other rhizosphere microbes. In case of five *Bacillus* strains, which showed excellent antagonistic effects against phytopathogenic fungi and bacteria, the secretion of some components of the protease, chitinase, cellulase, lipase and  $\beta$ -1,3-glucanase enzyme systems were investigated under inductive and non-inductive circumstances. Enzyme activities were measured both with classical methods and with other experimental approaches based on chromogenic enzyme substrates. The best biocontrol strains constitutively secreted chymotrypsin-like proteases and/or trypsin-like proteases, and lipases. On the contrary, the chitinase components were only secreted in chitin containing media. Cellulases and  $\beta$ -1,3-glucanases were produced only at very low level either in inductive media.

**Keywords:** *Bacillus*, extracellular enzymes, antagonism

## INTRODUCTION

Antagonistic bacteria are able to reduce the population density or disease-causing activities of the pathogens through one or more of the following mechanisms: antibiosis, competition and hyperparasitism (PAULITZ and BELANGER, 2001; WHIPPS, 2001). Among them, hyperparasitism and in some cases antibiosis relies on lytic enzymes capable to degrade of cell walls and membranes of pathogenic fungi and bacteria. First of all, chitinolytic, proteolytic and lipolytic enzymes have been considered important in the biological control of soilborne plant-pathogenic microorganisms (BERKELEY et al., 1973; ORTIZ et al., 1973; PRIEST, 1977; PLEBAN et al., 1997).

Besides the antibiotic production, the secretion of certain extracellular enzymes also could have great importance in the effectiveness of biocontrol bacilli. Some of these enzymes, first of all  $\beta$ -1,3-glucanase, chitinases, lipases and proteases could directly promote the inhibition processes, while others, such as cellulases and xylanases could help the competition of the bacilli against other rhizosphere microbes.

## MATERIAL AND METHOD

The used non-inductive medium was YEG (glucose 0.2%, yeast extract 0.2%) the corresponding inducing media contained YEG supplemented with the inducer at 1 mg/ml concentration. The used inducers were: carboxymethylcellulose for cellulase, laminarin for  $\beta$ -1,3-glucanase, casein for proteases, colloid chitin for chitinases and trybutyrin for lipase.



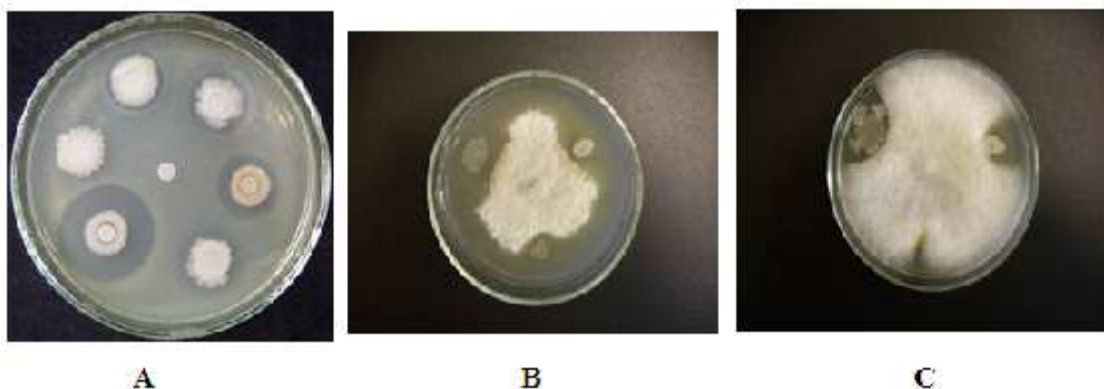
Enzyme activities were measured both with the classical dinitrosalicylic method of MILLER (1959) in the case of  $\beta$ -1,3-glucanase, endocellulase and xylanase, and with chromogenic enzyme substrates in the case of lipase, proteases and chitinases (KREDICS et al., 2001). The taxonomical positions of the isolates with best antagonism ability were determined by partial sequencing the 16S ribosomal RNA genes. For PCR reaction standard conditions were applied with the following primers: Eub-341f (5'-CCTACGGGAGGC AGCAG-3') and UP-765r (5'-CTGTTTGCTCCCCACGCTTC-3') (MUYZER et al., 1993).

## RESULTS

Numerous isolates (350 strains) deriving from tomato rhizosphere were investigated in the *in vitro* antagonism tests (Fig. 1). The species identity of the strains with highest antagonistic potential was determined by partially sequencing of their 16S ribosomal genes.

According this, the 5 best performing isolates were the following: B5= *Bacillus mojavensis*, B12= *B. subtilis*, B23= *B. subtilis*, B73= *B. amyloliquefaciens* and B83= *B. amyloliquefaciens*.

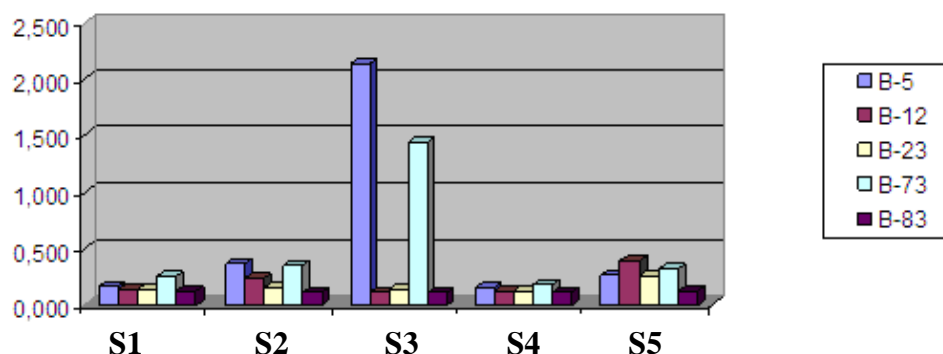
In the case of these *Bacillus* strains, which all displays excellent antagonistic effects against both phytopathogenic fungi and bacteria, the secretion of some components of the protease, chitinase, cellulase, lipase and  $\beta$ -1,3-glucanase enzyme systems were investigated under inductive and non-inductive circumstances.



**Figure 1:** *In vitro* antagonism of some *Bacillus* strains against *Clavibacter michiganensis* (A), *Botrytis cinerea* (B) and *Phytophthora infestans* (C).

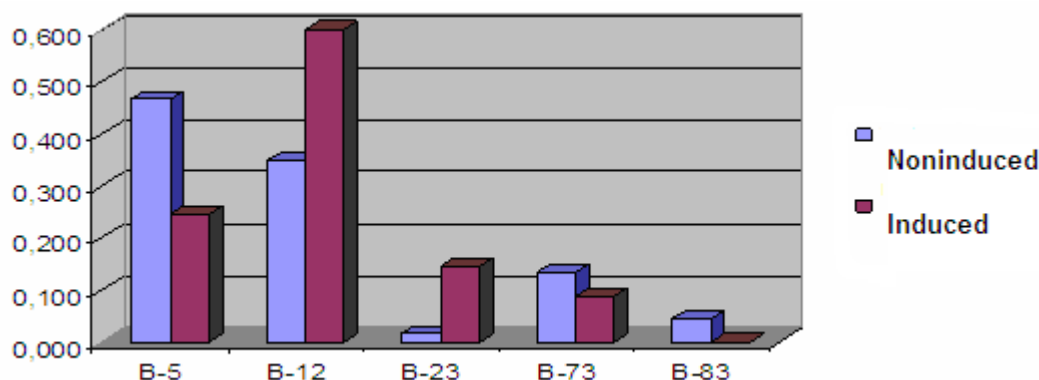
The best biocontrol strains constitutively secreted chymotrypsin-like proteases and/or trypsin-like proteases (Fig. 2.), and lipases (Fig. 3.). On the contrary, the chitinase components, NAG-ase (N-acetylglucosaminidase) and chitobiosidase were only secreted in chitin containing media on inductive manner (Fig. 4.). Cellulases, xylanases and  $\beta$ -1,3-glucanases were produced only at very low level either in inductive media (results are not shown).

**Relative enzyme activities**



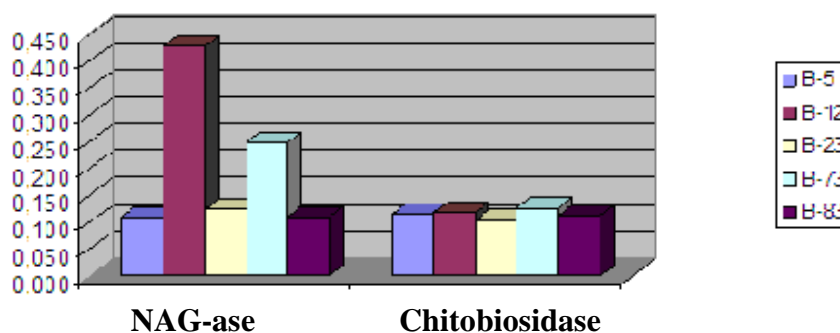
**Figure 2: Constitutive secretion of distinct proteases by five *Bacillus* strains as detected with five (S1-5) chromogenic protease substrates.**  
 S1: Bz-Arg-pNA, S2: Bz-Phe-Val-Arg-pNA, S3: Suc-Ala-Ala-Pro-Phe-pNA, S4: N-acetyl-L-Leu-pNA, S5: CBZ-Ala-Ala-Leu-pNA.

**Relative enzyme activities**



**Figure 3: Production of p-nitrophenyl-palmitate splitting enzymes in yeast extract glucose medium (YEG, non-induced) and YEG+ tributyrin medium (induced).**

**Relative enzyme activities**



**Figure 4: Secretion of chitinases in YEG + colloid chitin medium.**

**CONCLUSIONS**

Besides producing distinct antibiotics the secretion of cell wall and membrane degradation enzymes could also be very important factors of the biocontrol *Bacillus* strains as regards their effectiveness against distinct phytopathogenic fungi and bacteria. In some cases the proteases and lipases are secreted constitutively by the best biocontrol *Bacillus* strains.

### ACKNOWLEDGEMENTS

The project is co-financed by the European Union through the Hungary-Romania Cross-Border Co-operation Programme 2007-2013 (SOILMAP, HURO/0901/058/2.2.2).

### REFERENCES

- BERKELEY, R. C. W., S. J. BREWER, J. M. ORTIZ, J. B. GILLESPIE. (1973). An exo- $\beta$ -N-acetylglucosaminidase from *Bacillus subtilis* B; characterization. *Biochim. Biophys. Acta* **309**, 157-168.
- KREDICS, L., DÓCZI, I., ANTAL, ZS., MANCZINGER, L. (2001). Effect of heavy metals on growth and extracellular enzyme activities of mycoparasitic *Trichoderma* strains. *Bull. Environ. Contam. Toxicol.* **66**, 249-254.
- MILLER, G. L. (1959). Use of dinitrosalicylic acid reagent for determination of reducing sugar. *Anal. Chem.* **31**, 426-428.
- MUYZER G., DEWAAL E.C., UITTERLINDEN A.G. (1993) Profiling of complex microbial populations by denaturing gradient gel electrophoresis analysis of polymerase chain reaction amplified genes coding for 16S ribosomal RNA. *Appl. Environ. Microb.* **59**, 695-700.
- ORTIZ, J. M., R. C. W. BERKELEY, S. J. BREWER. (1973). Production of exo- $\beta$ -N-acetylglucosaminidase by *Bacillus subtilis* B. *J. Gen. Microbiol.* **77**, 331-337.
- PAULITZ, T. C., BELANGER, R. R. (2001). Biological control in greenhouse systems. *Annu. Rev. Phytopathol.* **39**, 103-133.
- PLEBAN S, CHERNIN L, CHET I. (1997). Chitinolytic activity of an endophytic strain of *Bacillus cereus*. *Letters in Applied Microbiology* **25**, 284-288.
- PRIEST, F. G. (1977). Extracellular enzyme synthesis in the genus *Bacillus*. *Bacteriol. Rev.* **41**, 711-753.
- WHIPPS, J. M. (2001). Microbial interactions and biocontrol in the rhizosphere. *Journal of Experimental Botany* **52**, 487-511.

## INFLUENCE OF CULTURE CONDITIONS ON THE ANTIBIOTIC PRODUCTION OF ANTAGONISTIC BACILLUS STRAINS ISOLATED FROM TOMATO RHIZOSPHERE

L. MANCZINGER, B. BÓKA, M. VÖRÖS, E. SAJBEN, A. BERKI, S. KOCSUBÉ, Cs.  
VÁGVÖLGYI

Department of Microbiology, Faculty of Science and Informatics, University of Szeged,  
Szeged, Közép fasor 52. Hungary  
mancing@bio.u-szeged.hu

### ABSTRACT - Influence of culture conditions on the antibiotic production of antagonistic *Bacillus* strains isolated from tomato rhizosphere.

Many phytopathogenic bacteria and fungi attack tomato plants both in seedling (e.g. *Rhizoctonia solani*, *Pythium debaryanum*) and in developed foliar state (e.g. *Phytophthora infestans*, *Botrytis cinerea*, *Alternaria solani*, *Xanthomonas vesicatoria*, *Pseudomonas syringae* pv. *tomato*, *Clavibacter michiganensis*). It would be desirable to find an efficient biocontrol approach for preventing the destructive effect of these pathogens. In the frame of this study, more than 250 bacteria with antagonistic properties were isolated and characterized. Results of the preliminary antagonism tests revealed that the strains belonging into the genus *Bacillus* were the most efficient agents against the tomato pathogenic bacteria and fungi.

The *Bacillus* strains with the best antagonistic traits were investigated in detail. The antibiotics present in the cell-free ferment broths were detected and analysed by thin layer chromatography. Specific PCR-based approach was developed and used for the detection of the distinct antibiotic-synthesis gene clusters (iturin, surfactin, fengycin, bacillomycin and mycosubtilin) in the genomes of the strains. Our investigation revealed that the best antagonistic strains produced high amount of surfactin and/or fengycin antibiotics. On the basis of these experiments two strains were selected for further investigations. The influence of the Cu<sup>2+</sup> and Fe<sup>2+</sup> ions and the quality of carbon and nitrogen sources were tested in liquid culture for the antibiotic production levels by the strains. Both copper and iron highly elevated the production rate at least of the tyrosine containing antibiotics. The applied carbon and nitrogen sources highly influenced both the quantity and quality of the antibiotic mixture secreted by the strain B23 of *Bacillus subtilis*.

**Keywords:** *Bacillus*, antibiotics, antagonism

## INTRODUCTION

Many phytopathogenic bacteria and fungi attack tomato plants both in seedling (e.g. *Rhizoctonia solani*, *Pythium debaryanum*) and in developed foliar state (e.g. *Phytophthora infestans*, *Botrytis cinerea*, *Alternaria solani*, *Xanthomonas vesicatoria*, *Pseudomonas syringae* pv. *tomato*, *Clavibacter michiganensis*). It would be desirable to find an efficient biocontrol approach for preventing the destructive effect of these pathogens. Of the biological control alternatives to chemical pesticides used for reducing plant diseases, the application of non-pathogenic soil bacteria at roots is promising. Treatments with these beneficial organisms were in many cases associated with reduced plant diseases in greenhouse and field experiments. These bacteria can antagonize first of all fungal pathogens by competing for niche and nutrients, by producing low-molecular-weight fungitoxic compounds and extracellular lytic enzymes, and indirectly, by stimulating the defensive capacities of the host plant. Powerful antifungal metabolites can be synthesized

by most of the *Bacillus* strains. It was suggested that antibiotic production by these strains plays a major role in plant disease suppression (LECRERE at al. 2005).

## MATERIAL AND METHOD

The antibiotics present in the cell-free ferment broths were detected and analyzed by thin layer chromatography (TLC). The amount of the secreted tyrosine containing antibiotics in these ferment broths after producing crude antibiotic preparates were evaluated with optical density measurement at 280 nm. For the molecular experiments DNA samples were isolated from the strains, and PCR-based approach was developed and used for the detection of the distinct antibiotic-synthesis gene clusters (iturin, surfactin, fengycin, bacillomycin and mycosubtilin) in the genomes of the strains. The PCR reactions were performed with specific primers (Table 1). The applied original medium for antibiotic production (BESSON et al., 1987): (constituents in g/l) glucose 10, glutamic acid 5, KH<sub>2</sub>PO<sub>4</sub> 1, K<sub>2</sub>HPO<sub>4</sub> 1, MgSO<sub>4</sub> x 7H<sub>2</sub>O 0,5, KCl 1, FeSO<sub>4</sub> x 7 H<sub>2</sub>O 0,005, CuSO<sub>4</sub> x 5H<sub>2</sub>O 0,00016.

**Table 1. Sequence of the primers which were used in the specific PCR reactions**

Target Gene	Primer Pairs	Sequence
iturin	ituD-F	5' -ATG AAC AAT CTT GCC TTT TTA- 3'
	ituD-R	5' -TTA TTT TAA AAT CCG CAA T- 3'
surfactin	sfp-F	5' -ATG AAG ATT TAC GGA ATT TA- 3'
	sfp-R	5' -TTA TAA AAG CTC TTC GTA CG- 3'
fengycin	fen-F	5' -GTA CAG CTC GCC GAA TTC TT- 3'
	fen-R	5' -GGC TAC AAT ATG CCG GCT GTG- 3'
mycosubtilin	mycA-F	5' -GAC TGG GAT TTA TCC CAT ATC- 3'
	mycA-R	5' -GAT TTT GGT TGA CTC TAG CGC 3'
bacillomycin	BACC-ML-F	5' -CAG AGA GTC TAT CAT TCC GGA T- 3'
	BACC1-R	5' -CGC TGA TGA CTG TTC ATG CT- 3'

## RESULTS

In the frame of this study, more than 250 bacteria with antagonistic properties were isolated and characterized by *in vitro* antagonism tests. Results of the antagonism tests revealed that the strains belonging into the genus *Bacillus* were the most efficient agents against the tomato pathogenic bacteria and fungi.

The *Bacillus* isolates with the best antagonistic traits were investigated in detail. Mostly the *Bacillus subtilis* strains produce a variety of antimicrobial cyclic lipopeptides, including iturin, fengycin and surfactin. The details of the above mentioned examinations were compared with the antagonistic properties of the strains on solid culture media. Our investigation revealed that the best antagonistic strains produced high amount of surfactin and/or fengycin antibiotics. On the basis of these experiments two strains were selected for further investigations. The influence of the Cu<sup>2+</sup> and Fe<sup>2+</sup> ions and the quality of carbon and nitrogen sources were tested in liquid culture for the antibiotic production levels by the strains. Both copper and iron highly elevated the production rate at least of the tyrosine containing antibiotics (Table 2. and Table 3). A very like behavior was experienced by

others as regards the producing of iturin and surfactin by *Bacillus* strains (MAKKAR and CAMEOTRA, 2002; LIN et al., 2007).

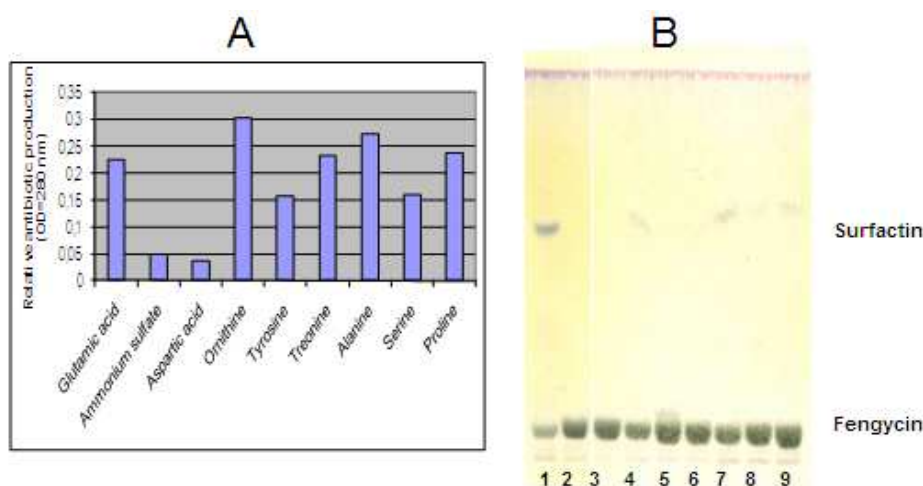
**Table 2. Influence of the Cu<sup>2+</sup> and Fe<sup>2+</sup> ions on the antibioticum production**

Modified Besson-media	CuSO <sub>4</sub> .5H <sub>2</sub> O content (mg/l)	Fe <sub>2</sub> (SO <sub>4</sub> ) <sub>3</sub> .6H <sub>2</sub> O content (mg/l)	B05 strain OD280	B23 strain OD280
Besson 1	0,16	5	0,070	0,066
Besson 2	0,16	-	0,100	0,101
Besson 3	0,08	5	0,125	0,131
Besson 4	0,32	5	0,108	0,096
Besson 5	0,64	5	0,138	0,093
Besson 6	1,28	5	0,255	0,096
Besson 7	-	5	0,068	0,047
Besson 8	0,16	2,5	0,047	0,058
Besson 9	0,16	10	0,264	0,118
Besson 10	0,16	20	0,640	0,408
Besson 11	0,16	40	0,917	0,509

**Table 3. Influence of the carbon and the nitrogen source on the antibioticum production**

Carbon Source	Nitrogen Source	B05 strain OD280	B23 strain OD280
-	Na-glutamate	0,097	0,087
glucose	Na-glutamate	0,162	0,048
fructose	Na-glutamate	0,153	0,288
sucrose	Na-glutamate	0,218	0,160
maltose	Na-glutamate	0,011	0,158
starch	Na-glutamate	0,272	0,293
-	Bacto peptone	0,096	0,123
glucose	Bacto peptone	0,297	0,111
fructose	Bacto peptone	0,234	0,180
sucrose	Bacto peptone	0,230	0,279
maltose	Bacto peptone	0,142	0,119
starch	Bacto peptone	0,200	0,116

The applied carbon and nitrogen sources highly influenced both the quantity and quality of the antibiotic mixture secreted by the strain B23 of *Bacillus subtilis* (Fig.1 and Fig. 2).



**Figure 1. Influence of ammonium sulphate and some amino acids on the amount (A) and composition (B) of the secreted antibiotic mixture of *B. subtilis* B23 strain. 1=glutamic acid, 2=ammonium sulphate, 3=aspartic acid, 4=ornithine, 5=tyrosine, 6=threonine, 7=alanine, 8=serine, 9=proline. The carbon source was glucose.**



**Figure 2. Influence of some carbon source on the antibiotic production of *B. subtilis* B23 analysed by TLC. G= glucose, F= fructose, S= saccharose. The nitrogen source was glutamic acid.**

## CONCLUSIONS

The Cu<sup>2+</sup> and Fe<sup>2+</sup> ions and the quality of carbon and nitrogen sources highly influenced the antibiotic production levels of the depsipeptide antibiotics of *Bacillus* strains. Both copper and iron highly elevated the production rate at least of the tyrosine containing antibiotics. The surfactin production rate was the high in the presence of glutamic acid as nitrogen source.

## ACKNOWLEDGEMENTS

The project is co-financed by the European Union through the Hungary-Romania Cross-Border Co-operation Programme 2007-2013 (SOILMAP, HURO/0901/058/2.2.2), and by the project named TÁMOP-4.2.1/B-09/1/KONV-2010-0005 – Creating the Center of Excellence at the University of Szeged, which is supported by the European Union and co-financed by the European Regional Fund.

## REFERENCES

- BESSON F., CHEVANET C., MICHEL G. (1987): “Influence of the culture medium on the production of iturin A by *Bacillus subtilis*.” *Journal of General Microbiology* **133**, 767-772.
- LECLERE V., BECHET M., ADAM A., GUEZ J. S., WATHELET B., ONGENA M., THONART P., GANCEL F., CHOLLET-IMBERT M., JACQUES P. (2005): “Mycosubtilin overproduction by *Bacillus subtilis* BBG100 enhances the organism’s antagonistic and biocontrol activities.” *Applied and Environmental Microbiology* **71**, 4577-4584.
- HUNG-YUH L., YERRA KOTESWARA R., WEN-SHI, W., YEW-MIN T. (2007): “Ferrous ion enhanced lipopeptide antibiotic iturin A production from *Bacillus amyloliquefaciens* B128”. *International Journal of Applied Science and Engineering* **5**, 123-132.
- MAKKAR R. S., CAMEOTRA S. S. (2002): “Effects of various nutritional supplements on biosurfactant production by a strain of *Bacillus subtilis* at 45 °C”. *Journal of Surfactants and Detergents* **5**, 11-17.



## TRICHODERMA COMMUNITIES OF THE WINTER WHEAT RHIZOSPHERE

KREDICS<sup>1</sup> LÁSZLÓ LÁDAY MIKLÓS<sup>2</sup>, KÖRMÖCZI<sup>1</sup> PÉTER, MANCZINGER<sup>1</sup> LÁSZLÓ,  
RÁKHELY<sup>3</sup> GÁBOR, VÁGVÖLGYI<sup>1</sup> CSABA AND SZEKERES<sup>4</sup> ANDRÁS

<sup>1</sup>Department of Microbiology, Faculty of Science and Informatics, University of Szeged,  
Szeged, Közép fasor 52., H-6726 Szeged, Hungary  
kredics@bio.u-szeged.hu

<sup>2</sup>Plant Protection Institute, Hungarian Academy of Sciences, Budapest, P.O. Box 102., H-  
1525 Budapest, Hungary

<sup>3</sup>Department of Biotechnology, Faculty of Science and Informatics, University of Szeged,  
Szeged, Közép fasor 52., H-6726 Szeged, Hungary

<sup>4</sup>FumoPrep Ltd., Vállalkozók útja 1/B., 6782 Mórahalom, Hungary

### ABSTRACT – *Trichoderma* communities of the winter wheat rhizosphere in the Pannonian Plain

A total of 116 *Trichoderma* strains were isolated from roots of winter wheat from test holes of five agricultural fields in the Pannonian Plain. The identity of the strains was examined based on the sequence analysis of the internal transcribed spacer (ITS) region by *TrichOKEY* 2.0. The examined wheat field rhizosphere samples could be characterized with a remarkable biodiversity. The 11 taxa detected in the samples were *T. harzianum*, *T. pleuroticola*, *T. tomentosum*/*T. cerinum*, *T. virens*, *T. rossicum*, *T. spirale*, *T. brevicompactum*, *T. atroviride*, *T. gamsii*, *T. koningiopsis*/*T. ovalisporum* and *T. longibrachiatum*/*H. orientalis*. The most frequently isolated species was *T. harzianum* with 41 isolates representing a series of known ITS genotypes as well as 2 genotypes that were firstly obtained during this study. Both *T. virens* (31 isolates) and *T. atroviride* (9 isolates) could be classified into 2 ITS-genotypes, one of them being identical with that of the ex-type strains in the cases of both species. Ten isolates proved to belong to 2 genotypes of *T. rossicum*, one of them has not been found so far. The remaining 7 species were isolated with a lower frequency. Several species could be characterized with well-defined isoenzyme patterns during cellulose-acetate electrophoresis.

**Keywords:** *Trichoderma*, biodiversity, winter wheat rhizosphere

## INTRODUCTION

There is a worldwide need to adopt the practice of sustainable agriculture, using strategies that are environment-friendly, less dependent on agricultural chemicals and less damaging to soil and water resources. One of the key elements of such sustainable agriculture is the application of biocontrol agents for plant protection. The efficient control of fungal plant pathogens causing substantial losses in agricultural production is an important issue for all plant cultivation systems. Species of the genus *Trichoderma* (Ascomycota, Hypocreales, Hypocreaceae) are predominant components of the soil mycota in various soils (KLEIN and EVELEIGH, 1998). The genus involves promising biocontrol candidates with excellent antagonistic abilities against a number of plant pathogenic fungi. Several modes of action have been proposed to play roles in biocontrol capabilities, including antibiosis by the production of antifungal metabolites, competition for space and nutrients, plant growth promotion, induction of the defense responses in plants and mycoparasitism (HARMAN, 2004). These processes are supposed to act synergistically (SCHIRMBÖCK et al., 1994).

A number of studies are available in the literature about the distribution of *Trichoderma* species in different soil and rhizosphere ecosystems. Data presented in the early studies

about the biodiversity of the genus (DANIELSON and DAVEY 1973, WIDDEN and ABITBOL, 1980, NELSON, 1982) are hard to interpret as the identification of the species was based on morphological characters and a series of *Trichoderma* species were not yet described those times. Recent studies examined the *Trichoderma* communities of different habitats by molecular methods, including ITS (internal transcribed spacer) sequence-based identification with the aid of *TrichOkey* (DRUZHININA et al., 2005) and BLAST similarity searches performed with *TrichoBLAST* (KOPCHINSKIY et al., 2005), both programmes available online at the homepage of the International Subcommittee on *Trichoderma* and *Hypocrea* Taxonomy ([www.isth.info](http://www.isth.info)). Natural ecosystems investigated in details by molecular methods for *Trichoderma* biodiversity include a mid-European, primeval floodplain-forest (WUCZKOWSKI et al., 2003), soils from Russia, Nepal, northern India (KULLNIG et al., 2000), south-east Asia (KUBICEK et al., 2003), Sardinia (MIGHELI et al., 2009) and South America (HOYOS-CARVAJAL et al., 2009). A series of new genotypes as well as new phylogenetic species of *Trichoderma* have been recognized during these studies.

Besides the natural ecosystems, the investigation of agricultural soils may also reveal interesting data about *Trichoderma* biodiversity (GHERBAWY et al., 2004, MULAW et al., 2010), especially from the point of view of biocontrol applications, as the rhizosphere of agricultural soils is an ideal source of potential biocontrol agents. The aim of this study was to assess the biodiversity of the genus *Trichoderma* in the rhizosphere of winter wheat fields in the Pannonian Plain.

## MATERIAL AND METHOD

Soil samples with winter wheat seedlings were collected from five agricultural fields (Algyó, Deszk, Rúzsa, Kunszentmiklós and Tiszasziget) in the Pannonian Plain by a 5 cm x 5 cm square sampler in random sampling order. The chopped roots of wheat were placed to plates with Rose Bengal medium (5 g l<sup>-1</sup> peptone, 1 g l<sup>-1</sup> KH<sub>2</sub>PO<sub>4</sub>, 10 g l<sup>-1</sup> glucose, 0.5 g l<sup>-1</sup> MgSO<sub>4</sub>X7H<sub>2</sub>O, 0.5 ml l<sup>-1</sup> 0.2% dichloran-ethanol solution, 0.25 ml l<sup>-1</sup> 5% Rose Bengal, 20 g l<sup>-1</sup> agar supplemented with 0.1 g l<sup>-1</sup> oxytetracyclin, 0.1 g l<sup>-1</sup> streptomycin and 0.1 g l<sup>-1</sup> chloramphenicol to inhibit bacteria). Growing *Trichoderma* strains were transferred to solid yeast extract medium (2 g l<sup>-1</sup> yeast extract, 5 g l<sup>-1</sup> KH<sub>2</sub>PO<sub>4</sub> and 20 g l<sup>-1</sup> agar in distilled water – YEGS) supplemented with the above mentioned antibiotics. Monospore cultures of the isolated strains were deposited in the Microbiological Collection of the University of Szeged (SZMC; Table 1).

For the isolation of genomic DNA, *Trichoderma* isolates were cultured in 200 ml liquid YEG medium in 250 ml Erlenmeyer flasks which were inoculated to an end concentration of 10<sup>5</sup> conidia ml<sup>-1</sup>. Cultures were shaken with 200 rpm for 4 days at 25°C. Mycelia of the isolates were subjected to DNA isolation, PCR amplification of the internal transcribed spacer (ITS1-5.8S rDNA-ITS2) region, and automatic DNA sequencing as described previously (ANDERSSON et al., 2009). Sequences were analysed by the program *TrichOKey* 2.0 (DRUZHININA et al., 2005) available online at the homepage of the International Subcommittee on *Trichoderma* and *Hypocrea* Taxonomy ([www.isth.info](http://www.isth.info)).

Protein extraction was performed as described by LÁDAY and SZÉCSI (2001). CAE was as described by Hebert & Beaton (1993), with a CAE system from Helena Laboratories (Beaumont, TX, USA). Titan III cellulose-acetate gels (Helena Laboratories) were soaked for 30 min in electrophoresis buffer (0.25 mM Tris-glycine, pH 8.5) and were then blotted dry between sheets of filter paper. The protein extracts were applied from the sample plate

to the gel with a Super Z-12 Applicator. When the staining activity was low, the extracts were blotted two or three times. Electrophoresis was carried out at 180 V for 20 min. The gels were stained for 5 enzyme systems and the enzyme activities were detected using agar overlays. Staining protocols were as described previously (HEBERT AND BEATON 1993). All samples were extracted and analysed on three occasions in separate runs.

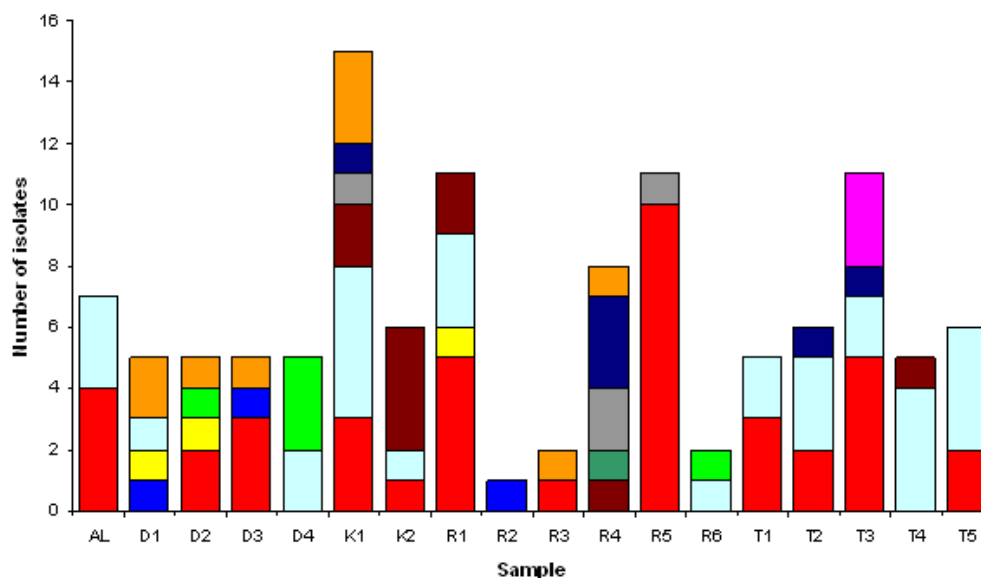
## RESULTS

A total of 116 *Trichoderma* strains were isolated from 18 sampling sites of 5 agricultural fields (Algyő, Deszk, Rúzsa, Kunszentmiklós and Tiszasziget) in the Pannonian Plain (Table 1). Isolations were performed directly from the roots of winter wheat. The number of isolated strains was the highest in the case of sample K1 (location: Kunszentmiklós, number of isolates: 15) and the lowest for sample R2 (location: Rúzsa, number of isolates: 1). The average number of isolates per sampling site was 6.4.

The 11 taxa detected in the samples were *T. harzianum*, *T. pleuroticola*, *T. tomentosum*/*T. cerinum*, *T. virens*, *T. rossicum*, *T. spirale*, *T. brevicompactum*, *T. atroviride*, *T. gamsii*, *T. koningiopsis*/*T. ovalisporum* and *T. longibrachiatum*/*H. orientalis*. The most frequently isolated species was *T. harzianum* with 41 isolates representing a series of known ITS genotypes as well as 2 genotypes that were firstly obtained during this study. Both *T. virens* (31 isolates) and *T. atroviride* (9 isolates) could be classified into 2 ITS-genotypes, one of them being identical with that of the ex-type strains in the cases of both species. Ten isolates proved to belong to 2 genotypes of *T. rossicum*, one of them has not been found so far. The remaining 7 species were isolated with a lower frequency.

Figure 1 shows the species diversity at the particular sampling sites. *H. lixii*/*T. harzianum* was the most abundant species (35.3%) and it was found in 12 of the 18 samples examined. It was the most frequent *Trichoderma* species found at three locations (Algyő, Deszk, Rúzsa) and in seven samples (A1, D2, D3, R1, R6, T1, T3). The next two most abundant species were *T. virens* and *T. rossicum* (26.7% and 8.6% of all isolates, present in 12 and 5 samples, respectively). *T. virens* was most abundant in the agricultural fields examined at Tiszasziget, where it accounted for 45.5% of the isolates. *T. rossicum* dominated sample K2 and could also be found in samples R1, R4, K1 and T4. *T. atroviride* occurred with a frequency of 7.8% of all isolates, this species could be found in 6 samples. *T. gamsii* could be found in 4 samples at 3 locations (5.17% of all isolates). The other taxa occurred with a frequency of less than 5%: *T. longibrachiatum*/*H. orientalis*, *T. brevicompactum*, *T. pleuroticola* and *T. tomentosum*/*cerinum* with 4.3%, 3.4%, 2.6% and 2.6%, respectively, each of them found in 2 geographic locations and 3 samples; while *T. koningiopsis*/*T. ovalisporum* (2.6%) and *T. spirale* (0.9%) occurred in single samples only (T3 and R1, respectively).

The highest biodiversity of *Trichoderma* species was detected in a sample from Kunszentmiklós (sample K1: *T. harzianum* and 5 further species among 15 isolates) and in a sample from Rúzsa (sample R4: 5 species among 8 isolates, no *T. harzianum*).



**Fig. 1. Biodiversity of the genus *Trichoderma* in the examined winter wheat rhizosphere samples. Different colors indicate different *Trichoderma* species: *T. harzianum* ■, *T. pleuroticola* ■, *T. tomentosum/T. cerinum* ■, *T. virens* ■, *T. rossicum* ■, *T. spirale* ■, *T. longibrachiatum/H. orientalis* ■, *T. brevicompactum* ■, *T. atroviride* ■, *T. gamsii* ■, *T. koningiopsis/T. ovalisporum* ■**

Source: own calculation

Sample R5 was characterized with a relatively poor biodiversity due to a large number of isolates from an individual species (*T. harzianum*). Only two species were detected in 8 out of 18 samples (A1, D4, R3, R5, R6, T1, T4, T5), in these samples either one of the two most abundant species (*T. harzianum* or *T. virens*), or both of them (A1, T1, T5) were present.

During the CAE-based isoenzyme analysis performed for the full set of isolates, banding patterns of five enzymes, 6-phosphogluconate-dehydrogenase (6PGDH), glucose-6-phosphate dehydrogenase (G6PDH), glucose-6-phosphate isomerase (G6PI), peptidase B (Leu-Gly-Gly) (PEPB) and phosphoglucomutase (PGM) were selected for analysis based on the results of a previous study (SZEKERES et al., 2006). A total of 38 electromorphs were registered in the population (Table 1). Several species could be characterized with well-defined isoenzyme patterns during cellulose-acetate electrophoresis.

**Table 1: Number of electrophoretic patterns for the examined enzymes**

Enzyme	Abbreviation	Activity	Number of electrophoretic patterns
6-phosphogluconate-dehydrogenase	6PGDH	+	7
glucose-6-phosphate dehydrogenase	G6PDH	+	6
glucose-6-phosphate isomerase	GPI	+	8
peptidase B (Leu-Gly-Gly)	PEPB	+	6
phosphoglucomutase	PGM	+	11

Source: own calculation

## DISCUSSION

The community of *Trichoderma* in the rhizosphere of winter wheat in the Pannonian Plain proved to be highly diverse. Beneficial taxa widely used as biocontrol agents against plant pathogenic fungi (e.g. *T. harzianum*, *T. virens*, *T. atroviride*) could be isolated from the samples examined during this study, indicating that the winter wheat rhizosphere may be a rich source of potential biocontrol isolates. The most frequent species isolated was *T. harzianum* followed by *T. virens*, which is in congruence with previous data (KULLNIG et al. 2000, MIGHELI et al. 2009, WUCZKOWSKI et al. 2003). *T. gamsii* and *T. rossicum* were also found in the winter wheat rhizosphere samples. Both of these species were previously shown to have a widespread distribution, occurring also in Central Europe (HOYOS-CARVAJAL et al. 2009, MIGHELI et al. 2009, WUCZKOWSKI et al. 2003). Only a single isolate of *T. spirale* was found in this study. This species was shown to be the dominant *Trichoderma* in the carbon-rich forest soil of Badde Salighesones in Sardinia (MIGHELI et al. 2009). *T. hamatum*, a species which was found to be subdominant in several Sardinian soils (MIGHELI et al. 2009) and *T. asperellum*, a predominant species of neotropic regions (HOYOS-CARVAJAL et al. 2009) could not be isolated during this study. On the other hand, *Trichoderma* species known as potential opportunistic pathogens in humans (*T. longibrachiatum/H. orientalis*) (DRUZHININA et al. 2008) and as causal agents of the green mould disease in mushroom cultivation (*T. pleuroticola*) (KOMON-ZELAZOWSKA et al. 2007) could be detected in the examined samples. The development of biocontrol products from isolates of these potentially harmful species should be avoided.

## ACKNOWLEDGEMENTS

The Project named „TÁMOP-4.2.1/B-09/1/KONV-2010-0005 – Creating the Center of Excellence at the University of Szeged” is supported by the European Union and co-financed by the European Regional Fund. The SOILMAP project is co-financed by the European Union through the Hungary-Romania Cross-Border Co-operation Programme 2007-2013 (HURO/0901/058/2.2.2).

## REFERENCES

- ANDERSSON M.A., MIKKOLA R., RAULIO M., KREDICS L., MAIJALA P., SALKINOJA-SALONEN M.S. (2009): Acrebol, a novel toxic peptaibol produced by an *Acremonium exuviarum* indoor isolate. *Journal of Applied Microbiology* 106: 909-923.
- DANIELSON R.M., DAVEY C.B. (1973): The abundance of *Trichoderma* propagules and the distribution of species in forest soils. *Soil Biology and Biochemistry* 5: 486-494.
- DRUZHININA I.S., KOPTCHINSKI A., KOMON M., BISSETT J., SZAKACS G., KUBICEK C.P. (2005): A DNA-barcode for strain identification in *Trichoderma*. *Fungal Genetics and Biology* 42: 813-828.
- DRUZHININA I.S., KOMON-ZELAZOWSKA M., KREDICS L., HATVANI L., ANTAL Z., BELAYNEH T., KUBICEK C.P. (2008): Alternative reproductive strategies of *Hypocrea orientalis* and genetically close but clonal *Trichoderma longibrachiatum*, both capable of causing invasive mycoses of humans. *Microbiology (UK)* 154: 3447-3459.
- GHERBAWY Y., DRUZHININA I., SHABAN G.M., WUCZKOWSKY M., YASER M., EL-NAGHY M.A., PRILLINGER H.J., KUBICEK C.P. (2004): *Trichoderma* populations from alkaline

agricultural soil in the Nile valley, Egypt, consist of only two species. Mycological Progress 3: 211-218.

HARMAN G.E., HOWEL C.R., VITERBO A., CHET I., LORITO M. (2004): *Trichoderma* species – opportunistic, avirulent plant symbionts. Nature Reviews Microbiology 2: 43-55.

HOYOS-CARVAJAL L., ORDUZ S., BISSETT J. (2009): Genetic and metabolic biodiversity of *Trichoderma* from Colombia and adjacent neotropic regions. Fungal Genetics and Biology 46: 615-631.

KLEIN D., EVELEIGH D.E. (1998): Ecology of *Trichoderma*. *Trichoderma and Gliocladium, Vol. 1. Basic Biology, Taxonomy and Genetics* (Kubicek CP & Harman GE, eds), pp 57-74. Taylor and Francis Ltd., London

KOMOŇ-ZELAZOWSKA M., BISSETT J., ZAFARI D., HATVANI L., MANCZINGER L., WOO S., LORITO M., KREDICS L., KUBICEK C.P., DRUZHININA I.S. (2007): Genetically closely related but phenotypically divergent *Trichoderma* species cause world-wide green mould disease in oyster mushroom farms. Applied and Environmental Microbiology 73: 7415-7426.

KOPCHINSKIY A., KOMOŇ M., KUBICEK C.P., DRUZHININA I.S. (2005): *TrichoBLAST*: A multilocus database for *Trichoderma* and *Hypocrea* identifications. *Mycol Res* 109: 657-660.

KUBICEK C.P., BISSETT J., DRUZHININA I., KULLNIG-GRADINGER C.M., SZAKACS G. (2003) Genetic and metabolic diversity of *Trichoderma*: a case study on South East Asian isolates. Fungal Genetics and Biology 38: 310-319.

KULLNIG C.M., SZAKACS G., KUBICEK C.P. (2000): Molecular identification of *Trichoderma* species from Russia, Siberia and the Himalaya. *Mycol. Res.* 104, 1117-1125.

LÁDAY M., SZÉCSI Á. (2001): Distinct electrophoretic isoenzyme profiles of *Fusarium graminearum* and closely related species. Systematic and Applied Microbiology 24: 67-75.

MIGHELI Q., BALMAS V., KOMOŇ-ZELAZOWSKA M., SCHERM B., FIORI S., KOPCHINSKIY A.G., KUBICEK C.P., DRUZHININA I.S. (2009): Soils of a Mediterranean hot spot of biodiversity and endemism (Sardinia, Tyrrhenian Islands) are inhabited by pan-European, invasive species of *Hypocrea/Trichoderma*. Environmental Microbiology 11: 35-46.

MULAW T.G., KUBICEK C.P., DRUZHININA I.S. (2010): The rhizosphere of *Coffea Arabica* in its native highland forests of Ethiopia provides a niche for a distinguished diversity of *Trichoderma*. Diversity 2: 527-549.

NELSON E.E. (1982): Occurrence of *Trichoderma* in a Douglas-fir soil. Mycologia 74: 280-284.

SZEKERES A., LÁDAY M., KREDICS L., VARGA J., ANTAL Z., HATVANI L., MANCZINGER L., VÁGVÖLGYI C., NAGY E. (2006): Rapid identification of clinical *Trichoderma longibrachiatum* isolates by cellulose-acetate electrophoresis-mediated isoenzyme analysis. Clinical Microbiology and Infection 12: 369-375.

WIDDEN P., ABITBOL J.J. (1980): Seasonality of *Trichoderma* species in a spruce-forest soil. Mycologia 72: 775-784.

WUCZKOWSKI M., DRUZHININA I., GHERBAWY Y., KLUG B., PRILLINGER H., KUBICEK C.P. (2003): Species pattern and genetic diversity of *Trichoderma* in a mid-European, primeval floodplain-forest. Microbiological Research 158: 125-133.

**PRODUCTIVITY OF TRITICALE (*TRITICOSECALE*) IN ASPECT OF  
INTERCROPPING WITH NARROW-LEAF LUPINE (*LUPINUS  
ANGUSTIFOLIUS*)**

**ĆWIERTNIEWSKA, MARTA–KOTECKI, ANDRZEJ**

Wroclaw University of Environmental and Life Sciences  
Department of Crop Production  
Pl. Grunwaldzki 24a 50-363 Wrocław  
marta.cwiertniewska@gmail.com

**ABSTRACT – Productivity of triticale (*Triticosecale*) in aspect of intercropping with narrow-leaf lupine (*Lupinus angustifolius*)**

The experiment was conducted in the years 2009-2010 in an experimental facility of Wrocław Agricultural University located in Pawłowice (17°02' E, 51°31' N, on a height of 122 meters above sea level.). The goal of the research was to determine the influence of the way the cropping is performed (pure and mixed sowing of narrow-leaf lupine) on the productivity of the Dublet triticale variety. The mixed cropping had four different proportions of triticale and narrow-leaf lupine sowing. The most important morphological attributes of triticale and the elements of cropping structure were determined.

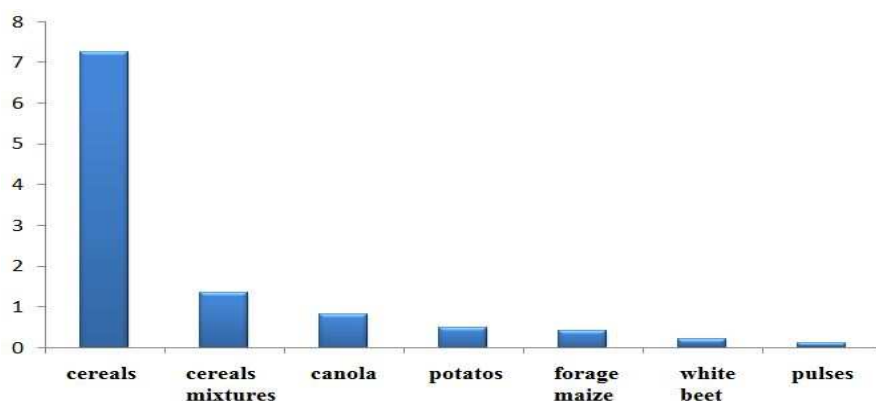
As an outcome of the performed research the fact was stated, that the sowing proportions affect both whole plants and seeds attributes changes. Influence of narrow-leaf lupine type on the quantity of grain yield in the mixtures was observed. Majority of biometric attributes was showing a statistically significant dependency on the amount of the sowing mixture components.

**Keywords:** narrow-leaf lupine, triticale, intercropping, yield

**INTRODUCTION**

According to FAOSTAT data Poland is the world's head producer of triticale. The amount of the triticale production makes half of the wheat production which is a dominant cereal in sowing structure in Poland (FAOSTAT, 2008). In year 2009, according to GUS data, cereals cultivated for seed purposes made 80% of sowing areas. Aside from pure sowing, cereals are also sown in cereal and cereal-legume mixtures. The growing domination of cereals in crops acreage which is observed in few last years in Poland causes some decrease of the share of other species (GUS, 2009). This is not a very beneficial phenomenon from ecological and phytosanitary point of view (FRANCIS, 1989). Cereal monoculture leads to excessive extraction of natural resources of the soil and pest accumulation resulting in a decrease of the yield (JONCZYK ET AL. 2007). That is why the growth of other plant species (especially the legumes) in the sowing structure is so significant.

The acreage of legumes crops for seeds intended for fodder usage in 2009 was only 92 thousands hectares of which cereal - legume mixture were half of the sowing acreage (GUS, 2009).



**Figure 1. Sowing structure in Poland in millions of hectares, 2009 (GUS)**

Plants belonging to *Fabaceae* family, because of the symbiosis with *Bradyrhizobium* bacteria, are limiting the necessity of the usage of high doses of nitrogenous fertilizers and as a result of this also washout of alimentary elements into groundwater is decreased (KSIĘŻAK, 2000; GRZEGORCZYK, OLSZEWSKA, 1997). Cereal-legume mixtures are increasing the biodiversity (KOSTUCH, JANOWSKI, 1999) leading to the yield stability increase (FRANCIS, 1989; NOWOROLNIK, 2000). Cropping of leguminous plants for grains mixed with cereal results with hard feed that is balanced in terms of amino acids content of proteins (KSIĘŻAK ET AL., 2009).

The main aim of research was to determine the influence of diversified intercropping density with narrow-leaf lupine on productivity of triticale. The influence of narrow-leaf lupine type on forming morphological attributes of triticale was also studied.

## MATERIAL AND METHOD

The experiment was set up in “split-plot” arrangement in four repetitions in the experimental station of Wroclaw University of Environmental and Life Sciences. In years 2009-2010 field researches on the influence of diversified density of sowing mixture with narrow-leaf lupine on the productivity of spring triticale was conducted. The Dublet variety of spring triticale was cultivated with two types of narrow-leaf lupine: Graf and Zeus. The mixtures were intercropped in four sowing proportions. The control objects were plots with pure sow of spring triticale.

**Table 1. Quantity of triticale and narrow-leaf lupine seed per 1 m<sup>2</sup> in intercropping mixtures**

Quantity of sown triticale (seeds per m <sup>2</sup> )	Quantity of sown narrow-leaf lupine (seeds per m <sup>2</sup> )
400	-
320	20
240	40
160	60
80	80



Surface of each plot was 15 square meters, the row width was 15 cm, the depth of sowing was 2-4 cm. The experiment was put on light soil, qualified as V bonitation class. Before the sowing fertilization in doses of 30 kg N, 60 kg P<sub>2</sub>O<sub>5</sub>, 120 kg K<sub>2</sub>O per hectare was applied.

Within the scope of the research on 10 randomly selected plants of triticale from every plot the following attributes were measured: plants height, spike length, flag leaf length, amount of kernels in one spike, weight of kernels in one spike, mass of the productive stalk, mass of the above-ground part and thousand kernels weight. The grain humidity was brought to 13%.

## RESULTS

Because of weak branching, the Graf type of narrow-leaf lupine is useful for sowing in a mix with triticale. The Zeus type has a faster growing rate, and gives greater yield of green mass (HR Smolice). The different growing rate of both types of lupine might modify the morphological traits of the spring triticale. Ignaczak and Andrzejewska (1997) observed that cereal plants sown in mixes gave better yield than those sown purely.

**Table 2. Morphological traits of spring triticale plants (mean values per year, 2009-2010, G – with Graf, Z – with Zeus)**

Quantity of sown seeds [seeds per m <sup>2</sup> ]		Height of the plant [cm]		Length of the spike [cm]		Length of the flag leaf [cm]		Weight of the above ground part [g]		Weight of the productive stalk [g]	
Lupine	Triticale	G	Z	G	Z	G	Z	G	Z	G	Z
80	80	100,5	101,1	7,5	7,8	11,3	12,8	1,86	1,81	3,72	4,22
60	160	96,0	99,8	6,9	7,0	10,3	10,5	1,51	1,57	3,50	3,59
40	240	92,5	95,5	6,3	6,0	9,3	9,4	1,30	1,32	2,82	3,09
20	320	92,3	96,3	6,3	6,5	9,0	9,8	1,23	1,39	2,58	3,12
-	400	89,5		5,2		8,5		0,99		2,24	
NIR ( $\alpha = 0,05$ )		4,5		0,6		1,4		0,25		0,60	

Source: own calculation

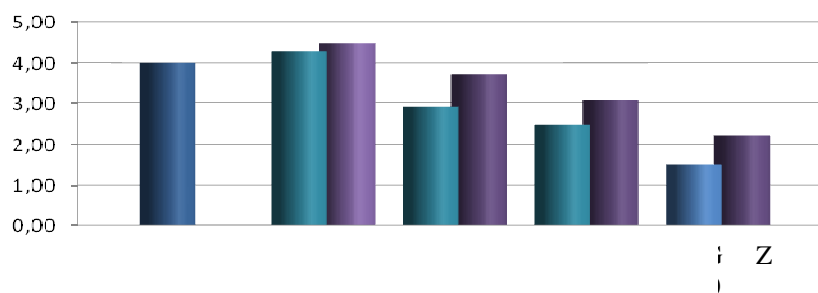
According to the averages from the years 2009-2010 it was observed that the proportion of triticale in a mix with lupine had an influence on the traits shown in *table 2*. All the analysed morphological traits of spring triticale decreased with the increase of the amount of grain and with the decrease of the amount of narrow-leaf lupine.

**Table 3. Traits of spring triticale grain (mean per year, 2009-2010, G – with Graf, Z – with Zeus)**

Quantity of sown seeds (seeds per m <sup>2</sup> )		Amount of kernels from one spike (szt.)		Weight of kernels from one spike (g)		Thousand Grain Weight (g)	
Lupine	Triticale	G	Z	G	Z	G	Z
80	80	40,6	50,7	1,43	1,91	3,78	3,86
60	160	44,6	45,1	1,59	1,62	3,90	3,81
40	240	36,7	48,4	1,23	1,48	3,55	3,88
20	320	32,5	39,7	1,11	1,44	3,59	3,83
-	400	29,35		1,05		3,76	
NIR ( $\alpha = 0,05$ )		7,2		0,33		r.n.	

Source: own calculation

The amount and weight of kernels from one spike are related. When the Graf type lupine was used in the mix, the best results were achieved when sowing 160 seeds of triticale and 60 seeds of lupine on a square meter. When the Zeus type lupine was used the amount and weight of kernels from one spike were the greatest when 80 seeds of triticale and 80 seeds of lupine were used in the mix. Also Kotecki et al (2003) observed the decrease of the amount and weight of kernels from one spike with the increase of the number triticale seeds added to the mix. Thousand Grain Weight (TGW) is a trait that is not dependent on the density of the sow and the type of lupine in the mix.



**Figure 2. Quantity of triticale grain yield (t·ha<sup>-1</sup>) (G – with Graf, Z – with Zeus) depending on sow density (triticale/lupine)**

Figure 2 shows the comparison of triticale crops acquired from mixes with Graf (G) and Zeus (Z) narrow-leaf lupine types in five sowing proportions. The mix with the Zeus type lupine gave better results in every instance. The best results were achieved with a mixed sowing of 320 seeds of triticale and 20 seeds of any type of narrow-leaf lupine. Kotecki et al. (2003) during the cultivation of triticale and lupine gained best results from pure sowing triticale.

## CONCLUSIONS

The averages from the years 2009-2010 for all the analysed traits, excluding the weight of a thousand seeds, have shown a crucial statistical dependence in the amount of spring triticale and narrow-leaf lupine sown on a square meter.

The height of the plant, length of the flag leaf, length of the spike, weight of the above ground part, and the productive stalk were bigger when less triticale was added to the mix, despite the type of the lupine.

The amount and weight of the kernels from one spike are mutually dependent traits. The largest values were achieved while sowing 80 seeds of triticale and 80 seeds of lupine with the Zeus type and 160 seeds of triticale and 60 seeds of lupine with the Graf type.

The yield of crops from both mixes was largest when sown with 320 seeds of triticale and 20 seeds of lupine and decreased when less triticale was added. The size of the crop was dependent on the type of lupine and was larger with the Zeus type.

## ACKNOWLEDGEMENTS

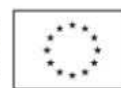
This paper has been co-funded from European Social Fund resources in the frame of „Enterprising PhD student – investment in innovative region development” project, supported by the Human Capital Programme.



HUMAN CAPITAL  
NATIONAL COHESION STRATEGY



EUROPEAN UNION  
EUROPEAN  
SOCIAL FUND



## REFERENCES

FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS - FAOSTAT:  
<http://faostat.fao.org/site/339/default.aspx> (16.03.2011)

FRANCIS C. A. (1989): “Biological efficiencies in multiple-cropping systems”, *Advanced in Agronomy*, vol. 42: 1-42

GRZEGORCZYK S., OLSZEWSKA M. (1997): „Rośliny motylkowate w mieszankach z trawami jako czynnik ograniczający nawożenie azotowe”, *Zeszyty Problemowe Postępów Nauk Rolniczych*, 453: 209-215

IGNACZAK S., ANDRZEJEWSKA J. (1997): „Rozwój i produktywność bobiku oraz zbóż w siewach jednogatunkowych lub mieszanych cz. I. rozwój roślin”, *Zesz. Probl. Post. Nauk Rol.*, 1997, 446: 355-363

JOŃCZYK K., KUŚ J., STALENGA J. (2007): „Produkcyjne i środowiskowe skutki różnych systemów gospodarowania”, *Probl. Inż. Rol.*, 1/2007: 13 - 21

KOSTUCH R., JANOWSKI B. (1999): „Ekologiczna rola roślin motylkowatych”, *Zeszyty Naukowe Akademii Rolniczej im. H. Kołłątaja w Krakowie*, 347: 203-212

KOTECKI A., KOZAK M., MALARZ W. (2003): „Ocena przydatności odmian łubinu żółtego do współrzędnej uprawy z pszenżytem jarym”, *Zeszyty Problemowe Postępów Nauk Rolniczych*, 495: 129-143

KSIĘŻAK J. (2000): „Rola roślin strączkowych w systemie rolnictwa zrównoważonego”, Pamiętnik Puławski, 120: 239-245

KSIĘŻAK J., PODLEŚNY J., BRZÓSKA F. (2009): „Uprawa mieszanek strączkowo-zbożowych i wykorzystanie w żywieniu zwierząt”, IUNG-PIB, Puławy

NOWOROLNIK K. (2000): „Mieszanki zbożowo-strączkowe w systemie rolnictwa zrównoważonego”, Pamiętnik Puławski, 120: 325-329

Plant Breeding Smolice IHAR Group Ltd: [http://www.hrsmolice.pl/index.php?p=lubin\\_00](http://www.hrsmolice.pl/index.php?p=lubin_00)

Statistical Yearbook of the Republic of Poland (2009): GUS, Warszawa

## **THE LINGUISTIC LANDSCAPE OF THE CENTER OF SANTA ROSA, CALIFORNIA**

**GALGÓCZI-DEUTSCH MARTA**

University of Szeged Faculty of Agriculture  
Andrássy street 15. Hódmezővásárhely, 6800 Hungary  
[deutsch@mgk.u-szeged.hu](mailto:deutsch@mgk.u-szeged.hu)

### **ABSTRACT - The linguistic landscape of the center of Santa Rosa, California**

26. 4% of the population of Santa Rosa is speak Spanish as their native language. Therefore the appearance of this minority language in public signage is very important, both for better understanding and for the recognition of the language minority group, especially in the city center where most services essential for daily life are located. The study of the linguistic landscape of the city center reveals the relation of dominant and minority languages: Spanish language gains recognition in most public signage, but it is placed in second position while the dominance of English language is reinforced even by the visual arrangement of the signs.

**Keywords:** linguistic landscape, minority language, bilingualism, public signs, Hispanics

## **INTRODUCTION**

The United States is a multilingual society where Spanish is the most the most widely-spoken minority language. According to the records of the census in 2002, the number of Hispanic population is 37.4 million that is the 13.3% of the entire population of the USA making it the country with 5th largest Spanish-speaking population (ARDILA, 2005). The term 'Hispanic' or 'Latino' in linguistic studies is used for those people whose native language is Spanish. Generally, it is observed that in cities where there is a significant number of Hispanic population those parts of the city which are inhabited by Spanish speakers have Spanish signage in the streets and in the shops and services respectively and the Spanish language is also present—in different degree—in other parts of the city (YANGUAS, 2009). The Spanish-speaking people use their native language in everyday life and especially the first generation immigrants often have difficulty in understanding and speaking English. For this reason, the appearance of Spanish language in public signage is a necessity as only this way can all Spanish language speakers can understand the information on display in public spaces. Another importance of the appearance of Spanish in streets is that it reflects how much the linguistic rights of the language minority group are realized in the community where they live. The city is the environment where the languages meet and their roles become obvious (BARNI ET AL., 2010).

In my study I examine the linguistic landscape of the center of Santa Rosa, Sonoma County, California, USA. According to the data of July 2009 the total population is 157.4868 with 41.619 Hispanics that constitutes the 26.4% of the entire population. My aim is study how the central area takes the Spanish speaking population into consideration from the language point of view that is how common it is to display the Spanish language in public signage, what content is written in two languages and how they are visualized. I chose the city as the proportion of the Spanish speaking population reaches the 26% and

the city center is the area where most of the services and infrastructure can be found, therefore it is the most likely to be visited by minority language speakers as well.

In the study of the linguistic landscape there are several factors to be considered in order to assess the role of minority language in the society: first of all, whether the minority language is present in public signage besides the dominant language. If it is present, its position and visual display—whether it is first or second or is written with the same size and types of letters—is also to be considered as these visual representations reflect the language ideology, the status of a minority language in the society (SHOHAMY, 2006). Furthermore, Landry and Bourhis distinguished two major functions of public signs: informative and symbolic functions (SPOLSKY, 2009). In my study I also use these concepts in order to gain more information about the message of public signs.

## **MATERIALS AND METHODS**

To study the linguistic landscape of a given territory I used similar method that Griffin (GRIFFIN, 2004) did. I defined the scope of the town that I intended to examine with the help of the city map. I used the digital photos taken by Dawn Dolan: I examined the photos and with their help I could draw the linguistic landscape of the center: I studied the number of monolingual and bilingual signs, the type of information they contain and the written format they have and related the Spanish language content to the English one. Though Dawn Dolan has taken numerous photographs of different parts of the city center in order that I would be able to draw the conclusions precisely, I am able to demonstrate only a few relevant pictures in my study. Therefore I have chosen photos that well characterize the linguistic landscape of the city and grouped them in monolingual English, bilingual and monolingual Spanish categories to provide a clear description.

## **RESULTS**

### **Monolingual English signs**

The sign in *Figure 1.* gives information about the parking regulations in monolingual English disregarding the understanding of the Spanish speaking population. Similarly, the sign in *Figure 2.* is about a regulation, particularly it is a prohibition regarding skateboarding, cycling, loitering etc. and informing about prosecution. The informative function of both signs is that they provide information about prohibitions and their symbolic function is that they address the English speaking population. Both signs are official and according to the categorization of Spolsky and Cooper they are categorized as ‘prohibitions’ (SPOLSKY, 2009). The information they provide is relevant and important in order to observe the rules as otherwise violators can face legal charges.



**Figure 1 and 2: Parking Regulation and Official Prohibition**

Source: <http://www.flickr.com/photos/ohsknapp/3700638830/> and Dawn Dolan

### Bilingual signs

The sign of *Figure 3*. advertises an on-site mortgage specialist while the sign in *Figure 4*. warns to dispose only garbage in the container and the sign in *Figure 5*. indicates to wait until the call. In all three signs it can be seen that the first language (above) is always English and the second (below) is the Spanish. As opposed to the monolingual English signs, the importance of Spanish language is already recognized here.



**Figure 3, 4 and 5: Advertisement, Restriction and Regulation in a Bank**

Source: Dawn Dolan

In the case of *Figure 3*. the information it contains is a business service. In order to gain more profit it is important to address the large number of Spanish speaking population in the mother tongue (YANGUAS, 2009). Furthermore, in case of the official signs in *Figure 4*. and 5. the authorities also take the Spanish speaking population into consideration and in order to keep the orders they apply Spanish language in the signage. In all three cases, the information is exactly the same in both languages with English in the first and Spanish in the second place suggesting the dominance of English language. However, in case of *Figure 4*. the red letters give some emphasis to the Spanish writing.

### **Monolingual Spanish signs**

The sign in *Figure 6*. advertises a bank service by which the customer can get to his salary quicker. As there are a large number of Spanish speakers in Santa Rosa, the bank recognizes the necessity of Spanish advertisement, most supposedly because they are more likely to become clients if they are addressed in their native language in a fully monolingual Spanish advertisement instead of a bilingual one. Here, only the take-away brochures are in English, the advertisement itself is in Spanish only.



**Figure 6: Bank Advertisement**

Source: Dawn Dolan

The advertisement in *Figure 6*, therefore, has informative and symbolic functions, too. It provides valuable information about a banking service, besides gives full right to Spanish language being the only one used in the advert and indicating that the bank addresses directly the Spanish speaking population.

### **CONCLUSIONS**

Based on the signs I have examined it can be concluded that in the center of Santa Rosa, where the Hispanics constitute the  $\frac{1}{4}$  part of the population, the minority language appears in numerous signs in public spaces. However, the dominance of English language is obvious from the public signage: there are monolingual English signs with relevant information disregarding Spanish speakers and on the bilingual signs English is visualized as the dominant language. Bilingual signs can be found mainly in public institutions where the appearance of Spanish speakers is likely and their understanding is necessary. Monolingual Spanish signs appeal mainly in advertisements where advertisers recognize the necessity of the use of Spanish language in order to provide a full understanding in a larger scope of possible clients and attract more customers from minority language groups, too (SPOLSKY, 2009).

The signs on display have both informative and symbolic functions. As far as information is concerned they have the same content written, but the symbolic function suggests the dominance of English language. However, the use of Spanish language itself has symbolic function: it does not only serve the better understanding for the hispanic population but it also recognizes the linguistic rights of Spanish language, therefore contributes to and re-enforces the ethnical identity of Hispanic people that is highly important in a multicultural society.



## **ACKNOWLEDGEMENTS**

This study was conducted under the supervision of Dr. Fenyvesi Anna, University of Szeged Department of English Studies. The photos were taken and provided by Dawn Dolan.

## **REFERENCES**

- ARDILLA A. (2005): "Spanglish: An Anglicized Spanish Dialect", *Hispanic Journal of Behavioral Sciences*, Sage Publications p. 61-80
- BARNI M., BAGNA C. (2010): "Linguistic landscape and language vitality", Eliezer Ben-Rafael, Elana Shohamy and Monica Barni: *Linguistic landscape in the city Multilingual Matters Ltd, UK*, p. 3-19
- GRIFFIN J. L. (2004): "The presence of written English on the streets of Rome. A review of English in Italy, with evidence of its infiltration into Public life", *English Today* 78. 2004 April, p. 3-8
- SHOHAMY E. (2006): "Language policy: Hidden agendas and new approaches", London and New York, Routledge
- SPOLSKY B. (2009): "Prolegomena to a sociolinguistic Theory of public signage" Shohamy and Gorter: *Linguistic landscape. Expanding the scenery*. Routledge, UK, p. 25-40
- YANGUAS I. (2009): "The linguistic landscape of two Hispanic neighborhoods in Washington D.C.", *Revista electronica de lingüística aplicada*, p. 30-44  
<http://www.city-data.com/city/Santa-Rosa-California.html>  
<http://www.flickr.com/photos/ohsknapp/3700638830/>

## STATISTICAL OVERVIEW OF BIRTH, DEATH AND MIGRATION TRENDS AT EU LEVEL

PAKURÁR MIKLÓS–OLÁH JUDIT

University of Debrecen Centre for Agricultural and Applied Economic Sciences  
Faculty of Applied Economics and Rural Development  
Institute of Management and Organisation  
4032 Debrecen, Böszörményi Street 138.  
pakurar@agr.unideb.hu olahjudit@agr.unideb.hu

### **ABSTRACT – Statistical overview of birth, death and migration trends at EU level**

RuralJobs is a collaborative research project partly funded under the European Commission Research and Development 7<sup>th</sup> Framework Program (FP7). It involves partner institutions from eight Member States. University of Debrecen is the coordinator. RuralJobs quantifies labour market, demographic and economic trends, and the impact of employment creation measures and policies in six, representative “reference areas” across the EU, and uses the information to demonstrate how rural development measures can be better targeted and how rural development policies should evolve. The Eurostat database was chosen as the main source of information for statistical analysis. The birth rates, death rates and the migration are described. According to a contemporary research the most important questions of the new generations of Europeans are: the quality of the health system, confrontation between generations on pensions, and the integration of immigrants which are closely related with employment issues.

**Keywords:** birth, death, migration, EU level, population

## INTRODUCTION

It is forecasted that the demographic changes will cause unprecedented circumstances in the history of Europe which affects the regions prosperity, living standards and problems between generations (KWASNIEWSKI, 2005). From 2005 to 2030 the working age population of the European Union will decrease by 20.8 million (6.8%), and the age group of 65 and over will grow by 40 million (52.3%) therefore the dependency ratio will change unfavourably and the productive part of the population has to make extra efforts to maintain the cost of upbringing and pensions of the economically dependent population.

Demographic characteristics of the European Union have been changed drastically for decades. The most notable events of demography between 1999 and 2004 according to Philipov’s study have been: fertility decline, postponement of births, population ageing and increased immigration (PHILIPOV ET AL., 2008). New situation arose with the enlargement of the EU in 2004 and 2007 when ten and two countries joined the Union respectively. The study of PHILIPOV ET AL., (2008), the most important questions of the new generations of Europeans are: the quality of the health system, confrontation between generations on pensions, and the integration of immigrants. Continuous follow up of demographic events and their effect on other areas is needed to tailor the policy of the community.

BIJAK ET AL. (2007) studied the impact of international migration on population ageing and developed population and labour force projections for 27 European countries. Based on the analysis of fertility, mortality, economic activity, assumptions on migration flow data and probable policy developments the research concluded that negative trends in population and labour force aging will not be compensated by reasonable immigration. The statements

have reference to the EU as a whole but in regions like Andalusia where the immigration is important the different patterns of behaviour of immigrants in terms of fertility lead to a change of trend and a greater increase in fertility rates which may result in population growth locally.

If fertility rates remain on the current level, EU population will be decreasing significantly, the ratio of elderly will increase, the number of working people will decrease, and the ratio of dependent population will grow. This negative trend should be changed to secure the increasing standard of living and economic development of the European citizens. One way of solving the problem of decreasing population is to increase the immigration. The UN Population Division determined the size of the immigration to the EU which counteracts the effect of low fertility rates to maintain current number of population. BOUVIER (2001) assessed the effects of immigration on the future of the European Union. Taking as a first base the fact that reproduction is density-dependent for many species LUTZ ET AL. (2006) studied the relationship between population density and human fertility on the time series of 145 countries. It was found that there was a negative relationship between population density and human fertility and individual fertility preferences were also in negative relationship with population density which suggests that population density should be taken into account when fertility issues are studied. In the same time this relationship affects negatively the sparsely populated rural areas.

The reason of population decrease in rural areas and increase in urban areas is believed as the consequence of better life conditions in urban areas than in rural areas. However GÓRZ AND KUREK (2000) learned from a research that since the growth of population was higher in rural areas than urban areas the living conditions were on a much more lower level in rural areas than urban areas. Rural areas were characterised with economic inefficiency, low living standards, high state support, hidden unemployment on small family farms, inefficient use of labour, decreased house building and domestic overcrowding. Similar tendencies happened in Romania where the population with small area of holdings migrated to rural areas in a hope to make a living on farming but the lack of capital, the lack of adequate knowledge and the small average size of holdings resulted in inefficient production and a low standard of living.

Aging population is also a significant problem of many non European countries. According to KINCANNON ET AL., (2005) the sum of the older population, aged 65 and over, of China and the United States was 29 % of the world's population in 2000. This number of elder people will grow double in size over the following three decades. The ratio of older population support and the effect of economies wellbeing of the population are significant questions of both countries.

## **METHODOLOGY**

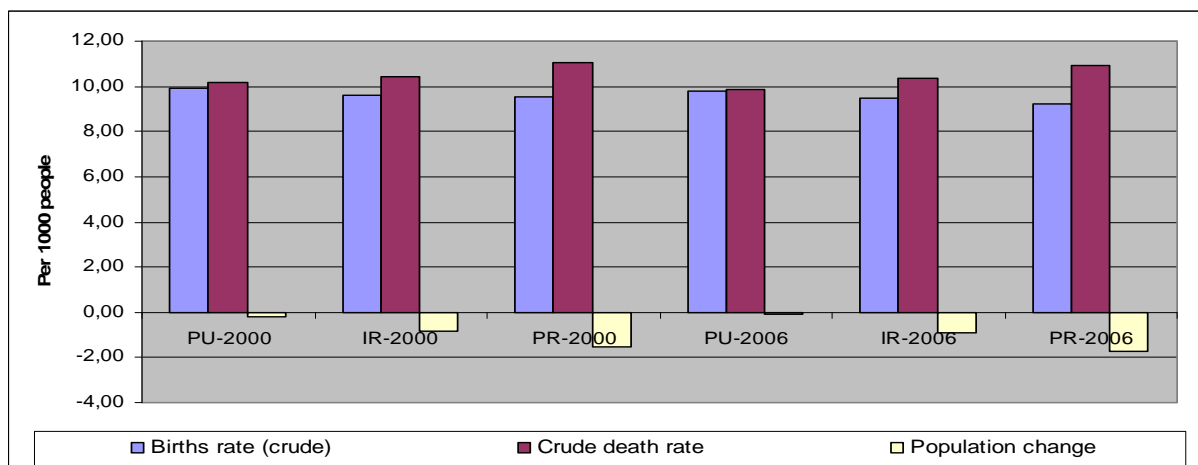
The Eurostat database was chosen as the main source of information for statistical analysis. The birth rates, death rates and the migration are described. When the data base was selected the following considerations were important: availability of data for all the EU 27 countries on national and regional (NUTS2 and NUTS3) level. The examined time period was from 2000 to 2006, the end was determined by the availability of data on the Eurostat database. Tendencies were evaluated by comparing the data of the first year and the last year of the examined period. Taking into account rurality the regions were divided into three groups: predominantly urban regions (PU), intermediate regions (IR) and predominantly rural regions (PR). The categorisation of rurality based on the methodology

of the Organisation for Economic Co-operation and Development which method uses population density as the criteria of rurality.

## RESULTS

The growth of a population depends on the number of births and deaths in a time period (Table 1). Natural change of population does not take into account the alteration of the population from immigration and emigration (net migration). Natural change of population is equal with crude birth rate minus crude death rate which shows the increase or decrease of a population in a certain time period. Crude birth rates were 9.78 (PU), 9.46 (IR) and 9.21 (PR) in the EU in 2006 which values were lower than crude birth rate values in 2000. Crude death rates ranged from 9.86 (PU) to 10.95 (PR) in 2006. The natural change of the population was different in PU, IR and PR regions of the EU being the less intensive in PU regions (-0.69), and the more intensive in PR regions (-2.67).

**Table 1. Births rate (crude), deaths rate (crude) and population change in the EU27, NUTS3**



Source: Eurostat General and regional statistics, 2000, 2006

**Table 2. Births rate (crude) NUTS 3**

	2000-2006		
	%		
	PU	IR	PR
<b>Average</b>	-1.68	-1.72	-3.56

Source: Eurostat General and regional statistics, 2000, 2006

Crude birth rate values decreased in each category in PU, IR and PR regions by 1.68%, 1.72% and 3.56% (Table 2). This tendency shows that the birth rate became more unfavourable in time in each region type but the pace of decrease was more than double in PR regions than in PU regions.

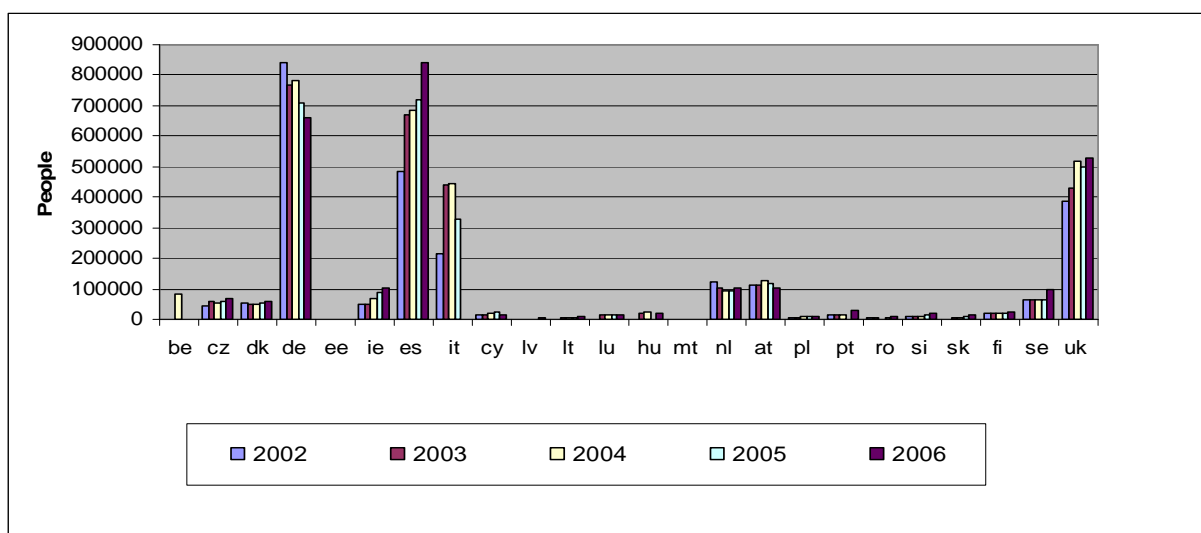
**Table 3. Crude death rate NUTS 3**

	2000-2006		
	%		
	PU	IR	PR
<b>Average</b>	-2.86	-0.79	-1.01

Source: Eurostat General and regional statistics, 2000, 2006

The crude death rate also decreased in PU, IR and PR regions by 2.86%, 0.79% and 1.01% respectively which trend relatively favourable for the urban population and adverse for rural people (*Table 3*).

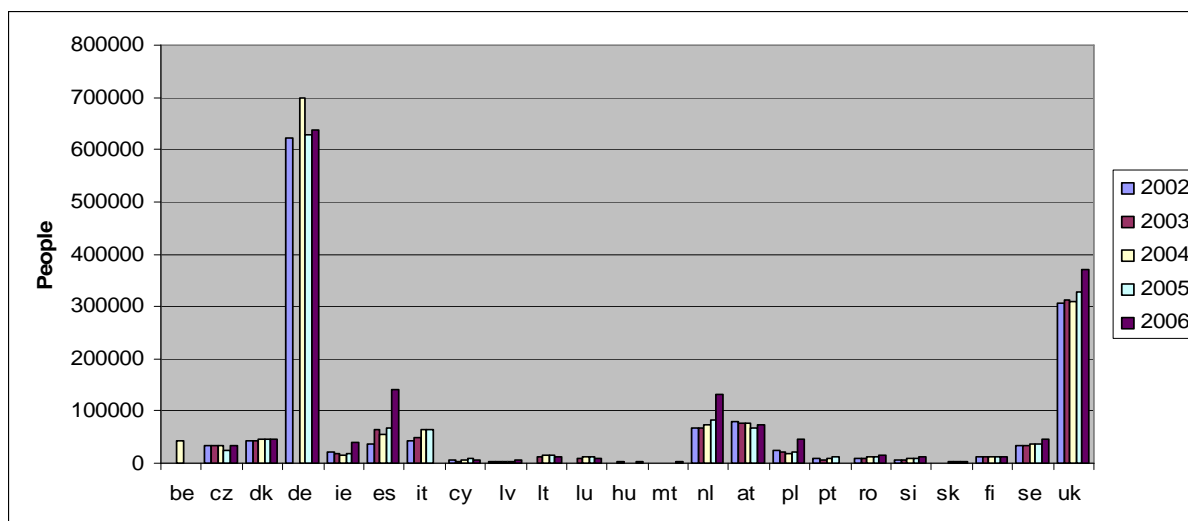
**Table 4. Total immigration**



Source: Eurostat General and regional statistics, 2002, 2006

The natural change of the population was found negative in PU, IR and PR regions of the EU but the average number of population increased moderately in the examined categories. The source of the increase of the population was the net migration to the EU. Since the ratio of missing immigration and emigration data is rather high, years of 2002-2006 with the most complete dataset was chosen to present an example of migration in different countries. Immigration to EU countries shows a very diverse picture. There were countries being extremely attractive for immigrants like Spain, Germany, Italy and the UK (*Table 4*). These countries received more than two times of immigrants than the next countries with a rather high number of immigrants e.g.: Ireland, Netherlands, Austria, and Sweden. The immigration in absolute values to the remaining countries was on a low level. More immigrants arrived from outside the EU25 countries as the average total immigration was more than twice as big as the average immigration from the EU25.

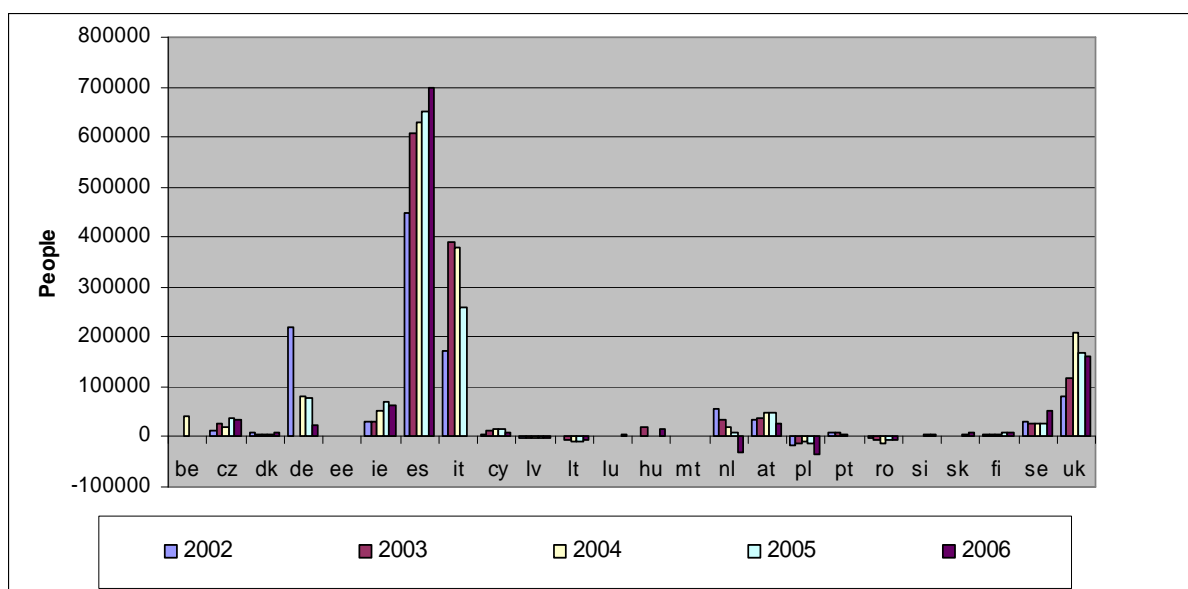
**Table 5. Total emigration**



Source: Eurostat General and regional statistics, 2002, 2006

The number of emigrants was a small fraction of the number of immigrants in the EU in the period of 2002-2006 (Table 5). Germany and the UK were the most important immigrant countries and these two countries had also the biggest numbers of emigrants. The goal of emigrants was mainly a country out of the EU25 and only less than half emigrants aimed on EU25 country.

**Table 6. Total net migration**



Source: Eurostat, 2002, 2006

Net migration, the difference between immigration and emigration, crude birth and crude death values of a time period determine the population change in a region (Table 6). As the natural change of population was generally negative the source of population growth came from the net migration in the regions where population growth was experienced. Countries

with higher net migration values usually had a population increase e.g.: Germany, Ireland, Spain, and the UK. Some eastern European countries with less developed economy had a negative net migration like Poland, Romania, Lithuania and Latvia. The Netherlands with a high negative net migration was an exception in 2006 which was an extremely high value since the population growth was positive from 2002 to 2006.

## CONCLUSIONS

The immigration policy of a host country has to be adapted to the requirement of the labour market and to the needs of the immigrants. Immigrants' inclusion into the society or marginalization depends in a great deal on the law of the host country. The tendency of natural population change increased the disadvantageous position of rural areas. Crude birth rate decreased in PU, IR and PR regions of the EU from 2000 to 2006 and the decrease was more than double in PR regions than in PU regions. The crude death rate also decreased in PU, IR and PR regions which trend relatively adverse for rural people. The natural change of the population was different in PU, IR and PR regions of the EU with the best in PU regions and the least favourable in PR regions. Low fertility rates caused population decrease in every RuralJobs countries; however net migration did compensate this negative tendency in some areas. In France, Italy, Spain and the UK immigration was more intensive than emigration that led to population growth, but in Bulgaria, Hungary, Lithuania and Romania migration showed opposite tendencies which only deepened the demographic problems.

## REFERENCES

- BIJAK, J., KUPISZEWSKA, D., KUPISZEWSKI, M., SACZUK, K. AND KICINGER, A. (2007): Population and labour force projections for 27 European countries, 2002–2052: impact of international migration on population ageing *European Journal of Population/Revue européenne de Démographie*, Volume 23, Number 1 / March, 2007, p. 1-31
- BOUVIER, L. F. (2007): Replacement Migration: Is it a Solution to Declining and Aging Population? *Population & Environment*, Volume 22, Number 4 / March, 2001, p. 377-381
- GÓRZ B. AND KUREK, W. (200): The population of the Polish countryside: Demography and living conditions *GeoJournal*, Volume 50, Numbers 2-3 / February, 2000, p. 101-104
- KINCANNON, C. L., HE, W. AND WEST, L. A., (2005): Demography of Aging in China and the United States and the Economic Well-Being of their Older Populations *Journal of Cross-Cultural Gerontology*, Volume 20, Number 3 / September, 2005, p. 243-255
- KWASNIEWSKI K. (2005): Europe's Demography Demographic Challenge *Intereconomics*, Volume 40, Number 2 / March, 2005, p. 54-55
- LUTZ, W., TESTA, M. R. AND PENN, D. J. (2006): Population Density is a Key Factor in Declining Human Fertility *Population & Environment*, Volume 28, Number 2 / November, 2006, p. 69-81
- PHILIPOV, D., LUTZ, W., RICHTER, R. AND WILSON, C. (EDS) (2008): The New Generations of Europeans: Demography Demography and Families in the Enlarged European Union *European Journal of Population/Revue européenne de Démographie*, Volume 24, Number 2 / June, 2008, p. 243-244.

## **DOUGH REOLOGICAL AND KERNEL HARDNESS INVESTIGATION ON DIFFERENT HUNGARIAN WINTER WHEAT VARIETIES**

**SZABÓ, P. B.**

University of Szeged, Faculty of Engineering, 6724 Mars square 7. Szeged, Hungary  
e-mail: szpb@mk.u-szeged.hu

### **ABSTRACT - Dough reological and kernel hardness investigation on different Hungarian winter wheat varieties**

The aim of this research was the investigation of winter wheat varieties, the kernel hardness and the dough features. We determined the kernel hardness with two dynamic methods. We measured the parameters of flour. The correlations among hardness index and the examined flour parameters were also significant ( $r=0.816-0.876$ ). We found strong correlation between the grinding energy ( $e_g$ ) and water absorption ( $r=0.878$ ) of the flour. Hardness index – wet gluten ( $r=0.833$ ), and hardness index – water absorption ( $r=0.876$ ), hardness index – P value of alveograph ( $r=0.816$ ) showed also positive correlations. We found correlation the water absorption and P value of alveograph ( $r=0.873$ ).

**Keywords:** wheat kernel hardness, flour parameters, dough features

### **INTRODUCTION**

The kernel hardness has great effect on the baking properties of the resulting flour. Flour, which is made from hard wheat generally have a medium to high protein content and stronger gluten than that, which is made from soft one. The kernel Hardness-locus on chromosome 5D is the main determinant of grain texture in bread wheat. Puroindoline-a (pin-a), puroindoline-b (pin-b) and Grain Softness Protein (GSP) genes are tightly linked at this locus and their products are the predominant components of friabilin, a 15 kDa endosperm protein complex. The friabilin protein complex determines the kernel hardness. Generally, when the amount of the friabilin is high, the kernel hardness is soft reverse (ÁCSNÉ ET AL. 2001). We can sort the kernel hardness in these two groups. Hardness in wheat is largely controlled by genetic factors but it can be affected by the environment, for example the weather (GYIMES, 2004). The transgenic expression of wild type Pin-a sequence in the Pin-a null genotype gave soft grain with the characteristics of soft wheat including stronger starch bound friabilin. The results of MARTIN ET AL. (2006) support the hypothesis that both wild type Pin genes need to be present for friabilin formation and soft grain. Vitreousness is also impact to evaluate the Middle-European wheat. The flour of hard wheat with high gluten content generally contains about 12,0-13,0 % (or more) crude protein under Middle-European conditions. The relationship between wheat protein content and kernel texture is usually positive and kernel texture influences the  $e_g$  during milling. Hard textured wheat grains require more  $e_g$  than those of soft ones. The aim of our research was to determine the relationships between kernel hardness and other technologically important traits in wheat varieties widely used in the Hungarian agriculture (VÉHA, 2005.).



## MATERIALS AND METHODS

Registered and widely used seven of HRWW and four of SRWW Hungarian wheat varieties were tested in the study. We used the varieties of Szegedi Gabonatermesztési Kutató Kht. (Cereal Research NPC, Szeged) as samples, which were labeled with code number.

Cleaned grain samples were used to identify the hardness index (HI) by SKCS-4100 instrument (Perten Inc.). The SKCS-4100 can complete a test in about 3 minutes, and simultaneously reports mean and standard deviation data for kernel weight, diameter, and moisture content, as well as the HI. This machine examines 300 whole kernels (SZABO ET AL., 2005; BEAN ET AL. 2005).



**Figure 1. SKCS 4100 instrument (Perten, Inc.)**

Grain samples were grinded by Perten 3303 for establishing the  $e_g$  using a 1-phase output indicator interface. This involves grinding a sample, and sieving a weighed amount (usually 10 g) through a standard screen for a standard time. The percentage of throughs is recorded as the PSI (GYIMES ET AL. 2008).



**Figure 2. Perten 3303 disc mill (Perten, Inc.)**

Moisture content, wet gluten content, farinograph and alveograph tests were determined according to the EU-Standards. Farinograph gave information on the water absorption of the flour. Twin correlations were used to determine the relationship among the various traits, the significant level was 5 %.

## RESULTS AND DISCUSSION

Hardness Indexes and grinding energies of selected wheat entries in the study (*Table 1*).

**Table 1. Hardness index and e<sub>g</sub>**

Entry code	Hardness Index	Grinding Energy (mWh/cm <sup>2</sup> )
VI.	19,6	0,21
II.	27,3	0,23
IX.	28,6	0,25
III.	36,0	0,24
VII.	57,3	0,43
IV.	61,0	0,44
VIII.	67,3	0,46
XIII.	68,3	0,47
XII.	80,6	0,53
X.	80,6	0,55
XI.	81,3	0,54

The Perten-HI and grinding energy values were showed in *Table 1*. The SKCS 4100 compartmentalize the results in two groups. Under 50, the samples belong to Soft Wheat-, while samples above values 50 considered as Hard Wheat category. The average HI was 55.2 with minimum of 20 and maximum of 81 values. The II., III., VI. and the IX. samples are Soft Wheat, and the other samples are Hard Wheat.

*Table 2* and *Table 3* show the selected parameters of the sample.

**Table 2. Selected parameters of the samples**

Class	Entry code	Moisture (%)	Flour yield (%)	Water absorption capacity (ml)	Wet gluten (%)
S O F T	II.	13.27	71.88	54.8	21.58
	III.	13.86	71.79	57.3	27.48
	VI.	14.01	74.01	54.0	16.85
	IX.	14.00	68.33	56.6	25.30
H A R D	IV.	13.90	72.89	60.9	28.13
	VII.	13.85	71.28	61.4	22.88
	VIII.	13.58	70.16	63.2	33.68
	X.	13.37	70.96	67.9	31.70
	XI.	13.15	67.94	66.8	35.60
	XII.	12.82	70.46	63.0	29.68
	XIII.	12.92	69.66	56.9	31.08

**Table 3. Results of the Alveograph**

Class	Entry code	Alveograph			
		P (mm)	L (mm)	P/L	W (J)
S O F T	II.	42.40	65.50	0.65	102.06
	III.	63.49	93.75	0.68	204.54
	VI.	45.72	51.50	0.89	103.99
	IX.	49.99	67.30	0.75	123.80
H A R D	IV.	88.25	70.00	1.26	251.35
	VII.	105.50	43.00	2.45	195.84
	VIII.	87.95	75.50	1.14	226.64
	X.	93.18	59.90	1.56	178.48
	XI.	100.30	47.00	2.16	189.91
	XII.	103.90	61.45	1.69	252.19
	XIII.	54.85	66.00	0.83	148.09

**Table 4. Correlation matrix for the technological traits and grinding energy of wheat samples**

	Hardness Index HI (%)	Grinding energy (mWh/cm <sup>2</sup> )	Moisture (%)	Flour yield (%)	Water absorption capacity (ml)	Wet gluten (%)	Alveograph				
							P (mm)	L (mm)	P/L	W (J)	
Hardness Index HI (%)	1										
Grinding energy (mWh/cm <sup>2</sup> )	0.991	1									
Moisture (%)	-0.637	-0.600	1								
Flour yield (%)	-0.437	-0.417	0.417	1							
Water absorption capacity (ml)	0.876	0.878	-0.346	-0.402	1						
Wet gluten (%)	0.833	0.781	-0.531	-0.660	0.756	1					
A L V E O.	P (mm)	0.816	0.826	-0.244	-0.224	0.873	0.560	1			
	L (mm)	-0.217	-0.320	0.141	0.096	-0.260	0.171	-0.325	1		
	P/L	0.640	0.687	-0.187	-0.240	0.724	0.300	0.875	-0.691	1	
	W (J)	0.675	0.634	-0.151	-0.055	0.623	0.582	0.808	0.209	0.468	1

According to the results, there was a very strong correlation between the grinding energy and the kernel hardness ( $r=0.991$ ). As *Table 4.* shows, the correlations among hardness index and the examined flour parameters were also significant ( $r=0.816-0.876$ ). We found strong correlation between the eg and water absorption ( $r=0.878$ ) of the flour. Hardness index – wet gluten ( $r=0.833$ ), and hardness index – water absorption ( $r=0.876$ ), hardness

index – P value of alveograph ( $r=0.816$ ) showed also positive correlations. We found correlation the water absorption and P value of alveograph ( $r=0.873$ ).

## CONCLUSIONS

The aim of the research was to determine the connection among the hardness index, grinding energy and the flour end-use quality parameters. There was a very strong correlation between the grinding energy and the kernel hardness ( $r=0.991$ ) (Figure 3.). We found strong correlation between the wet gluten and hardness index ( $r=0.833$ ) of the flour (Figure 4.).

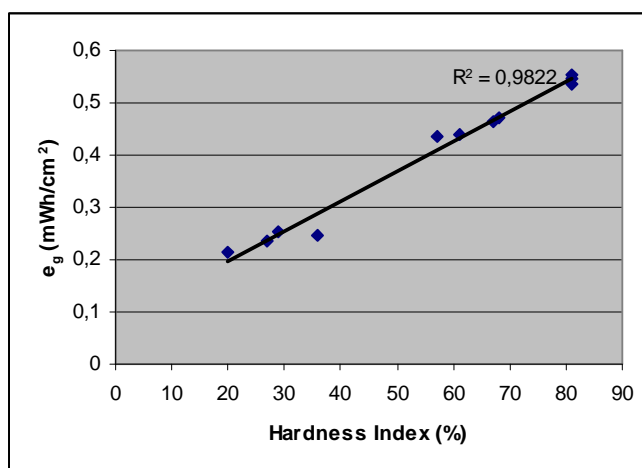


Figure 3. Connection between the HI and  $e_g$

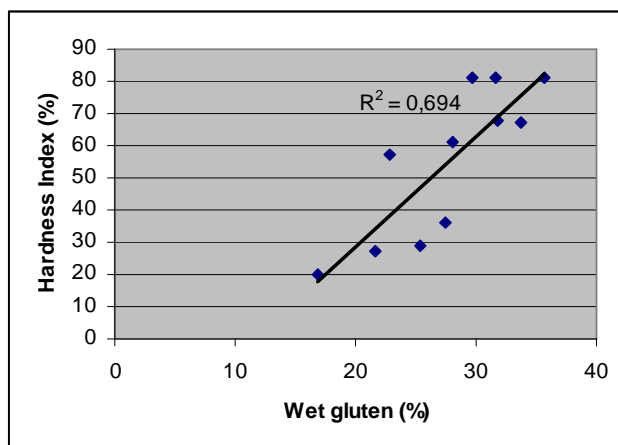


Figure 4. Connection between the HI and wet gluten

The associations were found in this study would help to better understand the technological aspects of wheat and flour quality as well as provide useful information to breeders to develop new, high quality hard or soft wheat varieties.

## REFERENCES

- ÁCS PÉTERNÉ, MATÚZ JÁNOS (2001): A szemkeménység mérési módszerének NIR készülékre történő adaptálása és felhasználása szegedi búza genotípusok szelekciójában (abstract in Hungarian), MTA, MÉTE, KÉKI 303. Tudományos Kollokvium 276. füzet, p. 6-7
- BEAN, S.R., CHUNG, O.K., TUINSTRA, M.R., PEDERSEN, J.F., ERPELDING, J. (2005): Evaluation of the Single Kernel Characterization System (SKCS) for Measurement of Sorghum Grain Attributes. USDA-ARS, Cereal Chem. 83(1), p. 108-113.
- GYIMES, E. (2004): Investigation of Relationship Among the Agro:physical Features of Wheat (*Triticum aestivum*) Kernel Varieties. PhD Thesys Mosonmagyaróvár (in Hungarian)
- GYIMES, E., SZABO P.B. (2008): Különféle típusú búzák aprózódási tulajdonságai, MTA AMB K+F Tanácskozás, ISBN 978-963-611-449-7, p. 51. o. (in Hungarian)
- MARTIN J.M., MEYER F.D., SMIDANSKY E.D., WANJUGI H., BLECHL A.E., GIROUX M.J. (2006): Complementation of the *pina* (null) allele with the wild type *Pina* sequence restores a soft phenotype in transgenic wheat. THEOR. AND APPLIED GENETICS 113 : 1563-1570.
- SZABÓ P.B., VEHA, A., GYIMES, E. (2005): Different Methods for Determining Kernel Hardness, SZTE SZÉF Tudományos Közlemények, p. 42-45, ISSN 1785-3419 (in Hungarian)
- VÉHA, A. (2005): Correlation between the kernel-hardness of different endospermium structure bread-wheats and flour quality parameters. Habilitation lectures (in Hungarian).

## OPTIMIZATION OF CHEMICAL FERTILIZERS APPLICATION AT ALOPECURUS PRATENSIS L., IN BANATPLAIN CONDITIONS

<sup>1</sup>VALENTIN LENESCHI, <sup>1</sup>LUMINIȚA COJOCARIU, <sup>2</sup>TAMÁS MONOSTORI,  
<sup>1</sup>DACIAN LALESCU

<sup>1</sup>Banat's University of Agricultural Sciences and Veterinary Medicine  
str. Calea Aradului nr. 119, Timișoara, Romania

<sup>2</sup>University of Szeged, Faculty of Agriculture,  
6800 Hódmezővásárhely, Andrásy út 15.  
valileneschi@yahoo.com

### Abstract – Optimization of chemical fertilizers application at *Alopecurus pratensis* L., in Banatplain conditions

Application of the fertilizers contributes to the enlargement of the biomass quantity and thus any effort is justified for the fodder plants where is aimed to obtain fodder volume (COJOCARIU L. ET AL., 2010).

The goal of this paper is to find a functional dependence of the dry matter production for the *Alopecurus pratensis* fodder based on different amounts of fertilizer, in order to obtain the technical optimum and also depending on the cultivation technology that is applied.

As biological material we used the variety Alpha of meadow foxtail, seeded in autumn at 12,5 cm and 25 cm distances between rows, by scattering method.

In the paper there are presented the results obtained in the species *Alopecurus pratensis*, cultivated at different distances between rows and fertilized with different doses of nitrogen. The largest yields of dry matter were recorded in all variants for the maximal dose of nitrogen (240 kg ha). However, the technical maximum of dry matter was recorded as following: 8219 kg ha<sup>-1</sup> for an amount of 214,65 kg ha<sup>-1</sup> nitrogen and for 12,5 cm distance between rows; 8091,8 kg ha<sup>-1</sup> for an amount of 216,25 kg ha<sup>-1</sup> nitrogen and for 25 cm distance between rows, and 8746 kg ha<sup>-1</sup> for an amount of 208,29 kg ha<sup>-1</sup> nitrogen and for sowing by scattering.

**Keywords:** *Alopecurus pratensis* L., nitrogen fertilizer, yield, dry matter.

## INTRODUCTION

Selection of a type of fodder plant for each ecological zone is essential to realize superior fodder productions for different species of animals (MOGA ET AL., 1983).

The extension of the species *Alopecurus pratensis* in cultivation is by major importance, both regarding the fodder productions, the quality of the obtained fodder, and because it has a high capacity of adaptation to the environmental conditions, having the capacity to resist in the short drought periods and in the humidity excess existing in the meadows, when the field is saturated (HANNAWAY, D.B. AND MCGUIRE, W.S., 1981; ROGER L. S., 2007).

Fertilization with chemical fertilizers in fodder graminaceous is beneficial, so that the meadow foxtail significantly responses to the nitrogen fertilizers, where the dry matter productions can reach significant values (BOHNERT D. ET AL., 2009).

## MATERIAL AND METHOD

The experiments were carried out at the Didactic and Experimental Station of the University of Agricultural Sciences and Veterinary Medicine of Banat from Timișoara.

The location of the territory is in West Plain of Romania, and the soil on which the

experiments were placed in a cambic chernozem.

The evolution of the climatic resources within the period 2009-2010 highlights the oscillatory character of them, with notable deviations comparing to the multiannual mean value.

**Table 1. The monthly mean temperatures (°C) registered at Meteorological Station of Timișoara (2009-2010)**

SPECIFICATION	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
2009	-1,1	1,4	6,6	14,7	18,0	20,1	23,1	22,9	19,0	11,6	7,3	3,2
2010	-0,3	2,8	6,7	12,0	16,6	20,5	23,1	22,5	16,2	9,2	9,3	0,7
Multi-annual means	-1,2	0,4	6,0	11,3	16,4	19,6	21,6	20,8	16,9	11,3	5,7	1,4

The temperatures recorded in the air and soil had high values. The monthly means of the air temperature exceeded the multiannual means, the mean temperature being over the multiannual mean (*Table 1.*). The precipitations fallen during the year of 2009 were fewer than in 2010, when the more abundant precipitations favoured the growth and the development of the meadow foxtail plants (*Table 2.*).

**Table 2. The monthly mean precipitations (mm) registered at Meteorological Station of Timișoara (2009-2010)**

SPECIFICATION	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
2009	28,3	25,4	48,2	22,8	44,8	110,9	40,4	28,4	4,8	80,4	102,1	79,4
2010	65,0	76,5	32,9	56,6	118	131,3	25,0	81,8	40,5	40,0	48,1	74,6
Multi-annual means	40,9	40,2	41,6	50,0	66,7	81,1	59,9	52,2	46,1	54,8	48,6	47,8

The biological material used during the two research years was the species *Alopecurus pratensis*, the variety Alpha. The culture was established every year, in autumn, in October, at 12,5cm and 25 cm distances between rows and by scattering sowing. The arrangement of the variants was in subdivided plots.

The fodder culture was fertilized with different doses of nitrogen fertilizer fractionally applied, namely: Doze 1- 60kg ha, Doze 2- 120kg ha, Doze 3- 180kg ha and Doze 4- 240kg ha.

In the paper there was analyzed the average of the dry matter yields recorded within two experimental years (2009-2010), in the meadow foxtail plants harvested in the moment of ear formation.

The production results were statistically processed. In numerous situations, the dependence between the effect and the cause is not possible to be linearly expressed, because each cause increase (fertilizer doses) is followed by a different increase of the effect (dry matter production). The effect of the fertilizers is greater for the first applied amounts and becomes lower for equal increases of the fertilizer.

For the sake of simplicity, in our statistical analysis, the quantity of nitrogen, the mean production of dry matter for *Alopecurus pratensis* under the influence of the nitrogen for 12,5cm, 25cm distance between rows respectively sowing by scattering were denoted by Azot, R12,5, R25, and Imp. respectively. The statistical analysis has been performed by STATISTICA 8 package .

## RESULTS

During the period 2009 respectively 2010 there was organized an experimental field which aimed to determine the production potential of the specie *Alopecurus pratensis*, being pursued the reaction of these plants at different doses of nitrogen fertilizer.

The minimal production of dry matter (6294 kg ha<sup>-1</sup>) was recorded in the unfertilized variant for 25 cm distance between rows, and the maximal production by 8714 kg ha<sup>-1</sup> was recorded in the variant fertilized with 240 kg ha<sup>-1</sup> by scattering sowing.

The goal of this paper is to find a functional dependence of the dry matter production of *Alopecurus pratensis* based on different quantities of nitrogen in order to get the technical optimum.

The following statistical analysis established the technical maximum of dry matter production of *Alopecurus pratensis* when different doses of nitrogen were applied.

A parabolic regression analysis of the *Alopecurus pratensis* dry matter production based on different quantities of nitrogen and a 12,5 cm distance between rows was performed (Figure 1). It was determined that the proportion of variance (46031731) was statistically significant (F=31325, df=1) for p value under 0,05 (95% confidence interval), where the F ratio provided the test of statistically significance (Table 3.).

**Table 3. Significance tests of regression coefficients of *Alopecurus pratensis* based on nitrogen and 12,5cm**

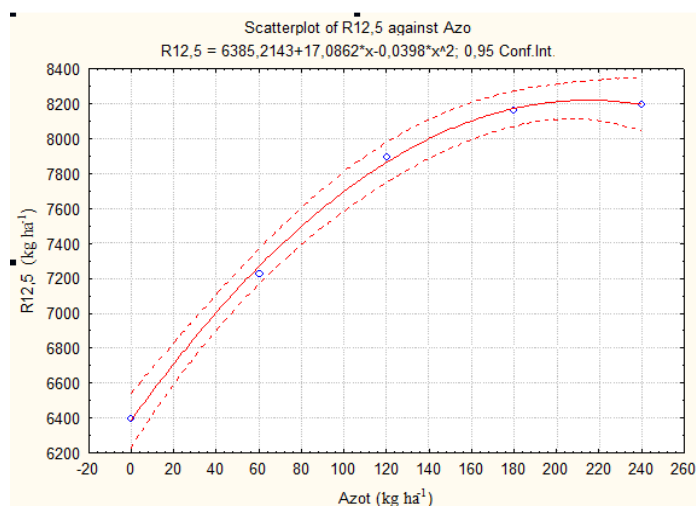
Effect	Univariate Tests of Significance for R12,5				
	SS	Degr. of Freedom	MS	F	p
Intercept	46031731	1	46031731	31325,67	0,000032
Azot	845613	1	845613	575,46	0,001733
Azot <sup>2</sup>	286858	1	286858	195,21	0,005084
Error	2939	2	1469		

The regression equation  $y=b_0+b_1x+b_2x^2$  was used to fit the best parabolic line to the data (Figure 1.). Thus the average dry matter production obtained under the above circumstances for *Alopecurus pratensis* in the experimental years, was expressed in terms of doses of nitrogen applied by the equation

$$R_{12,5} = 6385,2143 + 17,0862 \cdot \text{Nitrogen} - 0,0398 \cdot \text{Nitrogen}^2.$$

The strong positive linear correlation, after the linearization, was reported by the Pearson coefficient  $r=+0,99$  and determination coefficient  $r^2=0,9$ . The confidence intervals for the parabolic regression coefficients [6229,989; 6540,439], [14,022 ; 20,151] and [-0,052; -0,028] respectively were statistically significant. The maximum dry matter production of *Alopecurus pratensis* was estimated to 8219 kg ha<sup>-1</sup> for an amount of 214,65 kg ha<sup>-1</sup> nitrogen. This maximum (Figure 1.) was obtained as the local extremum of the quadratic function above and it was calculated by the vanishing of its first derivative.





**Figure 1: The effect of the nitrogen on the dry matter production in *Alopecurus pratensis* (12,5 cm)**

In the following it was performed a parabolic regression analysis of the *Alopecurus pratensis* production based on different nitrogen quantities and a 25 cm distance between rows (Figure 2.). It was determined that the proportion of variance (44622084) was statistically significant ( $F=13870$ ,  $df=1$ ) for p value under 0,05 (95% confidence interval), where the F ratio provided the test of statistical significance (Table 4.).

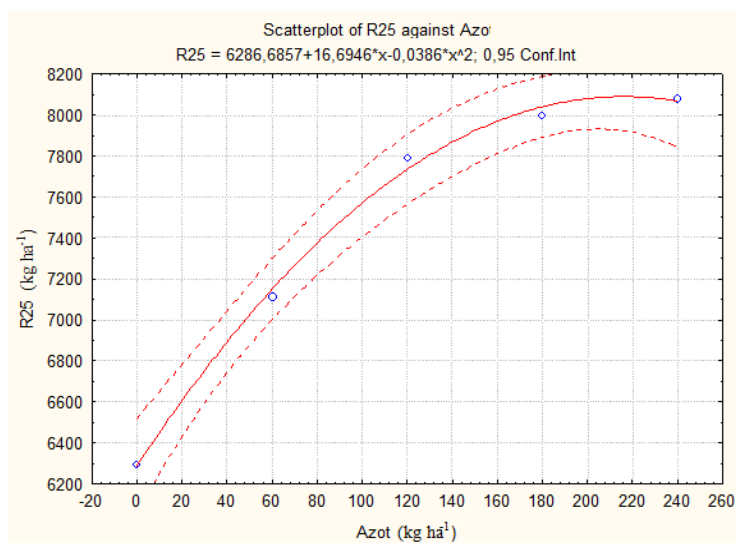
**Table 4. Significance tests of regression coefficients of *Alopecurus pratensis* based on nitrogen and 25 cm**

Effect	Univariate Tests of Significance for R25				
	SS	Degr. of Freedom	MS	F	p
Intercept	44622084	1	44622084	13870,90	0,000072
Azot	807301	1	807301	250,95	0,003961
Azot <sup>2</sup>	270911	1	270911	84,21	0,011667
Error	6434	2	3217		

The regression equation  $y=b_0+b_1x+b_2x^2$  was used to fit the best parabolic line to the data (Figure 2.). So the average dry matter production obtained under the above circumstances for *Alopecurus pratensis* in the experimental years, was expressed in terms of doses of applied nitrogen by the equation

$$R25 = 6286,6857 + 16,6946 * \text{Nitrogen} - 0,0386 * \text{Nitrogen}^2.$$

The strong positive linear correlation, after the linearization, was reported by the Pearson coefficient  $r=+0,99$  and determination coefficient  $r^2=0,99$ . The confidence intervals for the parabolic regression coefficients [6057,015; 6516,357], [12,160; 21,229] and [-0,057; -0,021] respectively were statistically significant. The maximum dry matter production of *Alopecurus pratensis* was estimated to 8091,8 kg ha<sup>-1</sup> for an amount of 216,25 kg ha<sup>-1</sup> nitrogen. This maximum (Figure 2.) was obtained as the local extremum of the quadratic function above and it was calculated by the vanishing of its first derivative.



**Figure 2. The effect of the nitrogen on the dry matter production in *Alopecurus pratensis* (25 cm)**

A parabolic regression analysis of the *Alopecurus pratensis* dry matter production based on different quantities of nitrogen and the sowing by scattering was also performed (Table 5.). It was determined that the proportion of variance in production (55162600) was statistically significant ( $F=73002$ ,  $df=1$ ) for p value under 0,05 (95% confidence interval), where the F ratio provided the test of statistically significance.

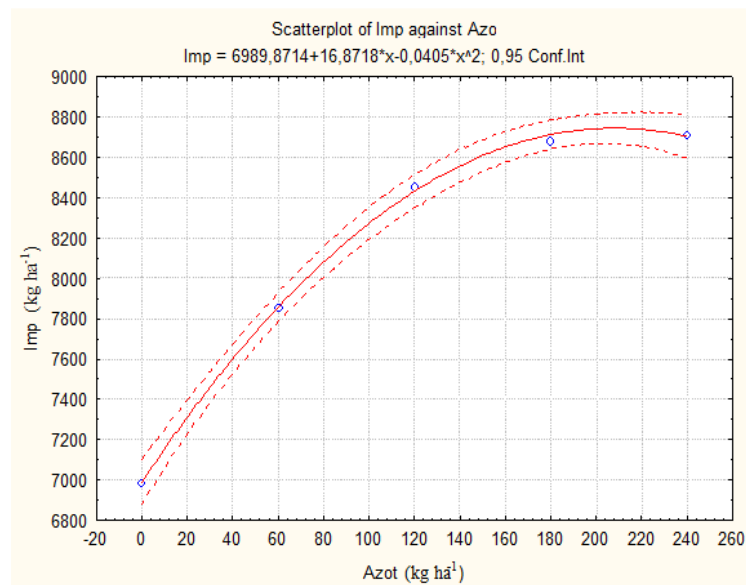
**Table 5. Significance tests of regression coefficients of *Alopecurus pratensis* based on nitrogen and Imp**

Effect	Univariate Tests of Significance for Imp				
	SS	Degr. of Freedom	MS	F	p
Intercept	55162600	1	55162600	73002,27	0,000014
Azot	824524	1	824524	1091,18	0,000915
Azot^2	298278	1	298278	394,74	0,002524
Error	1511	2	756		

The regression equation  $y=b_0+b_1x+b_2x^2$  was used to fit the best parabolic line to the data (Figure 3.). The average dry matter production obtained under the above circumstances for *Alopecurus pratensis* in the experimental years, was expressed in terms of doses of applied nitrogen by the equation

$$\text{Imp} = 6989,8714 + 16,8718 \cdot \text{Nitrogen} - 0,0405 \cdot \text{Nitrogen}^2.$$

After the linearization, the strong positive linear correlation was reported by the Pearson coefficient  $r=+0,99$  and determination coefficient  $r^2=0,99$ . The confidence intervals for the parabolic regression coefficients were [6878,561; 7101,182], [14,674;19,069] and [-0,049; -0,032] respectively. The maximum dry matter production of *Alopecurus pratensis* was estimated to 8746 kg ha<sup>-1</sup> for an amount of 208,29 kg ha<sup>-1</sup> nitrogen. This maximum (Figure 3.) was obtained as the local extremum of the quadratic function above and it was calculated by the vanishing of its first derivative.



**Figure 3. The effect of the nitrogen on the dry matter production in *Alopecurus pratensis* (Imp)**

## CONCLUSIONS

The production results recorded in *Alopecurus pratensis* depending on different nitrogen doses and different methods of sowing can be resumed as following:

By this study we obtained mathematical models regarding the functional dependency (quadratic functions) of the dry matter production in *Alopecurus pratensis* depending on the applied dose of nitrogen.

The maximum dry matter production of *Alopecurus pratensis* was estimated: to 8219 kg ha<sup>-1</sup> for an amount of 214,65 kg ha<sup>-1</sup> nitrogen and for 12,5cm distance between rows; to 8091,8 kg ha<sup>-1</sup> for an amount of 216,25 kg ha<sup>-1</sup> nitrogen and for 25cm distance between rows, and to 8746 kg ha<sup>-1</sup> for an amount of 208,29 kg ha<sup>-1</sup> nitrogen and for sowing by scattering.

The application of a larger dose is not justified. Whether we apply a smaller dose of nitrogen we could estimate the production that will be obtained.

## REFERENCES

- BOHNERT DAVID, RON TORELL, RAY ANGELL (2009): “Fertilization of Meadow Foxtail Dominated Flood Meadows”, Eastern Oregon Agricultural Research Center, University of Nevada, Reno;
- COJOCARIU L., (2010): “The tehcnical maximum of the main production characters depending on dose of cattle manure applied to italian ryegrass”, Romanian Journal of Grassland and Forage Crops, Cluj Napoca;
- HANNAWAY, D.B., MCGUIRE W.S. (1981): “Growing meadow foxtail for forage”. OSU Ext. Bull. FS264;
- MEAD R., R.N. CURNOW, A.M. HASTED (2002): Statistical Methods in Agriculture and experimental Biology”, 3rd Edition, Texts in Statistical Science, Chapman & Hall/CRC;
- MOGA, I., VARGA, P., KELLNER, E., BURLACU, GH., PAULIAN, FL., ULINICI, A., SIPOS, GH.,

(1983): “Plante furajere perene”. Edit. Academiei R.S.R., București;

PETERSEN R.G. (1994): “Agricultural Field Experiments. Design and Analysis”, CRC Press;

ROGER L. SHELEY (2007): “Tolerance of Meadow Foxtail (*Alopecurus pratensis*) to Two Sulfonylurea Herbicides Weed Technology”, pag.470–472, [www.http://oregonstate.edu/](http://oregonstate.edu/).

## THE CLASSIFICATION OF GENOTYPES ON THE QUANTITATIVE CHARACTERS AT *ALOPECURUS PRATENSIS* L., IN SIMIȘOARA CONDITIONS

<sup>1</sup>VALENTIN LENESCHI, <sup>1</sup>LUMINIȚA COJOCARIU, <sup>2</sup>TAMÁS MONOSTORI,  
<sup>1</sup>DACIAN LALESCU, <sup>1</sup>HORABLAGA MARINEL

Banat's University of Agricultural Sciences and Veterinary Medicine  
str. Calea Aradului nr. 119, Timișoara, Romania

<sup>2</sup>University of Szeged, Faculty of Agriculture,  
6800 Hódmezővásárhely, Andrásy út 15.  
valileneschi@yahoo.com

### ABSTRACT – The classification of genotypes on the quantitative characters at *Alopecurus pratensis* L., in Simișoara conditions

The increasing production of forage crops is the basis that can provide a modern animal husbandry. This is possible only through the existence of a biological material of great value on the one hand, and on the other hand, the existence of appropriate agricultural technology required to a superior capitalization of the biological potential (COJOCARIU L. AND LALESCU D.V., 2010).

The goal of this paper is to classify some biotypes of *Alopecurus pratensis* collected from spontaneous flora through the main morphological production characters (namely the shoot plant number, the leaf plant number, the plant height and the dry matter) emphasizing the correlations between these characters.

The biological material studied was the *Alopecurus pratensis* biotypes collected from Banat area. More precisely, there were studied *Alopecurus pratensis* biotypes around Remetea Mare Mare Topolovatu, Lugoj, Traian Vuia Sinersig, Buzias and Albina.

It was shown the similarities between Alpha and Sinersig biotypes; Topolovatu Mare, Buzias, Albina and Lugoj biotypes; Remetea Mare and Traian Vuia biotypes.

**Keywords:** *Alopecurus pratensis* L., biotypes, quantitative characters, correlations.

## INTRODUCTION

*Alopecurus pratensis* is a fodder plant very valuable due to its large productions and to the superior features which it gives to the fodder.

In a modern, sustainable agriculture, the animal husbandry occupies an important place, it assures a large part of the human food. The development of this field of agriculture depends on assuring the fodder necessities for the animal feeding (COJOCARIU L., 2005).

Knowing the biological particularities of the fodder plants represents a first step of the genetic and amelioration researches or of the technology researches, in order to increase the quantity and the quality of the fodders (BARON V.S. ET AL., 2000).

## MATERIAL AND METHOD

The experiment was placed in the vegetation house of the Didactic and Experimental Station of the University of Agricultural Sciences and Veterinary Medicine of Banat, Timișoara.

The biological material researched under aspect of morphological characters variability consisted of biotypes collected during the year of 2009 in Banat.

In the spring of the year 2010, the germinated seeds of the studied biotypes have been sowed in vegetation pots in a soil substrate of cambic chernozem, taken from the field of the research station.

The observations on the morphological characters (shrub weight, shoot number/shrub, number of green leaves/shrub, shrub height, dry matter percent) of the studied biotypes and of the control too, were made in the period of ear formation.

The cases of our statistical analysis were the Remetea Mare, Topolovatu Mare, Lugoj, Traian Vuia, Sinersig, Buzias and Albina biotypes. The variables GT, NrLa, NrFrT, HT, and SU analyzed denoted respectively shrub weight, the shoot number/ shrub, number of green leaves/shrub, shrub height and the dry matter respectively. The statistical analysis has been performed by STATISTICA 8 package.

## RESULTS

The results achieved under aspect of morphological observations that were performed put in evidence the productive capacity of the studied biotypes so that the weight of the largest shrub was found in the biotype from Sinersig (154,1g), and the weight of the smallest shrub was registered for the biotype from Traian Vuia (123,2g) comparatively to the control which had a mean weight by 163g.

The basic descriptive statistics are presented in *Table 1.* and the correlation matrix in *Table 2.* It was observed strong positive correlations between the variables GT, NrFrT and NrLa.

**Table 1: Descriptive statistics for the variables**

Variable	Descriptive Statistics					
	Mean	Median	Minimum	Maximum	Variance	Std.Dev.
GT	142,7875	146,6000	123,2000	163,7000	205,536	14,33651
NrLa	24,3500	24,0000	19,4000	31,3000	14,434	3,79925
NrFrT	138,0275	130,6250	95,6000	197,1900	1353,690	36,79253
HT	62,7375	63,1000	59,3000	65,2000	4,411	2,10030
SU	20,2312	19,9700	19,1600	21,5400	0,704	0,83928

**Table 2: Matrix of correlations for the variables**

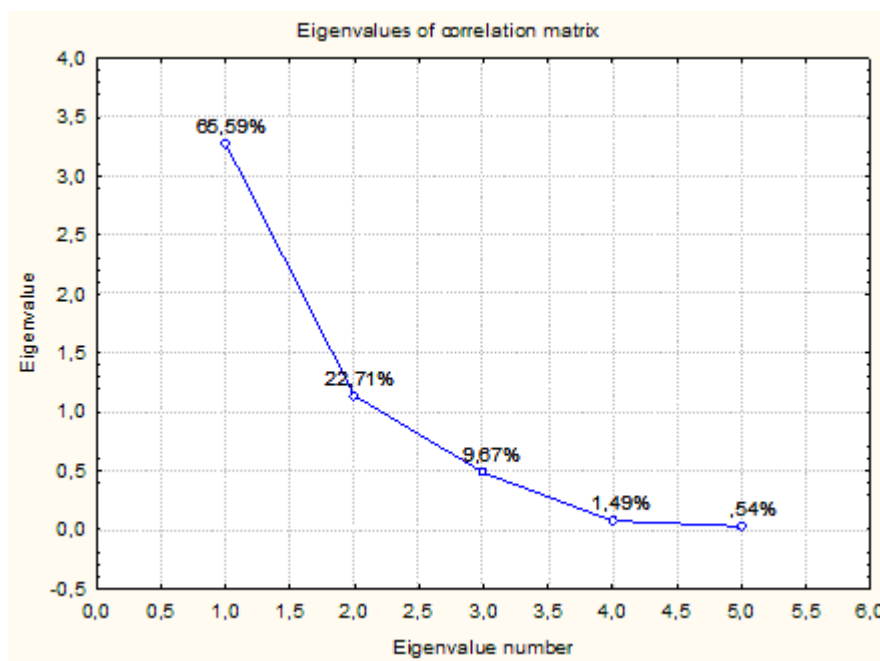
Variable	Correlations matrix				
	GT	NrLa	NrFrT	HT	SU
GT	1,000000	0,932619	0,929138	0,266271	-0,434140
NrLa	0,932619	1,000000	0,968898	0,234439	-0,564441
NrFrT	0,929138	0,968898	1,000000	0,263893	-0,495834
HT	0,266271	0,234439	0,263893	1,000000	0,149332
SU	-0,434140	-0,564441	-0,495834	0,149332	1,000000

Principal Component Analysis (PCA) has been performed on the 5 variables for the reference group with 8 cases. The results of PCA are shown in *Table 3.* to *Table 6.* and *Figure 1.* to *Figure 3.* The eigenvalues of the correlation matrix, the total variance (%), the cumulative eigenvalues, and cumulative variance (%) are shown in *Table 3.* There are 5 eigenvalues arranged in decreasing order, indicating the importance of the respective factors in explaining the variation of the data. Let us observe (*Figure 1.*) that the largest

eigenvalue (3,27) accounts for approximately 65,59% of the total variance and the second factor corresponding to the second eigenvalue (1,13) accounts for approximately 22,70% of the total variance, so the first and the second factors explain approximately 88,29% cumulative variance.

**Table 3: Eigenvalues of the correlation matrix and their total variance**

Value number	Eigenvalues of correlation matrix			
	Eigenvalue	% Total variance	Cumulative Eigenvalue	Cumulative %
1	3,279627	65,59254	3,279627	65,5925
2	1,135295	22,70590	4,414922	88,2984
3	0,483746	9,67491	4,898668	97,9734
4	0,074491	1,48983	4,973159	99,4632
5	0,026841	0,53682	5,000000	100,0000



**Figure 1: Eigenvalues of the correlation matrix**

Because the analysis is based on the correlation matrix, the results displayed in the *Table 4*. can be interpreted as the correlations of the variables with each factor. Thus we can conclude that the first component (corresponding to the first eigenvalue) is the linear combination

$$Y_1 = -0,52 * GT - 0,54 * NrLa - 0,53 * NrFrT - 0,15 * HT + 0,34 * SU$$

and the second component (corresponding to the second eigenvalue) is the following linear combination

$$Y_2 = 0,07 * GT - 0,01 * NrLa + 0,04 * NrFr + -0,82 * HT + 0,55 * SU.$$



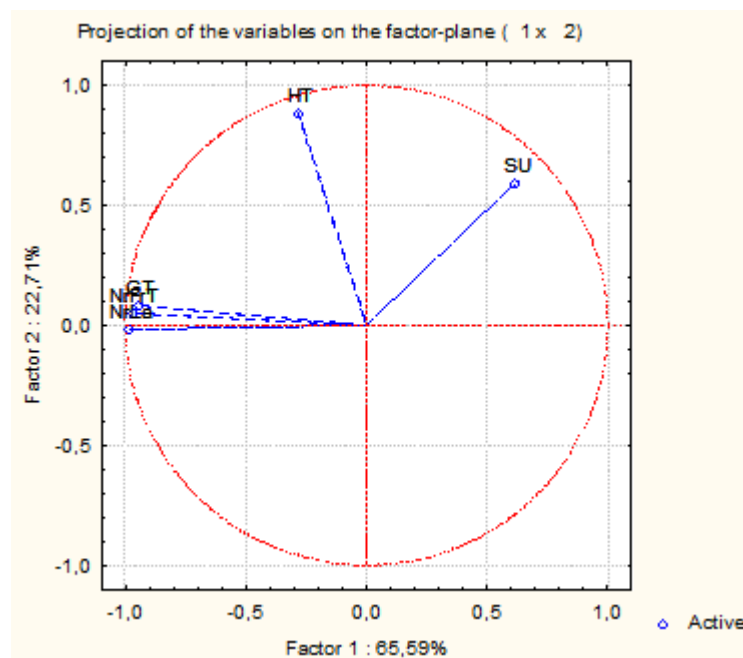
**Table 4: Eigenvectors of correlation matrix**

Variable	Eigenvectors of correlation matrix				
	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5
GT	-0,524558	0,078349	0,303060	0,784804	-0,104580
NrLa	-0,543484	-0,012094	0,129334	-0,309470	0,769402
NrFrT	-0,537143	0,044078	0,205599	-0,526089	-0,624895
HT	-0,157005	0,828742	-0,536797	0,019648	0,000259
SU	0,341014	0,552231	0,749003	-0,105617	0,081176

It can be noticed (*Table 5.* and *Figure 2.*) that the first factor is negative correlated with GT, NrLa, NrFrT and HT variables and positive correlated with SU variable. The second factor is negative correlated only with NrLa, and positive correlated with the other variables. The circle in *Figure 2.* provide a visual indication (scale) of how well each variable is represented by the factors  $Y_1$  and  $Y_2$ ; the closer a variable in this plot is located to the unit circle, the better is its representation by the current coordinate system. One interesting result shown in *Figure 2.* is that the variables are clustering, another proof of the correlation between the variables in the same cluster.

**Table 5: Factor coordinates of the variables**

Variable	Factor coordinates of the variables, based on correlations				
	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5
GT	-0,949962	0,083481	0,210784	0,214197	-0,017134
NrLa	-0,984235	-0,012886	0,089954	-0,084464	0,126053
NrFrT	-0,972753	0,046965	0,142998	-0,143586	-0,102378
HT	-0,284332	0,883026	-0,373352	0,005362	0,000042
SU	0,617567	0,588404	0,520945	-0,028826	0,013299



**Figure 2: Projection of the variables on the first two factor plane**

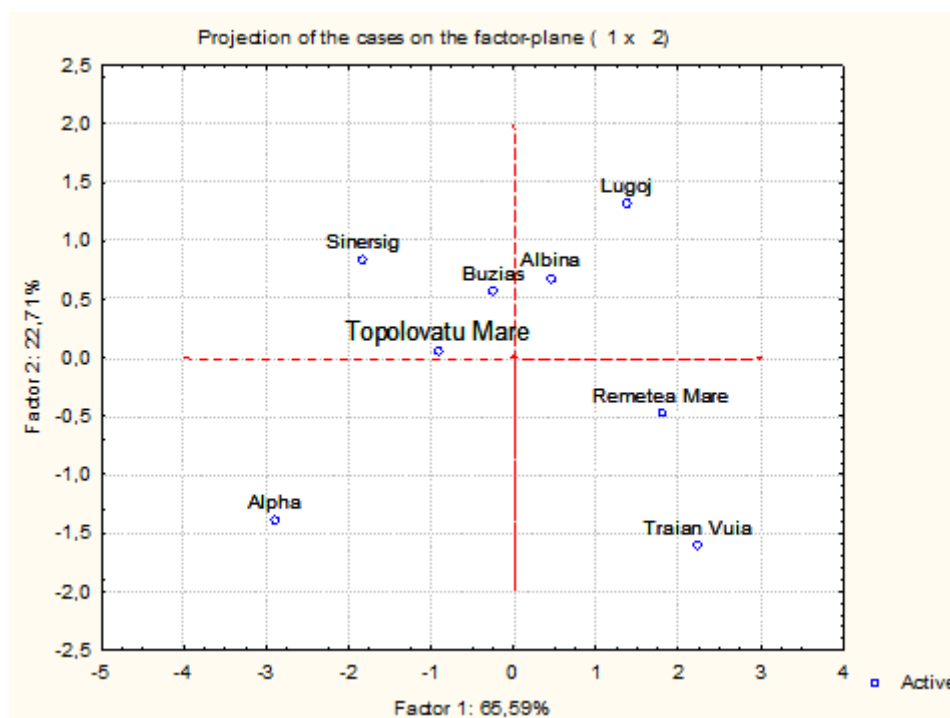


Table 6. reveals the coordinates of the observations corresponding to the new factors associated with the eigenvalues and eigenvectors of the correlation matrix. It can be noticed the relevance of the first two coordinates.

**Table 6: Factor coordinates of cases**

Case	Factor coordinates of cases, based on correlations				
	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5
Remetea Mare	1,79350	-0,47226	-0,332805	0,016599	0,073422
Topolovatu Mare	-0,91253	0,05624	-0,581012	0,209769	-0,034037
Lugoj	1,38544	1,31770	0,404670	-0,437573	0,122441
Sinersig	-1,82203	0,84017	-0,361397	-0,194298	-0,282037
Traian Vuia	2,23564	-1,60460	-0,085002	-0,074249	-0,154982
Buzias	-0,24079	0,56797	-0,874015	0,217813	0,193104
Albina	0,45934	0,68003	1,230015	0,414410	-0,064128
Alpha	-2,89858	-1,38525	0,599545	-0,152471	0,146216

The projection of the observations on the plane determined by the first two factors  $Y_1$  and  $Y_2$  is shown in Figure 3. It can be noticed the similarity of Alpha and Sinersig biotypes; Topolovatu Mare, Buzias, Albina and Lugoj biotypes. These similarities have been also highlighted by another method (Figure 4).



**Figure 3: Projection of the cases on the first two factor plane**

It was performed a classification of the analyzed biotypes by Ward's method in cluster analysis using the Euclidean distance. The biotypes Alpha and Sinersig; Topolovatu Mare, Buzias, Albina and Lugoj biotypes; Remetea Mare and Traian Vuia biotypes have formed clusters showing strong similarity between them (Figure 4).

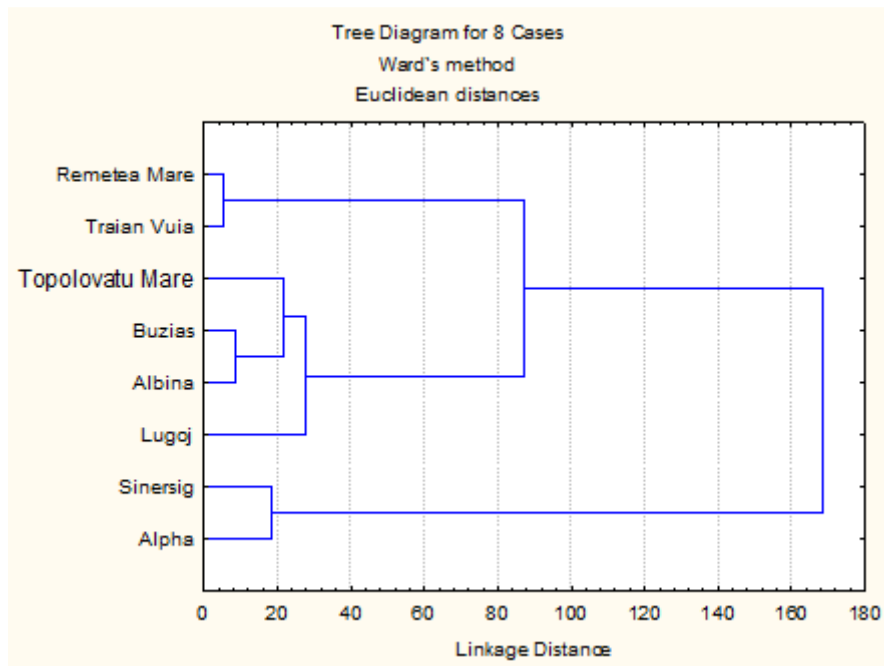


Figure 4: Dendrogram of the cases

## CONCLUSIONS

The statistical analysis above allow us to conclude that there are strong positive linear correlation (*Table 2.* and *Figure 2.*) between the number of shoots per plant, number of leafs per plant and plant weight..A visual evidence of the correlations mentioned above is also the clustering trend noticed in *Figure 2.* By the Ward method in cluster analysis using the Euclidean distance (*Figure 4.*), the similarities between Alpha and Sinersig biotypes; Topolovatu Mare, Buzias, Albina and Lugoj biotypes; Remetea Mare and Traian Vuia biotypes were pointed out.

## REFERENCES

- BARON V.S., DICK A.C., KING R.J., (2000): “Leaf and Steam Mass Characteristics of Cool-Season Grasses Grow in the Canadian Parkland”, *Agronomi Journal* v.92, p54-63;  
COJOCARIU LUMINIȚA, (2005): “PRODUCEREA FURAJELOR”, EDITURA SOLNESS TIMISOARA;  
COJOCARIU LUMINIȚA, V.D. LALESCU, (2010): “Plantele furajere si evaluarea lor prin metode statistico – matematice”, Editura Eurobit Timisoara;  
HORABLAGA M., MOISUC A., (2003): “Variability of dry substance percentage of some byotypes of *Alopecurus pratensis* L. from the Banat’s territory”;  
MEAD R., R.N. CURNOW, A.M. HASTED (2002): “Statistical Methods in Agriculture and experimental Biology”, 3rd Edition, Texts in Statistical Science, Chapman & Hall/CRC;  
PETERSEN R.G. (1994): “Agricultural Field Experiments. Design and Analysis”, CRC Press;

## **REDUCED FUSARIUM TOXIN BY PERITEC TECHNOLOGY**

**VÉHA, A., SZABÓ, P. B., GYIMES, E.**

University of Szeged, Faculty of Engineering, 6724 Mars square 7. Szeged, Hungary  
e-mail: szpb@mk.u-szeged.hu

### **ABSTRACT - Reduced fusarium toxin by peritec technology**

We modelled the PeriTec technology with a laboratory size, batch-operating, horizontal debranning machine by SATAKE. Applying different treatment times we varied the rate of debranning.

As for DON toxin contamination, a continuous decrease can be found by increasing the rate of debranning. The total flour obtained during grinding the unpolished wheat contains 0.25 mg/kg toxin on average, which decreases to 0.11 mg/kg if we apply the highest, 40s polishing.

During our work we focused mainly on the toxin contamination of the grains and their milling products, as well as on other characteristics that are important with regard to milling processing.

As a result of debranning, the toxin content of the grinding fractions decreased, which justifies that the PeriTec method is suitable for the reduction of toxin contamination.

On the basis of the experimental results, the optimum peeling was the peeling which resulted in a weight loss of about 6%, the toxin content significantly decreased (from 1,59 mg/kg to 0,94 mg/kg).

**Keywords:** wheat, PeriTec technology, fusarium toxin

## **INTRODUCTION**

Nowadays, more and more attention is paid to micotoxin contamination in the food safety considerations of wheat, as an essential nutrient raw material, in particular to the toxins produced by fusarium fungi (Zomborszky, 2004; Scott, 1990; Egmond, 1984; Szeitzné, 2009). During our experiments we dealt with the laboratory modelling of a new milling surface treatment called PeriTec technology to find out to what extent this method can reduce toxin contamination.

The fungi causing the infection and most of the harmful toxins they produce are concentrated in the bran of the grain, thus the intensive surface cleaning, the so-called debranning operation could allow the reduction of contamination in the milling technology (Téren et al., 1990). The essence of the PeriTec technology - originally developed by SATAKE, a Japanese company, to clean rice - is that it gradually removes the bran layers of the grain by mechanical means before further processing (Gold, 2005).

We carried out our experiments using a naturally contaminated wheat lot. We modelled the PeriTec technology with a laboratory size, batch-operating, horizontal debranning machine by SATAKE. Applying different treatment times we varied the rate of debranning.

We studied how the physical parameters of wheat grain developed (kernel size, kernel hardness, ash content) as well as the rate of grain fracture. After peeling we ground the wheat samples in laboratory mills. We determined DON toxin content of all the resulting fractions with competitive Elisa method.

## MATERIALS AND METHODS

We carried out our experiments using a wheat plot from Gabonakutató Ltd, Szeged, naturally contaminated with fusarium.

We modelled the PeriTec technology with a laboratory size, batch-operating horizontal debranning machine by SATAKE (*Figure 1.*).

The main part of the equipment is a cylindrical working space delimited by a perforated plate. In this working space/area there is a horizontal-spindle, corundum-covered grinding wheel rotating (Monda et al., 1990). The operation of the machine is batch-type; 200g of wheat can be treated at a time. We inject the samples into the treatment area through the inlet. The rate of polishing can be altered by changing the treatment time applied. After the debranning operation we open the latch put/located at the bottom of the working space and the kernels fall into the central container, while the removed parts of the hull get into the two lateral chambers.

After conditioning the samples to a moisture content of 15%, they were subjected to different levels of rubbing applying 10, 20 and 40 s operation times.

We studied the development of the physical parameters of the wheat grains, as well as the rate of grain breakage. We determined the ash content of the samples according based on MSZ 6367/15-84. We used a Perten SKCS 4100-type instrument to measure kernel hardness.

Kernel length, width and thickness were determined with a digital calliper using 100 kernels per sample. We measured the rate of broken kernels using a 50 g sample manually sorted and separated.

After polishing the wheat samples were ground using a Quadrumat Senior type laboratory mill made by Brabender. During milling there were four fractions: 1. flour, 2. flour, fine bran and coarse bran.

We determined the DON toxin content of the base material and of all the fractions obtained during polishing and grinding with R-Biopharm RIDASCREEN FAST DON competitive ELISA test.



**Figure 1. SATAKE machine**

## RESULTS AND DISCUSSION

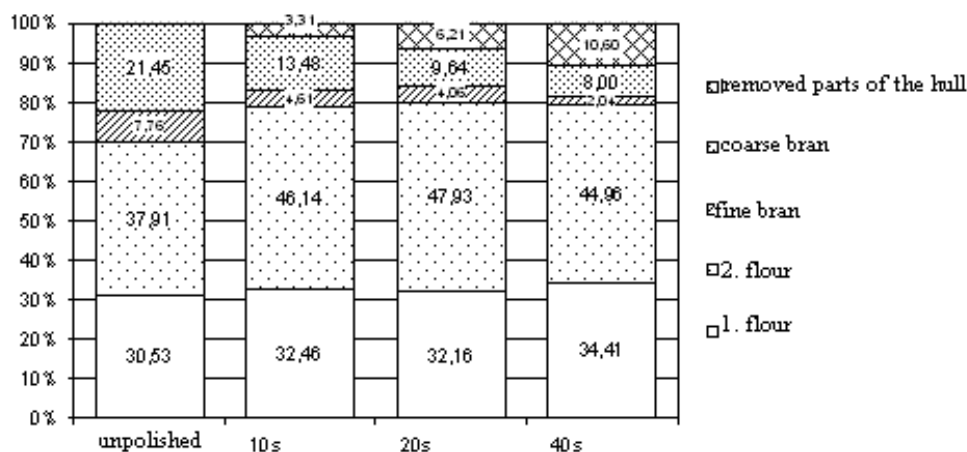
The development of the physical parameters of wheat as a result of peeling can be seen from *Table 1*.

**Table 1. Development of the measured characteristics of wheat as a result of debranning**

	Width (mm)	Length (mm)	Thickness (mm)	Kernel hardness (HI)	Broken grains (%)
unpolished wheat grains	3,25	6,64	2,86	70,49	2,32
10s polished wheat grains	3,22	6,53	2,72	71,77	4,01
20s polished wheat grains	3,24	6,53	2,69	69,59	5,12
40s polished wheat grains	3,13	6,38	2,55	70,85	9,28

From the specific grain dimensions thickness decreased to the highest degree as a result of rubbing. This thickness decrease may mean that the ventral furrow becomes shallow and thus the quantity of the contamination stuck in it also decreases. The kernel hardness index did not change significantly, however, the rate of broken grains in the lot increased significantly as a result of the strong mechanical impact applied during the operation.

*Figure 2.* shows the quantitative ratio of the fractions obtained during debranning and the subsequent grinding.



**Figure 2. Quantitative ratio of the obtained fractions**

The flour yield increased significantly with the application of the peeling operation, and the higher and higher rate of debranning resulted in the reduction of by-product (brans) rates obtained through grinding.

Figure 3. shows the total flour characteristics obtained during milling.

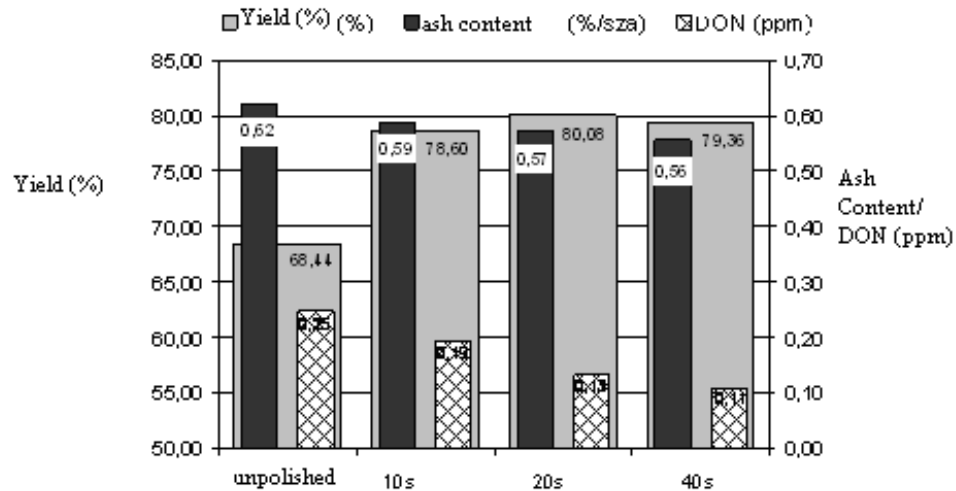


Figure 3. Rate of yield, ash content and toxin contamination of total flour

The flour yield increased, the value of the ash content – used to characterize the hull content of flour – decreased, which means a better flour quality in milling industry, and also the increase of the rate of white flour obtainable as a result of this technology. The 20 s polishing operation resulted in the best flour yield.

As for DON toxin contamination, a continuous decrease can be found by increasing the rate of debranning. The total flour obtained during grinding the unpolished wheat contains 0.25 mg/kg toxin on average, which decreases to 0.11 mg/kg if we apply the highest, 40 s polishing.

Figure 4 shows the DON toxin content of all the obtained fractions. The toxin contamination of the wheat grains and the grinding fractions gradually decreased as a result of debranning. The very high toxin content of the removed parts of the husk indicates that toxins are concentrated in the outer husk layers. Although the DON content of the base (material) wheat was relatively low (0.74 mg/kg), the DON content of the removed materials was about 4 mg/kg, which exceeds all the hygienic limits.

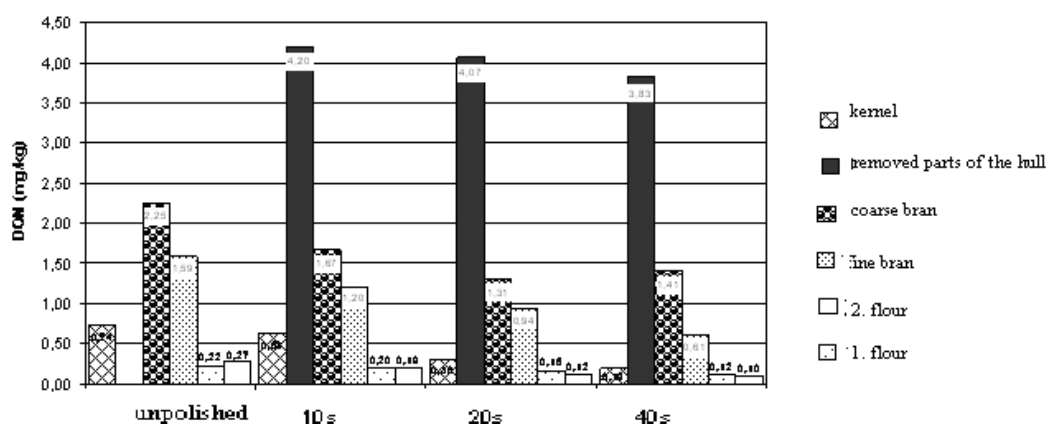


Figure 4. DON toxin content of the debranning and grinding fractions

During our work we focused mainly on the toxin contamination of the grains and their milling products, as well as on other characteristics that are important with regard to milling processing.

## CONCLUSIONS

As a result of debranning, the toxin content of the grinding fractions decreased, which justifies that the PeriTec method is suitable for the reduction of toxin contamination.

On the basis of the experimental results, the optimum peeling was the peeling which resulted in a weight loss of about 6%:

- the toxin content significantly decreased (from 1,59 mg/kg to 0,94 mg/kg),
- the flour yield increased (from 70% to 80%),
- the rate of grain fracture remained within an acceptable level.

Despite the fact that the toxin content of the experimental wheat sample was rather low, 0,74 mg/kg, we got quite high values of toxin contamination, about 4 mg/kg, in the removed bran, which significantly exceeds the allowed rate. This result draws special attention to the importance of the surface cleaning of crops before milling and the significance of the debranning technology we studied.

## REFERENCES

- EGMOND, H.P. (1989): *Mycotoxins in dairy products*; Elsevier Science Publishers Ltd; Essex
- GOLD M. (2005): Gabonaelőkészítés PeriTec eljárással, *Molnárak lapja* 110. évf. 2005. 1-2 sz., (in Hungarian)
- MONDA S., MOSONYI Á. TÓTH J. (1990): Gabonaipari technológiák, *Kertészeti és Élelmiszeripari Egyetem Élelmiszeripari Kar, Budapest*, (in Hungarian)
- Scott, P. M. (1990): Trichotecenes in grains. *Cer. Foods World* 35, p. 661-666.
- SZEITZNÉ SZABÓ M. (2009): Gabonaalapú élelmiszerek fuzáriumtoxin szennyezettségének csökkentési lehetőségei, *Magyar Élelmiszer-biztonsági Hivatal tájékoztatója* (in Hungarian)
- TÉREN J., DRASKOVICS I., NOVÁK E. (1990): Mikotoxinok, toxinogén gombák, mikotoxikózisok. *Magyar Élelmezéstudományi Egyesület* (in Hungarian)
- ZOMBORSZKYNÉ KOVÁCS M. (2004): A penészgombák toxinjainak állategészségügyi vonatkozásai. *MezőHír, Mezőgazdasági Szaklap*, VIII. évfolyam 2004 február (in Hungarian)

## INFLUENCE OF NICKEL IN SOIL

**VERA POPOVIC<sup>1</sup>, JELA IKANOVIĆ<sup>2</sup>, DANICA MLADENOVIC<sup>1</sup>, GORDANA DOZET<sup>3</sup>, VOJIN  
DUKIĆ, SNEŽANA JAKŠIĆ<sup>1</sup>, NADA GRAHOVAC<sup>1</sup>**

<sup>1</sup>Institute of Field and Vegetable Crops, M. Gorkog 30, 21 000 Novi Sad, Serbia

<sup>2</sup>Faculty of Agriculture, Nemanjina 6, 11 081 Beograd - Zemun, Serbia

<sup>3</sup>Megarend University, Faculty of Biofarming, M. Tita 39, 24 300 Backa Topola,  
Serbia

vera.popovic@ifvcns.ns.ac.rs

### **ABSTRACT - Influence of nickel in soil**

The objective of this investigation has been to study consequences of soil pollution with nickel in five locations in the municipalities of Sremska Kamenica, Ledinci and Beocin. The analysis of soil samples collected in the five locations has shown that the percentage of nickel differed from location to location. Nickel contamination was registered in 60% of the analyzed sites. A possible nickel polluter in this area is the cement factory in Beocin (CFB). The intensity of nickel contamination of soil decreased progressively with the distance of the sampling sites from the cement factory in Beocin.

**Key words:** Srem, CFB, environmental protection, emission, nickel, soil

## INTRODUCTION

Highly industrialized countries are prone to high contamination with heavy metals in some areas or regions. Study of the presence of heavy metals in agroecological systems requires a multidisciplinary approach. Accumulation of heavy metals can significantly impair the ecological balance in nature.

Soil is a vital ecological and agricultural resource and it should be protected from further degradation. The rapid increase in the global population brings a corresponding increase in food demand. On the other hand, the intensified soil contamination with heavy metals caused by anthropogenic factors can reduce crop yields and quality of agricultural produce. Knowledge of factors that affect the behavior and accessibility of heavy metals in soil is of prime importance. A total content of heavy metals in a soil is the sum of metal inputs from several sources: parent material, precipitation, fertilizers, agrochemicals, organic and inorganic pollutants minus the amount of metals removed with crop yields, leaching and volatilization (KASTORI, 1997).

Heavy metals in soil are either formed by geochemical processes or are introduced from numerous external sources of contamination. Anthropogenic sources of heavy metals may be primary, e.g., heavy metals added to soil by fertilization, or secondary, when heavy metals released from nearby industrial facilities are transmitted by air. Ni is in the 24 place regarding its importance. Ni concentration is estimated to vary, depending on rock type, between 2 and 3600 mg/kg. Highest Ni concentrations are found in pyroxenes, acidic volcanic rocks contain less Ni, and particularly low Ni concentrations are found in alkaline and sedimentary rocks (BOGDANOVIĆ ET AL. 1997). According to BOWEN (1979), Ni persists in the soil for 1000-3000 years. The wide persistence range is due to differences of soil. In general, soil pollution with heavy metals is a long-term problem.



Degree of pollution of soils, especially with heavy metals, and potential risks of this pollution on safe food production have been extensively investigated (DAVIES ET AL., 1979, SEKULIĆ ET AL., 1999, PROTIC, 2004, POPOVIĆ ET AL., 2008, 2009.). The results indicated that about 5% of the soils analyzed so far fall in the category of very high risk, with Ni, Cr and Pb being the most common pollutants (PROTIC, 2004). Knowledge of soil status is a key factor in the planning and production of safe food (SEKULIĆ ET AL., 1999).

We have investigated the basic soil chemical properties and total Ni content, in order to establish potential risks for agricultural production.

## MATERIALS AND METHODS

The subject of this investigation were soils from the municipality of Srem. The paper deals with selected samples of arable land. Soil samples of, typically of the chernozem soil, have been taken for laboratory analyses. Samples were taken from the depth of 0-30 cm and they were analyzed for the following fertility parameters in laboratories of Institute of Field and Vegetable Crops in Novi Sad: pH value of soil suspension in KCl, potentiometric method; free CaCO<sub>3</sub> content - calcimeter by Scheibler; humus content - Tjurin's method; available phosphorus (extraction with ammonium lactate - AL method); phosphorus content determined by the; spectrophotometric method; available potassium (extraction with ammonium lactate - AL method); potassium content determined by flame photometry. After drying and grinding, soil samples were analyzed for total Ni content by the AAS method, after digestion with concentrated HNO<sub>3</sub> and H<sub>2</sub>O<sub>2</sub>.

These data were systematized by the given statistical and mathematical methods. Certain occurrences are presented in the form of tables.

## RESULTS AND DISCUSSION

The results of chemical analyses showed that the analyzed soils had retained their original basic chemical properties. The analyzed samples belonged to the class of slightly alkaline to moderately alkaline soils containing free calcium carbonate (*Table 1.*).

Humus content in the soil was low, ranging from 1.45% to 2.83%, while nitrogen content was medium, except at one site (0.098%). Available phosphorus ranged from medium, high to very high. Fertilization without prior soil analysis led to a situation that 60% of the soil samples belonged to the classes of high and very high content of available phosphorus (*Table 1.*). For the soils with extremely high contents of available phosphorus it is recommended to omit fertilization from one to three years while keeping track of the level of microelements.

**Table 1. Chemical properties of soil**

No.	pH in 1M KCl	pH in H <sub>2</sub> O	CaCO <sub>3</sub> %	Humus %	N %	P <sub>2</sub> O <sub>5</sub> mg/100g	K <sub>2</sub> O mg/100g
1	7.37	8.22	5.86	2.83	0.187	36.2	90
2	7.40	8.51	11.34	1.45	0.098	12.3	31
3	7.40	8.46	11.71	2.00	0.132	11.2	45
4	7.35	8.38	10.88	2.15	0.141	48.1	47
5	7.29	8.36	13.39	2.06	0.136	27.5	47

These high variations in phosphorus content across a relatively small research area are an indication of excessive application of phosphorous fertilizers. The anthropogenic impact on soil phosphorus content is therefore evident.

All investigated sites were found to have high to very high levels of available potassium, except in one location where potassium content has reached a toxic level that is not safe for the production of food, amounting to 90 mg/100g soil. Clearly, potassium fertilization can be safely and significantly reduced in the investigated area. A large range between minimum and maximum values of available potassium indicate a high influence of the anthropogenic factor on soil fertility. Results of soil analysis for total Ni content are shown in *Table 2*.

**Table 2. Total soil Ni content (mg/kg) in the analyzed locations (digestion with HNO<sub>3</sub> and H<sub>2</sub>O<sub>2</sub>)**

No.	Location	Description of location	Ni (mg/kg)
1	Sremska Kamenica	Mišeluk, 500m from the tunnel, close to the intersection	40.58
2	Sremska Kamenica	On the road to Popovica, in front of Mošina Vila, Fruškogorski Put St. 3	<b>52.41</b>
3	Ledinci	On the right hand side of the road towards the Danube, opposite the house no. 60	48.27
4	Rakovac	Salaksija , over housing area	<b>85.91</b>
5	Beočin	Exit of the Beocin roundaboutroad, 1.5 km, uphill, a plot to the right of the road	<b>112.48</b>
LSD		0.05	<b>7.21</b>
		0.01	<b>9.48</b>

The analysis of soil samples collected in the five locations has shown that the percentage of nickel differed from location to location. The results presented in *Tables 2. and 3.* clearly show that 60% of the analyzed sites were contaminated with nickel. The high difference between the minimum and maximum values of soil Ni indicates that its origins are not uniformly distributed across the analyzed area. Ni content statistically significantly decreases with further distancing from cement factory in Beočin (*Table 2.*).

**Table 3. Percentage of Ni in relation to MAC**

Parameter	Ni percentage
Average value	<b>67.92</b>
Minimum value	40.58
Maximum value	<b>112.48</b>
MAC	<b>50</b>
<b>Percentage of measurements exceeding MAC</b>	<b>60</b>

Ni content in soil may have geochemical origin, coming from parent material, or there is another source of Ni emission. In this case we have grounds to believe that the cement factory in Beočin is the source of Ni emission. This hypothesis is supported by the fact that the intensity of nickel contamination of soil decreases progressively with distance of the sampling sites from the factory.

## CONCLUSION

For production of quality food it is crucial to have good knowledge of soil properties, to be able to correct them by applying proper cultivation practices in order to ensure satisfactory crop yield and quality. The general situation found in the investigated area demonstrates strong anthropogenic influence on basic soil properties and a necessity to instruct the local farmers about basics of fertilizer application.

The conducted investigation indicated clearly of presence of heavy metals in the analyzed soils. Ni content statistically significantly decreases with further distancing from cement factory in Beočin. Although the soils in this area are only moderately degraded, they deserve due attention. Efficient elimination of industrial emissions and waste is a crucial factor for maintaining a healthy environment.

## REFERENCES

- BOGDANOVIĆ, DARINKA, UBAVIĆ, M., HAĐŽIĆ, V. (1997): Teški metali u zemljištu, Poljoprivredni fakultet i Naučni institut za ratarstvo i povrtarstvo, Novi Sad, Srbija, 97-100.
- BOWEN, H.J. (1979): Environmental Chemistry of the Elements, Academic Press, London, 1977, 50-55.
- DAVIES B.E., CONWAY, D., HOLT, S. (1979): Lead pollution of London soils: a potential restriction on their use for growing vegetables. *J. Agric. Sci. Camb.*93: 749-752.
- KASTORI R. (1997.): Teški metali u životnoj sredini, Poljoprivredni fakultet, Institut za ratarstvo i povrtarstvo, Novi Sad, Srbija, 97-102.
- POPOVIĆ VERA, SEKULIĆ, P., BALEŠEVIĆ-TUBIĆ, SVETLANA, ĐUKIĆ, V., DOZET, GORDANA (2008): Influence of traffic and emission to soil and wheat lead content, Proceedings, Eco-Conference, Novi Sad, Serbia, 67-72.
- POPOVIĆ VERA, ĐUKIĆ, V., DOZET, GORDANA (2009): Distribution and accumulation of lead in soil and wheat, Proceedings, The Second Joint PSU-UNS International Conference on BioScience, Novi Sad, Serbia; 292-297.
- PROTIĆ, N., MRVIĆ, V., BREBANOVIĆ-KRAMARŠIĆ, BRANKA, NIKOLOSKI, M. (2004): Mogućnost proizvodnje zdravstveno bezbedne hrane na nekim kalkokambisolima zapadne Srbije, Tematski zbornik, EKO-konferencija, Zdravstveno bezbedna hrana, Novi Sad, 89-95.
- SEKULIĆ, P., BOGDANOVIĆ, DARINKA, UBAVIĆ, M. (1999): Magnezijum u zemljištima Vojvodine; Zbornik radova, Naučni institut za ratarstvo i povrtarstvo, Novi Sad, Srbija, 33-38.
- SEKULIĆ, P., LAZIĆ, BRANKA, HAĐŽIĆ, V. (1999): Zaštita, uređenje i korišćenje zemljišta prigradskih i gradskih naselja. Monografija: Zaštita životne sredine gradova i prigradskih naselja, Novi Sad, Srbija, str. 299-305.

## **OPPORTUNITIES FOR IMPROVEMENT OF TOURISM AND AGRI-BUSINESS IN ROMANIA (CASE STUDY VÂRTOP ARIEȘENI "APUSENI MOUNTAINS)**

**UNGUREANU GEORGE<sup>1)</sup>, CHIRAN AUREL<sup>1)</sup>, GÎNDU ELENA<sup>1)</sup>, BREZULEANU STEJAREL<sup>1)</sup>,  
CIUREA ION VALERIU<sup>1)</sup> DUDAȘ ANCA<sup>2)</sup>**

University of Agricultural Sciences and the Veterinary Medicine of Iași;

ungurgeo@uaiasi.ro. ; ungurgeo@yahoo.com

Aleea Mihail Sadoveanu nr. 3, Iași, 700490, România

<sup>2)</sup>University of Oradea, Romania

iulia\_dai@yahoo.com

### **ABSTRACT - Opportunities for improvement of tourism and agri-business in romania (case study vârtop arieșeni "apuseni mountains)**

Today we cannot talk about one agricultural household economy, which are based just on agriculture. The diversification process and integration of more economic branch give essential change in agricultural household economy structure in the life of the rural and the habitants of this. Among a lot of activities that are presented now in mountain region of Romania one important role and with expansion tendency are represented by Agri-tourism activity. The initiation of agro tourism activity at one pension implied assimilation of new knowledge regarding a new domain, the family accumulation, during the process, professional experience in other areas than agriculture or leather manufacture (already known and exploited). In order to make it diverse and efficient, the agrotourism activity at the level of studied farms should respect the following:

- Elaboration, at the locality level (Vârtop Arieșeni "Apuseni Mountains) of a small touristic guide (at the tourists disposal), which should contain: the presentation of the area, the map of the area, possibilities of hiking, museums, marks, beauty spots, springs etc., which must give the tourists complete information about the offer, as well as about the way in which they can integrate;
- Improvement of personal touristic folder, by its printing in more languages of international use;
- Hoping that the agrotourism will develop, more and more, at the analysed farm, we suggest the organization of information and proposals of diversification in the agrotourism activity of the farm, things which should be given to tourism agencies through different tourism intermediaries in the whole country.

Analysing the current situation, we can assert that agrotourism is developing in satisfying conditions in Vârtop Arieșeni "Apuseni Mountains.

**Key words:** pension, agrotouristic activity, management, traditional.

## **INTRODUCTION**

Currently, there is striking tendency for people to spend their free time traveling, searching or by visiting towns and villages in the home country or other countries to know people and places or to seek treatment. How the influence of distance-time factor was reduced significantly by the modernization of transportation and tourism - as a way to spend enjoyable leisure time - has seen a boom unprecedented as one of the most remarkable features of the modern era (FLORINE BRAN, 2008).

Agri-tourism can be a feasible solution for creating additional jobs in all peasant households in rural areas (plains, hills and mountains), generating significant additional revenue. Travel services firm, offered traditional hospitality with a touch of the peasant and professional competence achieved through a special training can be combined with

agricultural activities in the most efficient way within the individual farm, creating a new type rural economy, "Agrotourism economy" (BETEILLER, R., 1996., M. BOYER, 1982). Vârtop-Arieșeni area is located in northwestern Romania, the counties interference Bihar to Alba, near the center of the Apuseni Mountains is a beautiful area with scenery exception, which makes it sought after by tourists in recent years and accounts for a large development. But to characterize this area as being beautiful is too little, as the painter said Stephen Luchian in 1909 "beauty is a mere word which says nothing of the dull landscape splendor." Although it has a historic and tourist potential and exceptional realities show that the area is too little Arieșeni Vârtop-monetized, there are important resources for the revitalization of tourism development and tourism for the benefit of the complex.

## MATERIAL AND METHOD

The case study was done in the Apuseni Mountains Vârtop-Arieșeni and consisted of designing a public opinion survey, which aimed to analyze opportunities for improving tourism and rural tourism in the area studied.

Each question in the survey represents an indicator. Selection was based on the existence of questions or assumptions of a theory of social phenomena studied. Special attention was given to building responses involving both scales can Bishops-tion, as well as the measurement of attitudes, taking into account the views that we started to get to attitudes. In developing the questionnaire, were observed several rules that have sought to provide answers to questions and a consistent form, allowing their correct capitalization: the questions refer to the opinions and not facts, the question must be to the point, short and placed in an appropriate language to be accessible, the question should provide all possible answers, and investigator in the field should not favor any of the answers tone or hue, the questions should be made with tact and a certain bias towards the subject for not etc.-and cause unwanted reactions.

The questionnaire included 23 questions developed and administered on a sample of 30 owners of guesthouses and hotels in the area studied.

## RESULTS

By analyzing the responses of subjects, have revealed the following:

Regarding the category of accommodation establishments were interviewed 39 owners of guesthouses in categories I, II and III and an owner of hotel, three star category (*fig.1*).

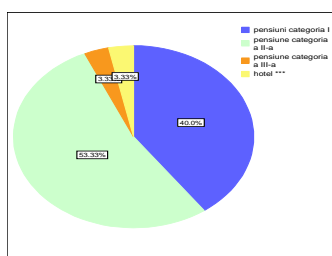


Figure 1. Structure of interviewed persons according to the guesthouses or hotel categories

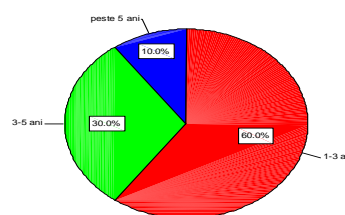


Figure 2. The age of the accommodation touristic units on the market

Of the total respondents, 40% have accommodation category I, 53.3% have accommodation category II, category III 3.3% and 3.3% had a three star hotel.

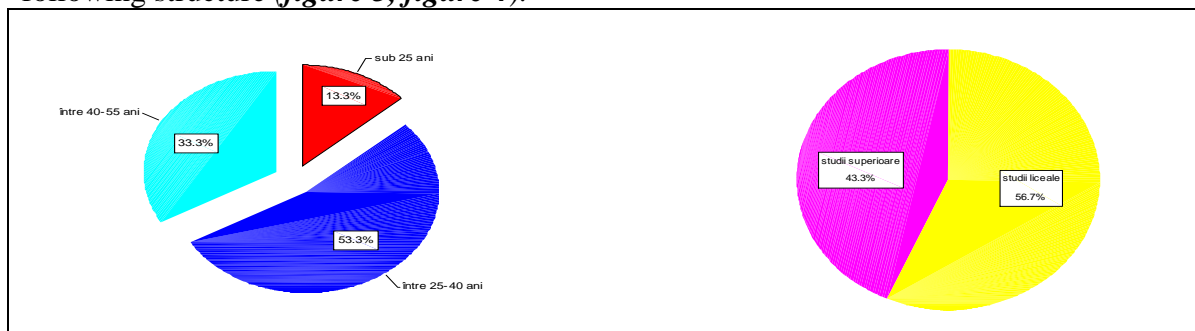
Regarding additional services offered by the accommodation of persons- they interviewed the following emerged: 6.6% Children provides surveillance, 56.6% provide extra bed for children - 76.6% have children's play statues and 70% are equipped with playground for children , 96.6% have room TV for tourists, 93.3% were equipped smoking room, 3.3% are equipped with a library with books and magazines and 10% for parties of books furnished room, all hostels have private parking analyzed and and 60% have parking for coaches, 43.0% have the restaurant, 30.0% have arranged space for conferences, 23.0% have fishing opportunities for leisure, standing near the watershed (Big Aries or its tributaries), 13.3% rents scooters, bikes and skis for tourists, 36.3% own garden or park or have arranged a special place of rest (or space gazebo with loungers), 16.6% did not provide additional services.

Regarding the granting of discounts offered by companies to accommodation, the situation is as follows: all of the accommodation granted discounts for children, 33, 3% of the guest gives a student discount study, 60.0% of the hostels offer discount for groups, 33 3% of the hostels offer discount for pensioners.

To the question "What is your unit program of the tourist?, All respondents replied that their facilities are open all year round accommodation. Also, all accommodation establishments in the area is considered rural, mountainous.

When asked "How old is your company in the field, on the market?", The answers show the following structure (*figure 2*):

Regarding the number of employees, ie their structure by age and level of training, all accommodation owners surveyed said they have between one and nine employees, with the following structure (*figure 3, figure 4*):



**Figure 3. Structure of employees number, on age categories**

**Figure 4. Structure of employees number, based on the background**

The main target groups of owners of boarding houses surveyed are business people, participants in conferences, organized groups, organized groups of students, youth, seniors, families, hence the apparent conclusion that organized groups are particularly preferred, due to the shortage a tourist guesthouse / hotel.

Regarding the degree of *some cases influence the activity of the pen owners siuni turistice/hoteluri intervievați*, cum ar fi: lack of qualified personnel in the Vârtop-Arieșeni, lack of or poor development of markets, burdensome legislation, institutional bureaucracy in dealing with state institutions, lack of financial resources and difficult relationship with banks, inadequate arrangements for the promotion, including promotion of the authorities' websites local, central agencies and tour operators, infrastructure in the area and supply

road from the responses received that some cases very much affect tourism activity undertaken in the area studied (Figure 5 - Figure 10).

All people interviewed said they use their distribution channels through the con-  
 Towing / negotiating with clients and 23.3% use distribution channels and agencies

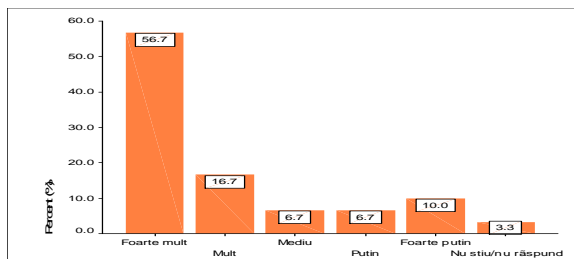


Figure 5. Influence of the lack of qualified employees in the area,

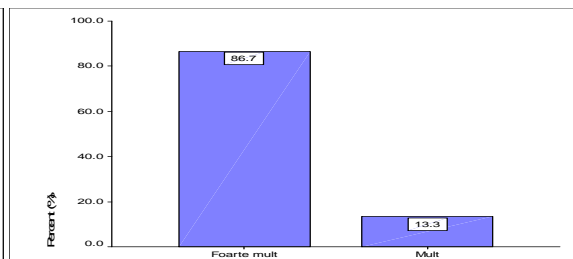


Figure 6 – Influence of the lack or poor market development, on current activities of the accommodation units

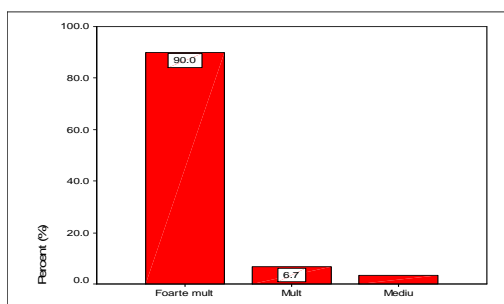


Figure 7. Influence of the cumbersome

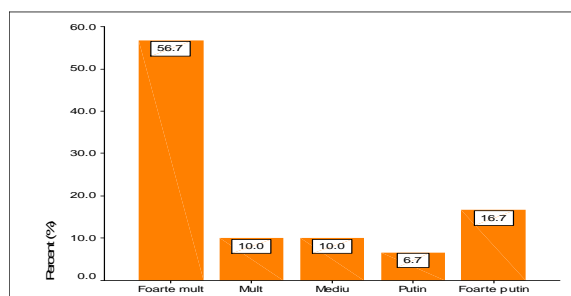


Figure 8. – Influence of the lack of financial resources, on current activities of the accommodation units

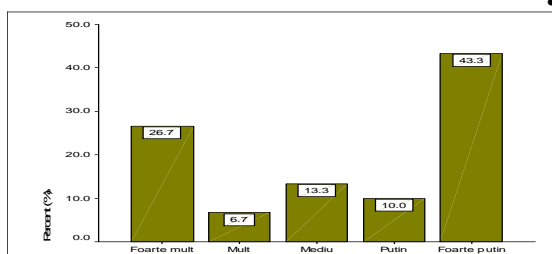


Figure 9. Influence of the insufficiency of vertising tools, on current activities of the accommodation units

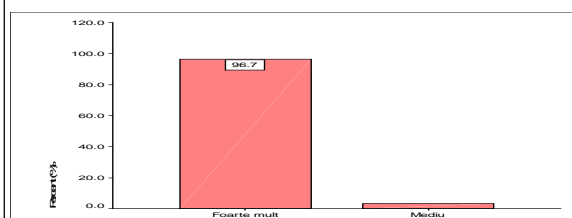


Figure 10. Influence of the infrastructure state and utilities supply in the area, on current activities of the accommodation units

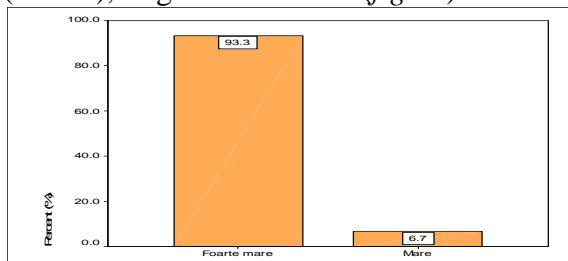
When asked "How important do you think is helping investors with funds / governmental facilities and European regional development?", 29 respondents said that is of "very high " and one responded that the matter "high", confirming the need implementation and usefulness of this measure.

The same responses (96.6% - 0.4% and very high importance - high importance) and they gave respondents the question "How important do you think has higher quality local products and services to develop the region?".

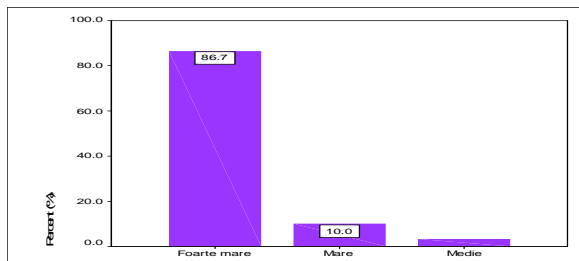
When asked "How important do you think has increased professional and management skills through courses, training and other forms of training to develop the region?", respondents said they have a very high importance (93.3%) or high (6, 7%) (Figure 11).

When asked "How important do you think is working with tour operators to promote

products, to develop the region?", respondents said they have a very high importance (86.7%), large and medium (fig.12).



**Figure 11 –Importance of increasing professional and managerial skills through attending courses, workshops and other programmes of professional the development of the region**

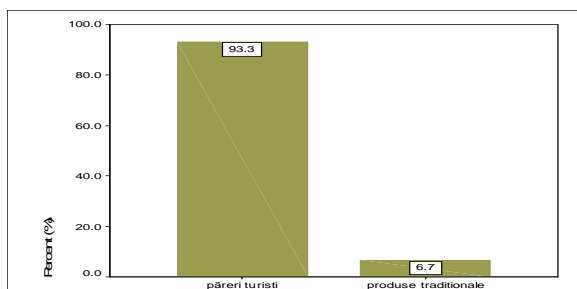


**Figure 12. –Importance of the collaboration with tour operators in view to promote products, for the training, for the development of the region**

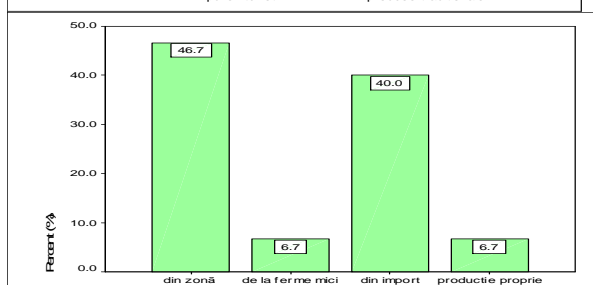
When asked "How do you identify the tourist?", Most respondents (93.3%) responded that in the light of the views expressed by tourists verbal or through questionnaires, and 6.7% of respondents consider that offer traditional products and does not change, so do not take account largely to the tourist (fig.13.).

Regarding the promotion of services, respondents used several ways of promotion. Thus, all use by outside advertising signs, banners, posters, distributing flyers, and 13.3% use those recommendations in the area, 96.7% achieved this through customers (customer-client recommendations), only 3.3% use Audio and video advertising, 90% are present on the websites of local authorities and 6.7% promotes its services through travel agencies and professional associations.

When asked "How do you acquire the necessary materials and services your business?", 46.7% of respondents replied that the area of specialized companies, 40% - on the Community market or imported, 6.7% - from small farms, individual producers and 6.7% said they also produce their own raw materials necessary for carrying (figure 14).



**Figure 13. Ways of identification of the tourists' preferences**



**Figure 14. Purchasing necessary goods and services for the activities of the touristic unit**

When asked "What are your sources of funding?", 96.7% said they use their own funds and only one respondent replied that the European funds. Only two owners (6.7%) have

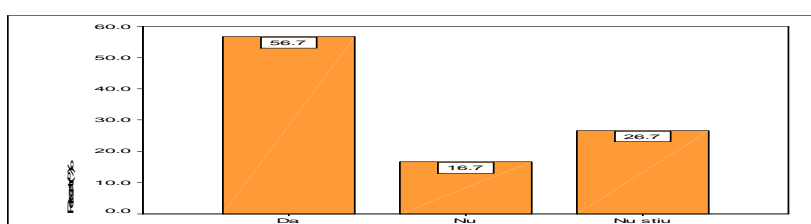


resorted to consulting services to obtain internal or external sources of funding, while 40% intend to use in the future.

Unfortunately, the landlord is not a member of a professional.

The question as to whether colaborarării with tourism operators and other operators in the region, 56.7% consider this cooperation as appropriate, a sufficiently large part of respondents (26.7%) are undecided, while 16.7% do not think appropriate to such a colatations (*Figure 15*). In that regards participation in information sessions or training in the industry or related sectors of the responses showed that 86.7% of respondents participated, with examples ANTREC promoter.

The last question on the usefulness of participation in courses for owners of hostels and staff, all respondents considered absolutely necessary courses of tourism promotion and attraction of tourists and of course to support young people in order to start business in this field.



**Figure 15. Opportunity of collaboration with the tour operators from the region**

## CONCLUSIONS

In the Vârtop-Arieșeni most hostels have been built from its own funds in the last 3-5 years, which indicates that it is a resort for young and growing.

Of the 30 owners interviewed, none is a member of a professional.

29 of the 30 respondents, said that infrastructure in the area and provision of facilities greatly affect their work.

Over 50% of the owners of hostels have only secondary education (high school).

All subjects surveyed believe that support for investors with funds, increasing the quality of local products and services, increase professional skills, working with tour operators are very important issues for tourism development and tourism in the area studied. All respondents felt that they need to promote training of tourism and attracting tourists.

## REFERENCES

- BETELLE, R. (1996) – L'agritourisme dans les espaces ruraux européens, *Annales de Géographie* nr. 592, Edit. Armand Colin, Paris.
- BOYER, M. (1982) – *Le tourisme*, Editions du Seuil, Paris
- BRAN FLORINA (1997) – *Turismul Rural*, Ed. Economică, București.
- CHELCEA S. (2001) - *Metodologia cercetării sociologice*, Editura Economică, București.
- CÁLINA, JENICA (2008) – *Agroturism*, Editura Sitech, Craiova.
- CANDEA, MELINDA, ERDELI, G., SIMON, TAMARA; PEPTENATU, D. (2003)– *Potențialul turistic al României și amenajarea turistică a spațiului*, Editura Universitară, București.
- CHIRAN A., GINDU ELENA, BACTER RAMONA-VASLICIA, RUGE MARIA (2008) – *Marketing turistic*, Ed. Universității din Oradea.

- COOPER, C., FLETCHER, J., GILBERT, D., WANHILL, S. (1996) – *Tourism, Principles and Practice*, Longman Ltd. Group, London.
- COSMESCU, I. (1998) – *Turismul, fenomen complex contemporan*, Editura Economică, București.
- GHERASIM, T., GHERASIM, D. (1999) – *Marketing turistic*, Editura Economică, București.
- MATEI, DANIELA (2005)– *Turismul rural: teorie și realitate*, Editura Terra Nostra, Iași.
- PETREA RODICA (2004) – *Turismul rural în Munții Apuseni*, Ed. Universității din Oradea.
- STĂNCIOIU A.F. (2004) – *Strategii de marketing în turism*, Editura Economică, București.

## **RESEARCH ON LOCAL VARIETIES AND BIOTYPES OF VINE-GROWING IN BUZIAȘ-SILAGIU AREA**

**VICTORIA MOS**

**DOBREI ALIN**

U.S.A.M.V.B. Timisoara, Calea Aradului 119, Romania  
avborca@yahoo.com

### **ABSTRACT - Research on local varieties and biotypes of vine-growing in Buziaș-Silagiu area**

Buziaș-Silagiu area has a tradition for the cultivation of vines in the western part of Romania. It is an area characterized by a very favorable climate and soil conditions, offering the possibility of successful cultivation of many varieties, from the earliest to more autumnal. The presence of numerous local varieties and biotypes in this area is an important source of biodiversity and production of authentic, specific vine and wine products. Some of these varieties have valuable agrobiological and technological features both for growers and consumers, but also for breeders: high production, high quality, drought resistance, frost resistance, tolerance to some diseases and pests. In recent years, consumer requirements are turning to ecological products, so finding those varieties with resistance to diseases and pests could cover an important market segment. Unfortunately, many of these varieties are in danger of extinction due to negligence or growers' preference for foreign varieties. They are found only in small groves of familial households, therefore saving them from extinction and reinstating them into the national patrimony became an important objective. All these considerations determined us to do research and make observations in wine growing areas in the western part of Romania, to discover or rediscover those varieties and biotypes, which correspond to current market requirements, but also for preserving the growing germplasm. We made ampelographic, physical and chemical measurements of these varieties and studied the quality and quantity of production. In this paper we summarized, on production lines, the principal ampelographic features of the identified varieties.

**Keywords:** biotypes, local varieties, biodiversity, Buziaș, Silagiu.

## **INTRODUCTION**

Local varieties are the result of natural and primitive artificial selection long practiced by anonymous winegrowers. They were formed in specific climatic conditions and have a more limited distribution. In this manner have resulted a number of indigenous species, preserved for their values: *Tămâioasă românească*, *Grasă de Cotnari*, *Galbenă de Odobești*, *Mustoasă de Măderat*, etc. These local varieties are represented as biotypes, or ecotypes. They have a good adaptation to growing conditions in the viticultural area in which they were formed, usually in the center of vineyards. Some of these varieties are recognized in the world because of their productive performance and are more prevalent in culture (DOBREI ET AL., 2009a). There are also less common varieties, with many valuable features, but poorly exploited by growers and breeders. Silagiu-Buziaș growing area is characterized by an abundance of local varieties, and biotypes encountered especially in small family plantations of householders. The technology of culture practiced in the case of these varieties is a simple one, it is reduced to pruning, 1-2 weedings, harvesting, while the phytosanitary treatments are missing or are limited to 1-2 spraying with bouillie bordelaise, which entitles us to claim that the grapes obtained can be considered ecological grapes, which in future will be very appreciated by a major segment of the market that is increasingly oriented towards ecological products, healthy for the human

body (DOBREI ET AL., 2009b, 2010a, 2010b). To this end we have undertaken an action to identify and research existing varieties of grapes growing in this area. In the family plantations of this area there have been identified and studied between 2008 - 2010 a total of 26 local varieties and biotypes, divided into three production lines: local grape varieties and biotypes for fresh consumption, varieties with mixed characteristics and varieties for winemaking.

## MATERIAL AND METHOD

Research has been conducted in the old plantations of householders from Buziaş-Silagiu area. During the field trips, there have been identified and sampled more than 40 varieties of plantations, but only 26 of them were considered interesting and retained for study. To establish the name of the varieties and local cultivars, we used several criteria: local name if any, name of the settlement where it was discovered, prevalent ampelographic and technological characteristics, etc. Of the 26 local cultivation retained in the study, 15 local varieties and biotypes have specific features for table grape varieties, 5 we found suitable for vinification, and 6 show mixed characteristics, consequently suited for both wine and fresh consumption.

## RESULTS

For a summary of the ampelographic characteristics, we used tabular presentation to refer only to the most important ampelographic traits: leaves, grapes, berry (*Tables 1-3*). The varieties were divided on production lines: table grapes, mixed varieties and cultivars for wine production.

**Table 1: Ampelographic characteristics of grape varieties for fresh consumption**

Nr.c rt.	Variety/Biotype	Leaf	Grape	Berry
1	Alb crocant de Buziaş	Medium to large, with slightly sketched sinuses	Medium to large, cylindrical-conical, with rare grains	Large, oval, with thin skin, elastic, greenish yellow
2	Alb lax de Silagiu	Medium to large pentalobed, but show foliar polymorphism	Large branches, cylindrical-conical, with rare grains	Large branches, cylindrical-conical, with rare grains
3	Coarnă albă	Medium to large, orbicular, pentalobed	Medium to large, cylindrical-conical sometimes wing	Large, oval, slightly pointed tip, thick-skinned, greenish-white, with a specific taste
4	Coarnă neagră	Medium, oblong, trilobate	Medium to large, cylindrical, or cylindrical-conical, dense berries	Medium to large, oval, thin-skinned, dark red, abundant bloom. core has a specific taste
5	Coarnă vânătă	Medium, pentalobed	Medium to large, cylindrical-conical with very dense berries	Medium with thick skin, bluish, with a thick bloom
6	Conic auriu	Small to medium,	Medium, conical, with rare	Large, to very large,

		pentalobed, with little obvious sinuses	grains	ellipsoidal, with thick skin, elastic, yellowish-green, covered with a thick bloom
7	Moldovel	Middle, kidney-shaped	Large to very large, cylindrical-conical, dense berry	Large to very large, oval, thick skinned, rigid, black-blue, covered with a thick bloom
8	Negru crocant de Buziaş	Large, almost full, with tends to lobar	Large, cylindrical-conical, lax, with rare grains	Large, inversely ovoid, with thick skin, elastic, bluish black, covered with a thick bloom
9	Ochiul boului	Large, almost full	Large to very large, branches, lax, with berries rarely placed	Very large, elastic skin, black-bluish, covered with a thick bloom.
10	Răşchirată albă	Medium, with pentalobed trends	Large to very large, branches, lax	Large, oval, thin-skinned, elastic, yellow-green, covered with a thin layer of bloom.
11	Roşu crocant de Silagiu	Medium to large pentalobed.	Medium, cylindrical-conical wing	Medium spherical. The peel is thin, elastic, dark reddish
12	Țâța caprei albă	Medium, pentalobed, with slightly sinuses sketched	Medium to large, cylindrical, with dense berries	Medium to large, oval, with thick skin and elastic, greenish yellow, covered with bloom
13	Țâța caprei neagră	Small to medium sized, with slightly sinuses sketched	Medium, branches, lax	Medium ellipsoidal, thick-skinned and elastic, bluish black, covered with a thick bloom.
14	Țâța vacii	Medium	Medium, branches, lax	Large, cylindrical, elastic skin, greenish, covered with bloom. It has a seed.
15	Auriu de Silagiu	Small, pentalobed round kidney-shaped	Medium cylindrical-conical, with rare berries	Large, round, slightly oval, the skin thick, elastic, yellowish-green, intense bloom.

Biotypes and local varieties of grapes for fresh consumption are characterized by large grape branches, of average weight, 250-350 g and length of 20-30 cm. Grape form was cylindrical, cylindrical-conical, or branch. Berries are large, uniform size, spherical, cylindrical or ovoid, pulpy flesh and crunchy. Some varieties can be distinguished by their long duration of storage on the hub, resistance to transport and long storage duration, even in unprepared conditions. The berry skin is rather thick, adherent to the pulp, elastic, of different colors, ranging from green-yellow and golden-yellow, to pink, purple or dark red, usually covered with bloom, giving them a pleasant commercial aspect. The taste is pleasant and some varieties have "scented" flavor or "Muscat" taste. Berries contain 1-2 seeds. It is known that consumers prefer large berries, brightly colored, crisp and refreshing. From this point of view, the following varieties stand out: *Negru crocant de Buziaş* și *Țâța vacii*.

**Table2: Ampelographic characteristics of grape varieties with mixed properties**

Nr.c rt.	Variety/Biotype	Leaf	Grape	Berry
1	Alb aromat de Silagiu	Middle, cuneiform, presents foliar polymorphism.	Medium, cylindrical-conical, rarely placed berry	Medium, oval, the skin is thick, elastic, yellowish-gold, heavy bloom, the aroma of scented
2	Coada oii	Large, pentalobed, with deep sinuses	Great, cylindrical-conical, sometimes parts, with dense berry	Medium to large, oval, the skin is thick, yellowish-green, with bloom fine.
3	Gras aripat de Silagiu	Medium, almost full, with slightly sinus sketched, large and sharp teeth	Large to very large, cilindroconic, wings, berries are often placed	Large to very large, the skin is thick, crisp, yellowish-green, with rust spots
4	Mărcovață	Large, wide, with large teeth	Medium cylindrical-conical, sometimes wing, with rare berry	Middle, with greenish yellow skin, intense bloom
5	Roz aromat	Very small, pentalobed	Medium, cylindrical-conical, and berries are often placed according	Medium spherical, the skin is elastic, pink, covered with a fine layer of bloom and has an aroma of muscat.
6	Roz bătut	Medium to large, cuneiform, with small sinuses	Large, cylindrical-conical, sometimes wing, with dense berry	Small to medium, slightly ovoid, the skin is thin, greenish pink with fine bloom

Local varieties with mixed qualities are generally characterized by medium-sized grapes, cylindrical-conical or cylindrical shape, with dense berry under the stem. Berries are medium sized, with elastic or rigid skin, colored in greenish yellow or pink, covered with a medium bloom layer. Berry pulp is fleshy, crunchy and juicy, with a pleasant taste. Some varieties have distinct flavors. Berries have 2-4 seeds of medium size. Grapes of these varieties are suitable both for fresh consumption, but also for producing wine with lower alcoholic strength. Following the qualitative and quantitative traits of this group, we note the following varieties: *Alb aromat de Silagiu* și *Gras aripat de Silagiu*.

**Table 3: Ampelographic characteristics of wine varieties**

Nr.c rt.	Variety/Biotype	Leaf	Grape	Berry
1	Arămiu de Silagiu	Large to very large, cuneiform, pentalobed	Large, cylindrical-conical wing with dense berry	Small, spherical, elastic skin and translucent.
2	Pătrujarcă	Small, orbicular, pentalobed, with deep sinuses and teeth rare	Small, cylindrical, with dense berry.	Medium, slightly oval, the skin is golden green, with thin bloom
3	Cabasmă neagră	Middle, tri or pentalobed, slightly sketched with sinuses	Medium cylindrical wing with dense berries	Medium spherical, the skin is thin, bluish black, with bloom
4	Negru compact de Silagiu	Middle, trilobite, or pentalobed	Small to medium, cylindrical-conical with dense berries	Small, spherical, black leather, covered with bloom
5	Vulpe	Medium to large, pentalobed	Large, cylindrical-conical, wings and forked at the top.	Medium spherical thin skin, reddish, covered with fine bloom

The biotypes for wine grapes are characterized by small or medium-dense berries, grapes with a toil-hardened appearance. Berry pulp was juicy and the thin skin allows significant accumulation of sugars. In this respect we distinguished *Pătrujarcă* variety.

### CONCLUSIONS

Local biotypes constitute a valuable genetic patrimony. In recent years, global but also local research trends aim to restore local varieties' importance in order to obtain high quality, typical authentic products. Rediscovery, research and promotion of local ecotypes contribute to the enrichment of the science of viticulture and wine development practices. The analysis results were remarkable for a number of valuable qualities of local biotypes: *Negru crocant de Buziaș*, and *țâța vacii* in the table grape varieties, *Alb aromat de Silagiu* and *Gras aripat de Silagiu* in the mixed varieties and for wine production *Pătrujarca* has been noted.

### REFERENCES

- DOBREI A., SALA F., MOȘ V. (2009): "Local Grapevine Biotypes and Varietis – a Source for Biodiversity, Specificity and Authenticity", Bulletin UASVM Cluj-Napoca, vol. nr. 66(1-2)/2009, p.260-266.
- DOBREI A., MOȘ V. (2009): "Research on identification and enhancement of local wine germoplasm in Buzias-Silagiu, area in order to achieve biodiversity conservation", Journal of Horticulture, Forestry and Biotechnology, vol 13 p.228-233, Ed. Agroprint Timișoara.
- DOBREI A., MĂLĂESCU M., GHIȚĂ A., CHRISTEA T., MOȘ V. (2010): "Research concerning local valuable grape varieties and biotypes Timis county, Romania", Journal of Horticulture, Forestry and Biotechnology, vol 14, p. 291-297, Ed. Agroprint Timișoara,
- DOBREI A., MOȘ V. (2010): "Research on assurance of viticultural biodiversity, by using local varieties and biotypes of Buzias-Silagiu area", Journal of Horticulture, Forestry and Biotechnology, vol 14, p.189-194, Ed. Agroprint Timișoara

## **EFFECT OF ENVIRONMENT AND GENOTYPE ON RHEOLOGICAL PROPERTIES OF FLOUR AND DOUGH OF WINTER WHEAT**

**ZEČEVIĆ VESELINKA<sup>1</sup>, BOŠKOVIĆ JELENA<sup>1</sup>, KNEŽEVIĆ DESIMIR<sup>2</sup>**

1 Faculty of Biofarming, Bačka Topola, Megatrend University Belgrade, Serbia

2 Faculty of Agriculture, Zubin Potok, University of Pristina, Serbia

joca@kg.ac.rs

### **ABSTRACT – Effect of environment and genotype on rheological properties of flour and dough of winter wheat**

Five winter wheat cultivars created in Small Grains Research Centre of Kragujevac (Ana Morava, Toplica, Vizija, Takovčanka and Lazarica) were grown at the macro field trial in three locations (Kragujevac, Sombor and Bačka Topola) during three years (2004-2006). Influence of environment (location and growing season) and genotype on rheological properties of flour and dough (water absorption, dough development time, dough stability time, dough weakness, and mixing tolerance index) were investigated. Analysis of variance showed highly significant differences among investigated cultivars (G), years (Y) and among their interactions (G x Y, G x L, Y x L, G x Y x L) for water absorption of flour. The strongest individual influence for water absorption had location (F=56.032<sup>\*\*</sup>) and G x Y x L interaction (F=55.712<sup>\*\*</sup>), and then year (F=45.069<sup>\*\*</sup>). Farinograph properties have shown that wheat flour on average belonged to A<sub>2</sub> and B<sub>1</sub> quality group, what means that investigated cultivars had high technological quality

**Key words:** wheat, quality, genotype-environment interaction, flour, rheology

## **INTRODUCTION**

Rheology investigates the elasticity and viscosity of the dough. The viscoelastic properties of dough affect the processing of dough and the texture properties of bread. Dough must have both the properties of a viscous fluid and those of an elastic solid, and must have viscoelastic texture (WALKER - HAZELTON, 1996).

Rheological characteristics such as water absorption, stability, mixing tolerance, elasticity, viscosity and extensibility are important for the milling and bakery industries in view of the prediction of the processing parameters of dough and the quality of the final products. These rheological characteristics change during the bread making process and are difficult to measure in definitive terms. To predict the quality of flour and the dough of it, a number of physical, chemical, and rheological characteristics must be known. This information can be obtained from analysis of flour and test devices, such as farinograph, extensograph and alveograph.

Wheat breeders can improve overall end-use quality of cultivars through evaluation and selection. However, genetic improvement in processing quality may not translate into improved 'consistency' in the marketplace due to inherent variation caused by production environments (PETERSON et al., 1998). On the one hand, information about the microscopic rheology of wheat-flour dough is required by the plant breeder if improved varieties of wheat are to result in enhanced export income.

Grain quality of winter wheat varies depending on genotype and growing conditions. The successful process of wheat breeding is based on the knowledge of characteristics of the genotypes as well as on the interaction of genotype and location. Understanding the cause



of genotype by environment interaction can be used to establish breeding objectives, identify ideal test conditions and formulate recommendations for areas of optimal cultivar adaptation (WEIKAI - HUNT, 2001). The presence of genotype-environment interaction complicates the selection of superior genotypes and the understanding of environmental and genotypic causes of significant genotype-environment interaction is important in all stages of plant breeding (DHUNGANA et al., 2007). Environmental factors play a main role in the expression of genotype characteristics. The ideal cultivar for high grain yield and technological quality need to express genetic potential in different environmental factors of growing (ZECEVIC et al., 2007; 2009; 2010).

There is inverse relationship between grain yield and protein content. Since bread making quality is influenced by both protein quantity and quality, breeders must apply breeding strategies to increase one without affecting the other to achieve specific wheat quality classes. The basic principles to quality improvement are understanding effects of G x E interactions on the expression of quality traits and understanding genetic control and diversity associated with quality traits (ABUGALIEVA - PEÑA, 2010).

The aim of this work was to study the effect of genotype and environment on the rheological flour and dough properties of winter wheat cultivars.

## **MATERIAL AND METHOD**

Five winter wheat cultivars created in Small Grains Research Centre of Kragujevac (Ana Morava, Toplica, Vizija, Takovčanka and Lazarica) were grown at the macro trial at experimental field in three locations (Bačka Topola, Kragujevac and Sombor) during three years (2004-2006). Influence of genetic and agro-ecological conditions of locations and growing seasons on rheological properties of flour and dough (water absorption, dough development time, dough stability time, dough weakness, and mixing tolerance index) were investigated. Based on the results of these properties, we determined the quality number and quality of flour group. Grain samples were milled using a Brabender Quadrumat Junior laboratory mill. The rheological properties were determined by using Farinograph "Brabender" according to ICC standard method No. 115/1 (1972, 1992).

The analysis of variance was calculated according to randomize complete block design with three factors: genotype (G), year (Y) and location (L) using ANOVA (MSTAT-C program, 1989). The significant differences among the means were grouped according to least significant difference (LSD).

## **RESULTS AND DISCUSSION**

Absorption measures the amount of water that can be absorbed by a given quantity of flour. In bread making, it is usually preferable to have flour that can absorb a large amount of water. Optimum absorption represents the maximum amount of water, as a percent of the flour weight, that will produce a high yield of bread during the baking process.

In general, high water absorption means good baking performance. It is considered that high protein quantity provides both high water absorption and good baking performance (BLOKSMA, 1990; BASARAN - GÖÇMEN, 2003). The high molecular weight glutenin subunits play an important role in governing the functional properties of wheat dough. Weak gluten flour has a lower water absorption and shorter stability time than strong

gluten flour. Water absorption and dough stability time are in significant positive correlations with protein concentration and gluten content (SELEIMAN et al., 2011). In this investigation, the water absorption varied in accordance with genotype, locations and years (Table 1). Average absorption value ( $\bar{x}_G$ ) ranged from 62.5% (Ana Morava) to 65.0% (Takovčanka). Genotypes reacted differently on investigated locations. According to location means, the highest water absorption for all cultivars was achieved in Sombor (64.8%), while the lowest in Bačka Topola (62.8%). The highest value of all investigated cultivars and localities for water absorption established in Kragujevac locality by cultivar Takovčanka (67.1%), while the lowest in Bačka Topola locality by cultivar Lazarica (60.8%).

**Table 1. Mean values for water absorption of wheat flour (%)**

Genotype (G)	Location (L)			$\bar{x}_G$
	Kragujevac	Sombor	Bačka Topola	
Ana Morava	61.1	63.5	62.9	62.5
Toplica	63.1	66.7	65.0	64.9
Vizija	61.7	64.9	61.3	62.6
Takovčanka	67.1	63.7	64.1	65.0
Lazarica	65.0	65.3	60.8	63.7
$\bar{x}_L$	63.6	64.8	62.8	63.7

Analysis of variance showed highly significant differences among investigated cultivars (G), years (Y) and among their interactions (G x Y, G x L, Y x L, G x Y x L) for water absorption of flour (Table 2). The strongest individual influence for water absorption had location ( $F=56.032^{**}$ ) and G x Y x L interaction ( $F=55.712^{**}$ ), and then year ( $F=45.069^{**}$ ). In our previous results, sedimentation value and gluten content also significantly depended on environment, cultivar, year and their interactions (ZECEVIC et al., 2009).

**Table 2. Analysis of variance for water absorption of wheat flour**

Source	DF	MS	F	LSD	
				0.05	0.01
Genotype (G)	4	27.146	34.410 <sup>**</sup>	0.698	4.157
Year (Y)	2	35.555	45.069 <sup>**</sup>	0.806	1.859
G x Y	8	14.026	17.779 <sup>**</sup>	0.966	1.405
Location (L)	2	44.203	56.032 <sup>**</sup>	0.806	1.859
G x L	8	27.856	35.310 <sup>**</sup>	0.966	1.405
Y x L	4	5.511	6.985 <sup>**</sup>	0.900	1.493
G x Y x L	16	43.950	55.712 <sup>**</sup>	1.537	2.118

The dough properties, in average for all cultivars and years, are presented in table 3. Rheological properties of dough (dough development time, dough stability time, dough weakness, and mixing tolerance index) were similar in Kragujevac and Sombor, but the best results obtained in Bačka Topola locality. According to CAMPOS et al. (1997), dough development was influenced by composition and quality of flour, moisture and dough temperature.

**Table 3. Farinograph characteristics of the dough**

Dough properties	Location		
	Kragujevac	Sombor	Bačka Topola
Water absorption (%)	63.6	64.8	62.8
Dough development time (min)	2.0	1.5	2.0
Dough stability time (min)	2.0	1.0	5.0
Dough weakness (BU)	60	70	40
Mixing tolerance index (BU)	40	40	30

The rheological properties were influenced by production environment, years and cultivars. Farinograph properties have shown that wheat flour on average belonged to A<sub>2</sub> and B<sub>1</sub> quality group, what means that investigated cultivars had high technological quality (Table 4). Quality number, in average, varied from 55.7 (Vizija) to 73.9 (Toplica). According to locations means, the highest quality number was measured in Bačka Topola (70.9) while the lowest was at location Sombor (59.6).

**Table 4. Quality number and quality group of wheat flour**

Genotype (G)	Location (L)			$\bar{x}_G$
	Kragujevac	Sombor	Bačka Topola	
Ana Morava	65.0/B <sub>1</sub>	60.8/B <sub>1</sub>	80.8/A <sub>2</sub>	68.9/B <sub>1</sub>
Toplica	72.8/A <sub>2</sub>	71.0/A <sub>2</sub>	78.0/A <sub>2</sub>	73.9/A <sub>2</sub>
Vizija	51.1/B <sub>2</sub>	50.8/B <sub>2</sub>	65.2/B <sub>1</sub>	55.7/B <sub>1</sub>
Takovčanka	61.7/B <sub>1</sub>	60.8/B <sub>1</sub>	67.0/B <sub>1</sub>	63.2/B <sub>1</sub>
Lazarica	69.3/B <sub>1</sub>	54.6/B <sub>2</sub>	63.5/B <sub>1</sub>	62.5/B <sub>1</sub>
$\bar{x}_L$	64.0/B <sub>1</sub>	59.6/B <sub>1</sub>	70.9/A <sub>1</sub>	64.8/B <sub>1</sub>

Previous results indicated that the quality number of the wheat flour dough was closely correlated with the strong gluten flour, which had high dough stability, high dough breakdown time, a high farinograph quality number, and low dough mixing tolerance index (LEI et al., 2008). In their investigations correlation analysis showed that the farinograph quality number was highly positively correlated with dough breakdown time, dough stability, and dough development time ( $r = 1.000, 0.958, 0.894$ , respectively), and highly negatively correlated with the mixing tolerance index ( $r = -0.890$ ).

Environment was the major source of variation for most of the chemical and rheological properties of flours extracted from both soft and hard wheat (MIKHAYLENKO et al., 2000), as reported previously (HAZEN - WARD 1997).

## CONCLUSIONS

Rheological properties of flour and dough were influenced by environmental factors, cultivar, and their interactions. Growing location had significant effect on water absorption of flour. The quality of the investigated cultivars was high and belonged to A<sub>2</sub> and B<sub>1</sub> quality group. The highest quality had cultivar Toplica, which belonged to A<sub>2</sub> quality group. According to location means, the highest quality number was measured in Bačka Topola, while the lowest was in Sombor.

## ACKNOWLEDGMENTS

The research was financed by the Ministry of Science and Technology of the Republic of Serbia under project TR 6893.B "Small grains-breeding and progressive growing technologies for improving yield and food quality".

## REFERENCES

- ABUGALIEVA A., PEÑA R.J. (2010): Grain quality of spring and winter wheat of Kazakhstan. *The Asian and Australasian Journal of Plant Science and Biotechnology*, 4 (Special Issue 1), p. 87-90.
- BASARAN A. - GÖÇMEN D. (2003): The effects of low mixing temperature on dough rheology and bread properties. *Eur. Food Res. Technol.* 217, p. 138–142.
- BLOKSMA A.H. (1990): Dough structure, dough rheology, and baking quality. *Cereal Foods World* 35, p. 237–244.
- CAMPOS D.T, STEFFE J.F - P.K.W Ng. (1997). Rheological behavior of undeveloped and developed wheat dough. *Cereal Chem.* 74, p. 489-494.
- DHUNGANA P., ESKRIDGE K.M., BAENZIGER P.S., CAMPBELL B.T., GILL K.S. & DWEIKAT I. (2007): Analysis of genotype-by-environment interaction in wheat using a structural equation model and chromosome substitution lines. *Crop Science*, 47, p. 477-484.
- HAZEN, S. P., AND WARD, R. W. 1997. Variation in grain functional quality for soft winter wheat. *Crop Science*, 37, p. 1086-1093.
- INTERNATIONAL ASSOCIATION FOR CEREAL CHEMISTRY. ICC-Standard No 115/1 Method for using the Brabender Farinograph. Approved 1972, revised 1992.
- LEI F.,- JI-CHUN T., - CAI-LING S. - CHUN L. (2008). RVA and farinograph properties study on blends of resistant starch and wheat flour. *Agricultural Sciences in China*, 7, 7, p. 812-822.
- MIKHAYLENKO G. G., CZUCHAJOWSKA Z., BAIK B. K., KIDWELL K. K. (2000): Environmental influences on flour composition, dough rheology, and baking quality of spring wheat. *Cereal Chemistry*, 77, 4, p. 507-511.
- PETERSON C.J., GRAYBOSCH R.A., SHELTON D.R. - BAENZIGER P.S. (1998): Baking quality of hard red winter wheat: Response of cultivars to environments in the Great Plains. *Euphytica*, 100, 1-3, p. 157-162.
- SELEIMAN M., ABDEL-AAL S., IBRAHIM M., ZAHRAN G. (2011): Productivity, grain and dough quality of bread wheat grown with different water regimes. *Journal of AgroCrop Science*, 2, 1, p. 11-17.
- WALKER C. E. - HAZELTON J. L. (1996): Dough rheological tests. *Cereal Foods World*, 41, p. 23-28.
- WEIKAI Y. - HUNT L.A. (2001): Interpretation of genotype x environment interaction for winter wheat yield in Ontario. *Crop Science*, 41, p. 19-25.
- ZEČEVIĆ V., - KNEŽEVIĆ D. - MIĆANOVIĆ D., (2007): Variability of technological quality components in winter wheat. *Genetika, Belgrade*, 39, 3, p. 365-374.
- ZEČEVIĆ V., - KNEŽEVIĆ D., - BOŠKOVIĆ J., - MADIĆ M. (2009): Effect of genotype and environment on wheat quality. *Genetika, Belgrade*, 41, 3, p. 247-253.
- ZEČEVIĆ V., - KNEŽEVIĆ D., - BOŠKOVIĆ J., - MIĆANOVIĆ D. - DOZET G. (2010): Effect of nitrogen fertilization on winter wheat quality. *Cereal Research Communications*, 38, 2, p. 244-250.

## **PRODUCTION PROGRAMMING IN THE CANNING**

**FABULYA ZOLTÁN – HAMPEL GYÖRGY**

University of Szeged Faculty of Engineering  
Mars tér 7, H6724 Szeged, Hungary  
fabulya@mk.u-szeged.hu

### **ABSTRACT – Production programming in the canning**

Our examinations aimed at the positive role of software production programming on costs. In addition to the fact that reduction of expenses can be reached with rearrangement of production between shifts, we pointed out that with this simulation technique the following problems can be avoided: product bump on the production belt due to careless planning, product piling in the heat-treatment unit and thus, product deterioration due to the heat-treatment which was not started in time.

To put the experiences in practice we developed a software system based on factory data. In development we used Microsoft Excel and Access programs as software environments and we made the necessary program codes in the built-in Visual Basic for Applications, as a programming language. We elaborated a user-friendly operation mode to reach functions with a special menu. We applied form-technique to upload and to modify data. Production programming and scheduling software modules can be used easily with dialogue boxes. Queries can be applied to check product bump on the production belt and sufficiency of heat-treatment capacity.

**Keywords:** modelling, optimization, autoclaving.

## **INTRODUCTION**

To increase quality is the primary aspect in food industrial researches. It is the most important aim to lessen the degree of conservation in food processing otherwise the food cannot preserve its original qualities, consuming and nutritional values. Furthermore, consumers claim the possibility to prepare their food more quickly, the safe and hygienic application, longer shelf-life, the constant and checked quality, the usability on wider scale and the solution of unexpected situations. All of them could be utilized by preserved food-makers but for this they have to employ modern work organization which follows the expectations of our time. (BIACS 1998, GOLDBERG 1994, KISS 2000, FARKAS 2001, BÍRÓ and BÍRÓ 2000)

Heat-treatment is used to prevent the microbiological danger thus it makes longer conservation-time possible. However, in case of an over-guaranteed heat-treatment there is a deterioration of quality, since sensory features, substance, taste, smell of the food can suffer a serious loss (discolouration on the surface in case of liver pastes, liquid exudation and jelly precipitation in case of meat, transformation into puree etc.)

It is worth involving engineering calculations, modelling, computer simulation in the research of this field, for the sake of the quality of products and expense-efficient production. A work organization should be formed which guarantees manufacture of products which are safe from microbiologic aspect; which keeps the regulations more precisely in the interest of higher quality and lower expenses. To do this there should be an informatics background which can provide the necessary assistance, on the basis of research results, to elaborate the suitable work organization. For this aim it provides the

user-friendly operation surfaces, which fulfill the claims of our time, the simulating and optimizing technique, the predicting and problem solving services and the flexible enlargement possibilities.

## **MATERIAL AND METHOD**

What basically determined the research and appeared in almost each element of the work was computer modelling. For this reason primarily we utilized the applied methods and techniques of this field from observation and data collection through details of modelling, programming, which often needed considerable creativity, up to the statistic methods of verification and validation of the model and finally, to the statistic processing of results coming from the experiments (simulation) carried out on the model.

For modelling and optimization with simulation we employed the microsoft Excel and Access 2003 programs both for development of the mentioned program with the built-in Visual Basic for Applications (VBA) service and for function insertion and statistic operations with Solver and Data Analysis functions available as the Excel complements.

## **RESULTS**

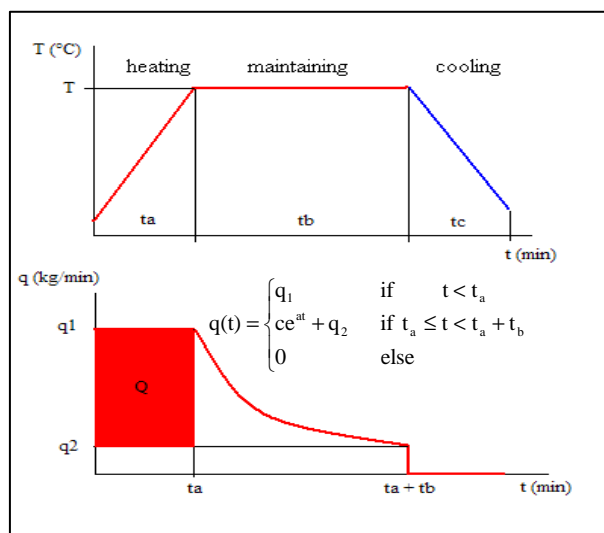
### **REDUCTION OF COSTS WITH SCHEDULING THE PRODUCTION**

Companies make a production plan for the forthcoming period in a certain frequency. At the company we carried out my researches at the production plan for the following week is elaborated on a weekly basis the most important element of which is to decide which products should be made in each shift. They have more production belts and it is product-dependent which product which belt can be made on. More products can be manufactured on the same belt, if the size of the can makes it possible, but only one of them can be made in one shift because of the loss of time due to refitting the belt. The weekly plan does not contain which product should be made on which belt because the product clearly determines the belt. However, the plan can have a mistake here since product bump can be experienced on the belts, in spite of the fact that different products are set in a shift. At present, the plan and the data from it are not checked with a computer, thus a problem of this latter kind can happen easily due to the human inadvertence.

The planning mistake that cannot be predicted easily is when products are made in parallel on different belts whose heat-treatment claim great capacity even separately and thus altogether they exceed the limit arising from the number of autoclaves. What is more, this mistake becomes clear only when the products arrive at the heat-treatment unit from the production belt and they form a waiting line which continuously grows. However, a strict regulation prescribes how long the maximum waiting time may be before heat-treatment. If it cannot be kept, a temporary cooling storage should be guaranteed, otherwise the germ number can considerably increase. For security reasons these conditions are calculated in the sterile formula but a germ activity over the level can imply explosion of conserves. It would not happen in the waiting line of some hours but after heat-treatment during the compulsory quarantine storage which lasts for a week or two, or in worse case, in the customers home, because the sterile formula was not determined according to the initial germ number which increased. The financial loss is significant because in this case the whole portion for heat-treatment (about 1 ton) or might as well, the total amount produced in the shift is endangered, so after a laboratory test it needs either further heat-treatment or it is destroyed.

## MODELLING THE GAS DEMAND OF A HEAT-TREATMENT PROCESS

On the upper part of *Figure 1*, the prescribed temperature (provided by the sterile formula of the given product) can be seen, while on the lower part the changes of the necessary steam mass flow in time (unknown, to be determined) are given.



**Figure 1. The prescribed temperature and changes of the necessary steam mass flow in time**

Product-dependent data known from the regulations on heat-treatment:

- $T$  – temperature to be reached (°C)
- $t_a$  – time of heating up (minute)
- $t_b$  – time to keep on temperature (minute)
- $t_c$  – time of cooling (minute)

Parameters of the  $q(t)$  steam mass flow (kg/min) are to be determined.

- $Q$  – steam demand (kg) of heating up, value dependent on the product mass
- $q_2$  – loss of the steam mass flow (kg/min), constant non-dependent on the product
- $c, a$  – parameters of curvature of the  $q(t)$  function, one of them is unrelated to the product and it determines the other.

With knowledge of the model, we can calculate the changes of steam demand of certain equipments in time which is related to the product to be treated (thus to the regulations on heat-treatment) and the starting points in time. Making use of the simulator created in Excel we constituted the daily data series of the total gas demand broken down in hours on the basis of the total heat-treatment in a day. The data of the gas demand should be calculated from these 24 data, but it has to be taken into consideration that a part of the steam produced is turned to the loss. It is unknown, too, and it is indicated as a new parameter ( $G$ ) of the model, like the gas amount which covers the loss in  $m^3/h$  unit of measure. It can be regarded constant in time. It was indicated in the technical description of the boiler that about  $80 m^3$  of gas is necessary to produce 1 t of steam. Thus, the total gas consumption per hour based on the model can be calculated both by realizing the steam demand of heat-treatments and from the loss. Then, it can be cross-checked with the measured gas consumption per hour.

We got the values of the model parameters (q2, k, a, G) with the Solver complement of Excel making use of the smallest squares method. However, the modelling of each day gave different results for the parameters. So the average of the parameters of five days (working days of a chosen week) provided by Solver was regarded as the final result which then we had to check (model verification) if with these parameters the gas consumption of the modelled day can be statistically considered as equal to the measured data. Checking it with the combined t-proof in case of all five days we found it adequate, there was no significant deviation ( $p < 0,05$ ). As a next step we examined if the model is adequate in case of days of the week which did not imply determination of the model (model validation). We had a positive answer again by means of a similar method. Consequently, the model and the simulator can be applied in software system, too.

## SOFTWARE ENVIRONMENT

A database manageable with an Excel spreadsheet would serve the user's interest the most. Thus, data processing and tabulation, graph making, which fit to the different demands and cannot be planned in advance, could be done easily. Application of spreadsheet guarantees a simple opportunity to provide program functions for calculations and graph making, besides it can be used as a development environment with the service Visual Basics for Applications (VBA) to elaborate the program. In addition, the database manager program should be used because firstly, it is easier to realize data storage, secondly, the program could have more functions, thirdly, the user-friendly way of data entry can be guaranteed by the technique of forms. Fortunately, both the spreadsheet and database manager can be applied since Excel sheets can be used as attached tables with the database manager program. It means that physically the data storage is realized on Excel sheets, while Access manages these data as if they were stored in its own tables. Thus, data correction done in Access will be stored on Excel sheets.

## USER INTERFACES, MAIN FUNCTIONS

After starting the program the first thing to appear is the main menu (*Figure 2.*) which shows three submenus, besides log out.

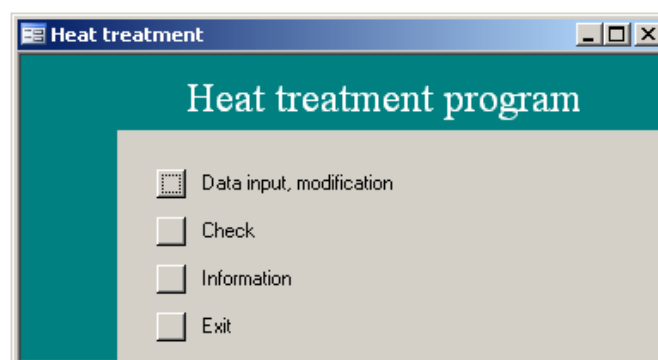


Figure 2. The main menu of Access

First of all, we can fix the data of tables „Product” and „Sterile formula” which can be modified only when a new product is to be manufactured or the regulations on the heat-treatment (sterile formula) of a given product should be modified because of the bigger



security or the earlier over-guaranteed regulations. The user will rarely need these functions, the program provides forms of data input to realize them. Indication of the data of the weekly production plan is used in a weekly frequency in the program which can be done by means of a form.

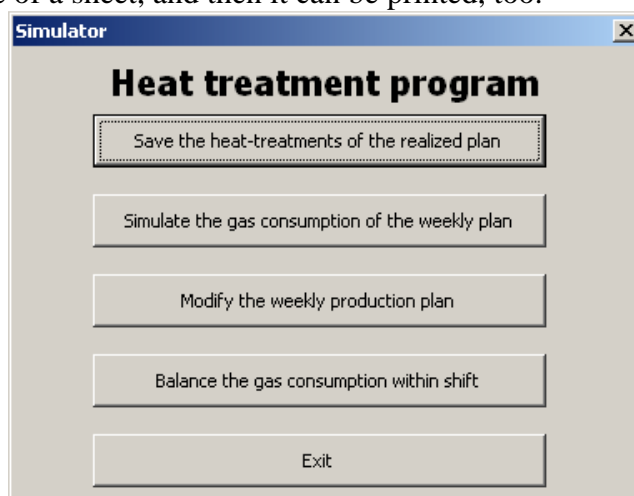
Due to the applied technique of attachment, data manipulations done in Access forms are stored on Excel sheets, so they can be used directly in Excel.

Data of the plan should be checked. The submenu „Check” guarantees these functions. The first one examines if the plan contains a mistake in case of which more products would arrive at one production belt at the same time (in the same shift). The list of products bumping on the production belts are provided by a query available on the Access surface which is shown by the program as the view print preview by means of a report. Since the table stores, among the product data, which production belt it can be made on, this result can be obtained without simulation.

The other checking function examines if the heat-treatments can be done in time. We can get the printable report without simulation, since the number of the necessary autoclaves can be calculated from the time spans of heat-treatment stored in tables. If the demand of any shifts exceeded the capacity, the plan should be modified. For this, the list shows when the capacity is unemployed in the suitable measure and then we can move the product here with the form which modifies the plan.

Having the checked plan the Excel spreadsheet takes over the work from the Access database manager to do the other tasks. It is the main menu shown in *Figure 3*. which helps us reach the functions that should be performed in the order of appearance with weekly frequency.

First, we can save heat-treatments of the realized weekly plan, then we can simulate gas consumption of the plan for the following week. Then, the program generates heat-treatment data necessary for the input of the simulator, and makes the calculated data for gas consumption broken down in shifts appear on a diagram. Data generation is done with a VBA (Visual Basic for Applications) operation, while the program switch on the adequate sheet to make the diagram appear. The task of this function is to point out if it is necessary to modify the plan, provided gas consumption of each shift shows a big deviation. The manual data modification can be accomplished with a form made for data input, but plan modification can be done automatically, too, in case of which a VBA operation rearranges the products of the plan within shifts. Modification can be followed by the user in a table of a sheet, and then it can be printed, too.



**Figure 3. The main menu of Excel**

The last function of the program guarantees that gas consumption within the given shift will be even, evolving the appropriate schedule by delaying the heat-treatment of the products. It is done by a VBA algorithm, together with the simulator, which in every shift of the production week tries to find the value variation of delay of heat-treatments which causes the gas consumption of the lowest standard deviation thus securing the even boiler-load and avoidance of high gas consumption peaks. In this function the maximum waiting time appears as a restriction since it cannot be exceeded to avoid spoilage of canned food. As a final result we can get the optimal value variation of the waiting time for the heat-treatment which then gives the recommended time to start heat-treatments.

Apart from the initial setting functions, the program should be used in a weekly frequency and by storing the data of the accomplished heat-treatments, it makes their registration possible. This registration is compulsory for the company but the stored data can provide an excellent basis for an informational system, too. In our database statements can be made with queries from different points of view, and our data can be displayed even in diagrams. We can easily observe changes, tendencies and seasonalities in the production profile. These functions can be formed in „Information” submenu. Thus, for example, we can have a statement on the weekly summary of production, a diagram of the changes in the produced amount of a certain product per week, production of a selected week per product etc.

## CONCLUSIONS

For the software developed for simulation, optimization and scheduling the Excel can be applied, in a user-friendly way, to store, process the data and to represent them in diagrams, to fulfill programming tasks, while the Access to feed data into the computer with forms and to form queries and reports. The developed computer system guarantees an easy possibility for data input and modification, to check product piling on the production belt, to avoid the long waiting lines for the heat-treatment by checking the autoclave capacity, to balance the gas consumption of the shifts and to prevent the gas consumption peaks.

## REFERENCES

- BIACS P. Á. (1998): „Mild foodprocessing – Health defending foods“, Magyar kémiai folyóirat 104 (3). pp. 115-117.
- BÍRÓ G., BÍRÓ GY. (2000): „Élelmiszer – biztonság, Táplákozás – egészségügy“, Agroinform Kiadó, Budapest, pp. 49-100.
- FARKAS J. (2001): „Future trend sin food technology – Novel food and transgenic food – A review“, Acta Alimentara 30 (3). pp. 267-279.
- GOLDBERG I. (1994): „Functional Foods“, Chapman & Hall, New York.
- KISS I. (2000): „Újabb élelmiszer-tartósítási eljárások“, Konzervújság, 2000 (2). pp. 40.

## EFFECTS OF HUMIC ACID ON GREEN FLESH PEPPER FORCING

ZOLTÁN PAP, KATALIN SLEZÁK, ANNA SZABÓ, MARIANN KRISZTIÁNNÉ KISS

Corvinus University of Budapest, Faculty of Horticultural Sciences, Department of Vegetable and Mushroom Growing, 1118 Villányi street 29-43., Budapest, Hungary  
zoltan.pap3@uni-corvinus.hu

### ABSTRACT - Effects of humic acid on green flesh pepper forcint

The natural humic acid can be a helper factor among others of plant germination, water and nutrient uptake. Moreover it helps to improve root-growing and increase stress tolerance. Products of humic acid extracts and also granulated forms can be essential accessory in integrated vegetable growing.

In our experiment a provocative test of Humic acid (Huminit<sup>®</sup> with 50 m/m % humic acid active substance) was set. It was used in 3 of 4 treatments in ratios of 0,3 kg/m<sup>3</sup>; 0,75kg/m<sup>3</sup> and 1,5kg/m<sup>3</sup> in 4 repeats. The control didn't get any humic acid. All of the treatments got the same amounts of water and N-P-K solution that was irrigated by water. Ratio of NPK was defined by phenological phase.

The green hot pepper variety was the *Capsicum annuum* 'Rush'. Planting time was on 20<sup>th</sup> of June 2010, pepper was planted in twin rows (90+60x35 cm), and plants were planted to small containers (9 liters of media/container). Plants were pruned to two stem. The treatments were mixes of substrates. The peppers were harvested in every 10-15 days.

Measurements: weight of harvested fruits that was measured after classification (4 groups: extra, I. class, II. class, wastrel); weight, diameter of shoulder, and length of one pepper; height of plants, chlorophyll content (in SPAD) of peppers.

Difference of peppers wasn't significant between treatments, although a small increasing of values of highest concentration of humic acid was noticed in heights and weights. Any difference of measured SPAD values wasn't found.

Research work was supported by the grant TAMOP-4.2.1/B-09/1/KMR-2010-0005.

**Keywords:** humic acid, pepper forcing, flesh green pepper

## INTRODUCTION

Producing healthy plants for integrated growing became a prime goal years ago, as proper plant health can reduce the number of necessary handling during the growing period. Most diseases and damages caused by pests can be prevented in well conditioned plantations. One of the main tasks of integrated production is to organize plant protection, which is based on reasonability and prevention (ZENTAI, 2001).

According to LEDÓNÉ (2009) integrated approach attributes equal importance to environmental protection, nature conservation and healthy food production, as a main part of human health; and in the same time, it takes economics into consideration. The need for applying integrated growing technologies arises from two sides: consumers need residue free vegetables, while producers need efficient plant protection technologies (ZENTAI, 2001). SOLTÉSZ (1997) says that environment conscious growing technologies do exist, and these apply certain kinds of chemicals, which have a less serious negative effect on environment. This should be a basic requirement for all growers (SERESS – FÖLDI, 2002). According to DEGUINE *et al* (2009) and FERRON – DEGUINE (2009) integrated growing and pest management have an effect on the reduction of polluting materials and might have a cost reducing effect as well (HOLB, 2009; WU AND SARDO, 2009).

Integrated growing technologies can open a way to the organic growing, and it may be more than a conventional technology (NOELL, 2002; WU AND SARDO, 2009). Applying

environment friendly growing technology in seedling production could be a requirement as well. In this technology additional materials can be used too. PAP *et al.* (2009) treated lettuce seedlings with huminic acid in potassium soap solution. Humic acids are formed from plant residues which dissolved in millions of years, and they have a positive effect on water and nutrient uptake (VADÁSZ, 1997). By applying this material, the usage of chemical fertilizers can be reduced in conventional vegetable forcing (SZLÁVIK, 2000). According to the research conducted by PAP *et al.* (2009) potash did not affect or only slightly affected the development of seedlings, but in the growing period it had a significant positive affect. Due to their experience, the quality of the growing media had a much more important role during seedling production, than potash.

The aim of this study was to examine the role of added Huminit with 12% humic acid content in soilless seedling production and the affect it has on grown plants. According to the data from field experiments, where humic acid caused 15-20% yield growth, we presumed that applying Hypothesis 0 = the sufficient dose of official information will have effect for increasing of yield at least in 15%. Humic acid can cause salt stress and gives any other problem in double dose.

## MATERIAL AND METHOD

The experiment took place in the Soroksár Experimental Field of the Corvinus University of Budapest. The most important physical features of forced pepper plants were measured. In our experiment a provocative test of Humic acid was set. Huminit<sup>®</sup> is an arid pelleted material with 50 m/m % humic acid active substance. It was used in 3 of 4 treatments in ratios of 0,3 kg/m<sup>3</sup>; 0,75kg/m<sup>3</sup> and 1,5kg/m<sup>3</sup> in four repeats. The control didn't get any humic acid.

Signs and treatments:

**A** – control - only soil.

**B** – 0,3 kg/m<sup>3</sup> of Huminit<sup>®</sup> mixed with 9 liters of soil.

**C** – 0,75kg/m<sup>3</sup> of Huminit<sup>®</sup> mixed with 9 liters of soil.

**D** – 1,5kg/m<sup>3</sup> of Huminit<sup>®</sup> mixed with 9 liters of soil.

All of the treatments got the same amounts of water and N-P-K solution that was irrigated by water. The amounts and ratio of NPK was defined by the current temperature and intensity of light, and also by phenological phase of peppers.

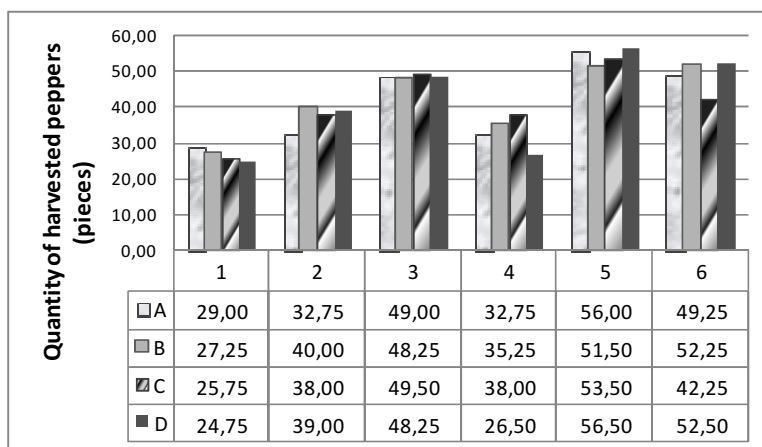
The green hot pepper variety was the *Capsicum annuum* 'Rush'. Planting time was on 20<sup>th</sup> of June 2010, pepper was planted in twin rows (90+60x35 cm), and plants were planted to small containers (9 liters of media/container). Plants were pruned to two stem. The treatments were mixes of substrates. The peppers were harvested in every 10-15 days. Harvesting was begun in August of 2010 and was performed 7 times. Six harvests were measured.

Measurements: weight of harvested fruits that was measured after classification (4 groups: extra, I. class, II. class, wastrel); weight, diameter of shoulder, and length of one pepper; height of plants, chlorophyll content (in SPAD) of peppers. In SPAD measurement we created 3 levels on every plant. Three points of three leafs per levels was measured by Konica-Minolta 502 SPAD chlorophyll meter.

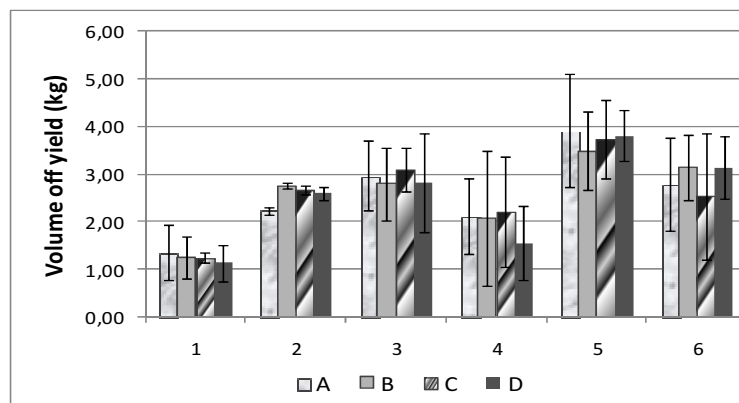
## RESULTS

According to the data showed on *Figures 1* and *2*, the quantity corresponded with the quality of the yield. No correlation was seen in case of neither measured parameters between the different treatments and the yield.

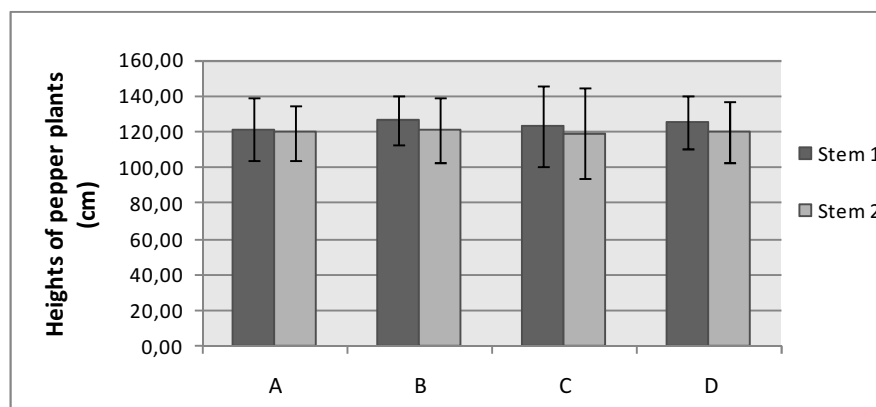
The measurements of plant height showed no difference in case of the various treatments, though on every double stalked plant had one slightly shorter stem.



**Fig. 1. The amounts of harvested pepper, Soroksár, 2010.**

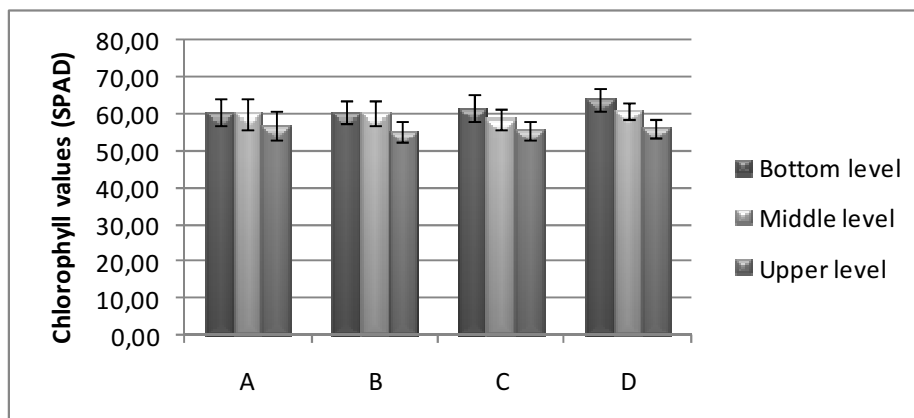


**Fig. 2. The average of total weights of harvested peppers of treatments, Soroksár, 2010.**



**Fig. 3.: The average of heights of pepper plants.**

Figure 4 shows the amount of chlorophyll in SPAD. Leafs from the lower zones had higher SPAD values, this result is reflected in the color of the leaves as well. No significant difference occurred in case of the various treatments.



**Fig. 4. The average of chlorophyll content (SPAD) in levels of treatments.**

## CONCLUSIONS

According to the data of the various measurements, no significant difference can be seen between the different treatments. Even those plants which got extreme dose of high humic acid, did not show any abnormalities. We can say that though humic acid caused no yield growth, it did not have a negative affect either, even if applied in double dose.

Since the plants did not get any serious stress during the growing period (in which case humic acid would have gotten a more important role), additional experiments needed to determine how plants treated with humic acid would react to stress factors such as drought and high salt level.

## ACKNOWLEDGEMENT

Research work was supported by the grant TAMOP-4.2.1/B-09/1/KMR-2010-0005.

## REFERENCES

- DEGUINE JP, FERRON P, RUSSELL D (2009): Sustainable pest management for cotton production. A review. In: Lichtfouse E, Navarrete M, Debaeke P, Souchere V, Alberola C (eds) Sustainable agriculture. Springer, pp 411–442.
- HOLB IJ (2009): Fungal disease management in environmentally friendly apple production. A review. In: Lichtfouse E (ed) Sustainable agriculture reviews, vol 2. Springer, pp 219–292.
- FERRON P, DEGUINE JP (2009): Crop protection, biological control, habitat management and integrated farming. A review. In: Lichtfouse E, Navarrete M, Debaeke P, Souchere V, Alberola C (eds) Sustainable agriculture. Springer, pp 461–470.
- LEDÓNÉ D. H. (2009): Integrált szemléletű fajtaválasztás. *Kertészet és Szőlészet*. 58(28): 30-31 (in Hungarian)

- NOELL C. (2002): Strategies for sustainability in agriculture from an economic point of view. English summary of Vol 5/2002 of the Institute for Agriculture and Environment series (in German)
- PAP Z., NÉMETHYNÉ U. H., LOVAS M. (2009): A környezettudatos palántanevelés tulajdonságai és optimalizálása a termesztési gyakorlat számára. *Agrár- és Vidékfejlesztési Szemle (Review on Agriculture and Rural Development)*. 4(1): 54.
- SERESS Z., FÖLDI M. (2002): Az ökológiai gazdálkodás lehetőségei a szántóföldi zöldségtermesztésben. *Hajtatás, korai termesztés*. 33(4): 36-39. (in Hungarian)
- SOLTÉSZ M. (1997): Integrált Gyümölcstermesztés. Mezőgazda Kiadó, Budapest. (in Hungarian)
- SZLÁVIK SZ. (2000): A kőzetgyapoton és a talajon termesztett paradicsom minősége, a kálium-humát alkalmazásának lehetősége. Doktori értekezés. Kertészeti és Élelmiszeripari Egyetem, Zöldségtermesztési Tanszék, Budapest. (in Hungarian)
- VADÁSZ J. (1997): Huminsavak és fulvósavak a növényi életfolyamatokban. PRI-COMP Kft., Veszprém. (in Hungarian)
- WU J., SARDO V. (2009): Sustainable versus organic agriculture. A review. In: Lichtouse E (ed) Sustainable agriculture reviews, vol 3. Springer, pp 41–76.
- ZENTAI Á. (2001): Az integrált növényvédelem gyakorlata és kilátásai a zöldségtermesztésben. *Gyakorlati Agrofórum*. 12(13): 59-61.

## RESEARCH ON THE BEHAVIOUR OF CERTAIN OILSEED RAPE VARIETIES IN GĂTAIA AREA

DRAGOȘ MARCELA, NIȚĂ SIMONA, NIȚĂ LUCIAN, PANAITESCU LILIANA, LUNGU  
MARIUS

Banat's University of Agricultural Sciences and Veterinary Medicine, Faculty of  
Agricultural Sciences,

Timișoara, Aradului street, No. 119, RO-300645, ROMANIA

[marceladragos@yahoo.com](mailto:marceladragos@yahoo.com)

### Abstract - Research on the behavior of certain oilseed rape varieties in Gătaia area

The study monitored the behavior of some rapeseed varieties in terms of oilseed rape yield and for their introduction in the culture. The study was conducted over a period of three years 2008-2010, in the Gătaia area of Timis county. For testing five varieties of oilseed rape (Alaska, Attila, Triangle, Digger, Milena) were selected. The soil of the experimental field was a vertic-preluvosol, medium clay loam/loam clay on medium fine clays. In the first year of experimentation (2008), the smallest oilseed rape yields have been recorded due to important deviations in this area. Under these conditions the oilseed rape yield ranged between 569 kg/ha and 732 kg/ha. The oilseed rape yield level of the second year of study (2009) ranged between 984 kg/ha and 1142 kg/ha, slightly higher than the previous year. In 2008 the highest oilseed rape yield of 732 kg/ha was obtained from variety Milena, followed by Alaska with a yield of 640 kg/ha, while the lowest oil-seed rape yield (569 kg/ha) was obtained from the variety Digger. In 2009 the highest oilseed rape yield (1149 kg/ha) was obtained from the variety Triangle, and the lowest oil-seed rape crop (984 kg / ha) was obtained from variety Alaska.

Research results show that by the introduction of the most suitable varieties in the culture, respecting the fertilizer recovering capacity of the varieties at the determination of the fertilization conditions and respecting the zonal optimum planting period, rape is a crop with real opportunities for expansion in the reference areas.

**Key words:** rape, variety, crop, soil

## INTRODUCTION

Rape is regarded as one of the most important oil crops from *fam. Cruciferae*.

The expansion in culture is due to the progress in the chemistry of oilseed composition, in the same time with the increase in seed-oil content.

Rapeseed chemical composition is influenced by genetic factors (variety), environmental conditions and applied technology (CAMP, 2005).

Nowadays a special attention is given to vegetable oils by using them as motor fuel (CAMP, 2005). TEMMER (1996) lists four advantages which advocate their use as alternative fuels: 1 - renewable energy, 2 - an alternative product for agriculture, 3 - a fuel-toxic, biologically degradable, 4 - closed CO<sub>2</sub> cycle. Rape is now a culture with fluctuating yields due to drought frequency in the sowing period, lower resistance to winter, the emergence in recent years during the late flowering forms, pests and diseases specific attack, susceptibility to shaking.

For Romania the researches reveal that good yields can be obtained with densities of 80-110 plants/sqm (BÎLTEANU, 1993, 2001, MAA, 1990), which is realised by the sowing of



120-150 seeds/sqm (BÎLTEANU, 2001), this characteristics ranks the rape among species that maintain and even raise the soil fertility.

## MATERIAL AND METHODS

The study was conducted over a period of three years 2008-2010, in the Gătaia area of Timis county.

The soil of the experimental field was a vertic-preluvosol, medium clay loam/loam clay on medium fine clays.

During the years of 2008-2010 research aimed at the behavior of rapeseed varieties in terms of oilseed rape yield for their introduction in the culture. In this sense, the comparative cultures were held, organized by the “strips” method in three repetitions.

The varieties studied were: Alaska, Attila, Triangle, Digger, Milena. Before sowing the field was ploughed with a disc harrow to refine the seed bed for sowing. Period of sowing was the last decade of August with 80 germinable seeds/sqm. The row distance was 12.5 cm and the sowing depth 2 cm.

Fertilization with phosphorus at a dose of P80 was performed before field preparation and nitrogen fertilization dose of N100 was performed on two occasions: first on the frozen ground in February at a dose of N66, while the remaining dose in the second half of March.

In the third decade of March the postemergent herbicide Lontrel 300 was applied in a dose of 0.4 l/ha. Sampling was done in the last decade of June directly from the chain to combine parcels variants.

## RESULTS AND DISCUSSION

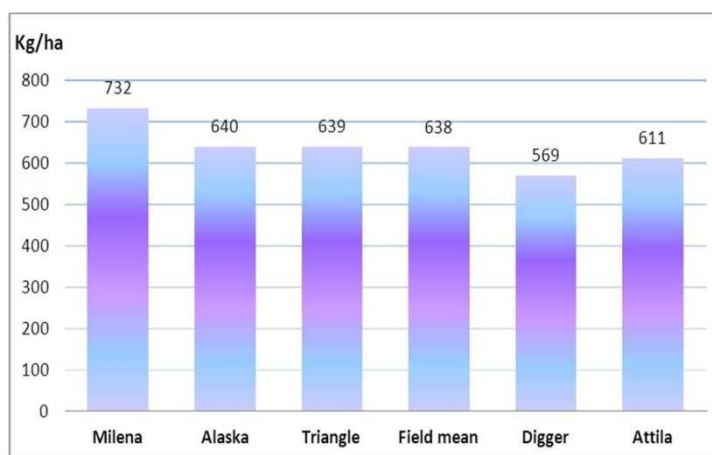
### Results of oilseed rape yield in the experimental year 2008

This year produced the lowest oilseed rape yield, due to the winter conditions and rainfall excess in the last two months of the growing season. Under these conditions the field mean had a value of 638 kg/ha. The differences in yield, compared with field average, were low in all varieties, without significance.

**Table 1. Seed-oil rape yield in the 2008 year**

Variety	Oilseed rape yield kg/ha	%	Difference kg/ha	Significance
Milena	732	115	94	-
Alaska	640	100	2	-
Triangle	639	100	1	-
Field mean	638	100	-	Mt.
Digger	569	89	-69	-
Attila	611	96	-27	-

DL 5 % = 106 kg/ha; DL 1% = 150 kg/ha; DL 0,1 % = 218 kg/ha



**Figure 1. Oilseed rape crop (kg/ha) obtained in the 2008 year from Gătaia**

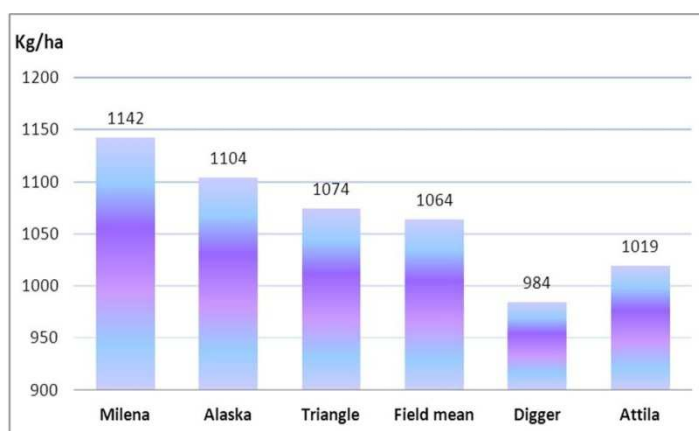
**Results of oilseed rape yield in the experimental year 2009**

The results of the second year of the study showed that for four varieties the oilseed rape yield was higher than 1000 kg/ha as follows: Milena (1142 kg/ha), Alaska (1104 kg/ha), Triangle (1074 kg/ha) and Attila (1019 kg/ha). The lowest oilseed rape yield with a value of 984 kg/ha resulted in the variety Digger.

**Table 2. Seed- oil rape yield in the 2009 year**

Variety	Oilseed yield kg/ha	%	Difference kg/ha	Significance
Milena	1142	107	78	-
Alaska	1104	104	40	-
Triangle	1074	101	10	-
Field mean	1064	100		Mt.
Digger	984	92	-80	-
Attila	1019	96	-45	-

DL 5 % = 113 kg/ha; DL 1% = 161 kg/ha; DL 0,1 % = 233 kg/ha



**Figure 2. Oil-seed rape crop (kg/ha) obtained in the 2009 year from Gătaia**

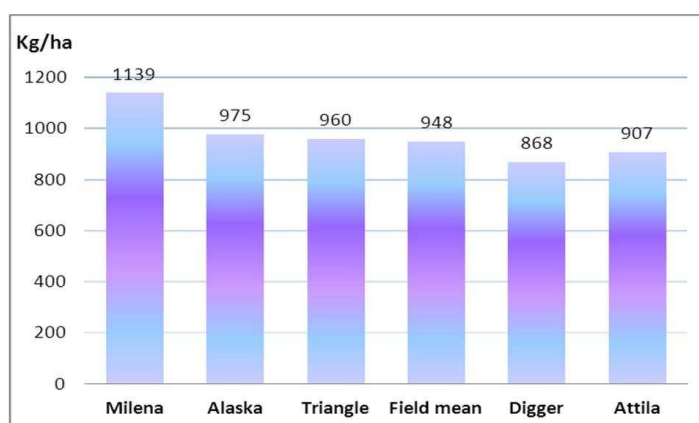
### Results of oilseed rape yield in the experimental year 2010

In the 2010 year it appears that, compared to the field average of 948 kg/ha, the harvest differences recorded in all tested varieties are lower, without signification, except variety Milena who recorded a very significant difference. In this context a difference can not be made in order to recommend a variety for cultivation.

**Table 3. Seed-oil rape crop in the 2010 year**

Variety	Oil-seed rape crop kg/ha	%	Difference kg/ha	Semnification
Milena	1139	120	191	XX
Alaska	975	103	27	-
Triangle	960	101	12	-
Field mean	948	100		Mt.
Digger	868	96	-41	-
Attila	907	92	-80	-

DL 5 % = 108 kg/ha; DL 1% = 153 kg/ha; DL 0,1 % = 221 kg/ha



**Figure 3. Oilseed rape yield (kg/ha) obtained in 2010 from Gătaia**

### CONCLUSIONS

1. Seed-oil rape yield from Gataia was between 1004 kg/ha for variety Triangle and 833 kg/ha for variety Attila, due to lower seed yield.
2. In the conditions of vertic preluvosol from Gătaia the highest oilseed rape yield (1142 kg/ha) was obtained in 2009 at the variety Milena and the lowest seed-oil rape yield (569 kg / ha) was recorded in 2008 at the variety Digger .

### REFERENCES

- BÎLTEANU GH., SALONTAI AL., VASILICA C., BIRNAURE V., BORCEAN I. (1991) Fitotehnie. E.D.P. București, p 283-292.  
BÎLTEANU GH. (2001) Fitotehnie, vol.2 Ed. Ceres, București, p. 283-292.  
TABĂRĂ V. (2005) Fitotehnie, Plante tehnice oleaginoase și textile, Ed. Brumar, p. 5

## THE EFFECT OF PICKING TIME ON THE YIELD OF PEPPER

NAGY KITTI<sup>1</sup>, TIMÁR ZOLTÁN<sup>2</sup>, SLEZÁK KATALIN<sup>1</sup>

<sup>1</sup> Corvinus University of Budapest, Faculty of Horticultural Sciences, Department of Vegetable and Mushroom Growing, 1118 Villányi street 29-43., Budapest, Hungary  
(kitti.nagy@uni-corvinus.hu)

<sup>2</sup> Red Pepper Research-Development Public Benefic Company, 6300 Obermayer tér 9.  
Kalocsa, Hungary

### **Abstract - The effect of picking time on the yield of pepper**

The main objective of our research work consists of determining the particular plant density suitable for spice pepper hybrids and of elaborating the trellis system and the pruning method. It is also among the aims to adjust the unheated greenhouse production technology of green pepper to the demands of spice pepper plants having a strongly different habit and to the harvestibility of biologically mature fruits. We studied the effect of picking frequency and trellis type on yields and fruit quality. Containers were arranged in twin rows (90+60x32 cm plant spacing) and stems were trained vertically. Four independent replications were used. Plants had two stems and 4 of them were planted on each m<sup>2</sup>. The highest yield, both in terms of fruit number and weight, was produced by the treatment, harvested in two week intervals. In terms of average fruit weight, the higher fruit weights were produced by the harvests with two week intervals.

**Keywords:** pepper, plastic cover, plant density, picking time, fruit quality,

## INTRODUCTION

The spice pepper growing area decreased by 25% over the previous year, 2009: 2000 ha, 2010: 1500ha (FruitVeb 2010). The decrease was caused by ecological and economic changes. Due to the climate changes the risk of traditional spice pepper growing (outdoor, sowed or planted) have been increased concerning both the yield and the terms of quality. The growing risk is much higher without proper proportion of the individual living condition (temperature, light) so the quality values are not formed by a high level, as under protected and controlled conditions. Growing under plastic cover proves to be suitable production technology that can result earlier onset of picking, increased number of pickings, better quality (purity, in the first place), better (and cheaper) post harvest maturation and therefore higher quality of the ground product.

The crucial issue of production technology under plastic cover is plant density. Plant number per square meter has determinant influence on the amount of light that plants receive, on the feasibility of plant care operations and on the health condition of plants, i.e. plant protection (BOSLAND - VOTAVA, 2000). The optimal plant density could be 4-4,5-5 plants per square meter. The pruning method and the trellis system are correlated with plant density and have determinant influence on the amount of light that plants receive, on the micro-climate, on plant protection and on the number of pickings. In the intensive growing of green pepper under unheated greenhouse conditions it is the two stem pruning that has become widespread (DASGAN – ABAK, 2003; GYÚRÓS – SZŐRINÉ, 2005), in contrast to the less intensive technology where a cordon trellis system is used (ZATYKÓ, 2000, DUROVKA et al., 2006).

Since with cultivation under plastic cover higher yield can be achieved more water and nutrients are needed compared to conventional open field (extensive) crop production. Multiple picking requires a continuous plant growth. It can be reached by fertilizing several times a week or even every day with a fertilizer that provides immediately available nutrients for the plants (TERBE, 2009). When fertilizing, we need to focus on potash supply, since the formation of pigments is strongly influenced by potassium (IRINYI – KAPITÁNY, 2004).

The increased number of pickings increases total yields as with the removal of ripen fruits plants are relieved and therefore are permitted to develop and mature other fruits at high quality (DUROVKA et al., 2006).

Composition parameters are influenced by several production technology factors, starting from fertilizer application to the timing of harvest (BELAKBIR ET AL., 1998; BOSLAND - VOTAVA 2000; ANCHONDO ET AL., 2001; IRINYI – KAPITÁNY, 2004; IRINYI – SLEZÁK, 2006A,B.; GYÖKÖS ET AL., 2009).

The main objective of our research work consists of determining the particular plant density suitable for spice pepper hybrids and of elaborating the trellis system and the pruning method. It is also among the aims to adjust the unheated greenhouse production technology of green pepper to the demands of spice pepper plants having a strongly different habit and to the harvestability of biologically mature fruits. In the first year of the series of experiments over several years we studied the effect of picking frequency and trellis type on yields and fruit quality. In this publication we discuss the issues of yields and the temporal pattern of fruit ripening.

## MATERIAL AND METHOD

The experiment was set up at the Experimental and Training Farm of the Faculty of Horticulture, Corvinus University of Budapest, in a high roof plastic greenhouse, using the (indeterminate) variety **Délibáb** in container growing.

Main technological parameters of the experiment:

Seedling raising was carried out in KITE trays with 96 cells (400 plants/m<sup>2</sup>), in seedling soil POT 20, with sowing date 1<sup>st</sup> April. Planting-out took place on the 20<sup>th</sup> May.

Treatments:

**SP1/1:** 1 plant/container, harvests at two week intervals,

**SP2/1:** 1 plant/container, harvests at four week intervals,

**SP3/1:** 1 plant/container, harvests at two week intervals, (later picking)

**SP4/1:** 1 plant/container, one picking,

Containers were arranged in twin rows (90+60x32 cm plant spacing) and stems were trained vertically. Four independent replications were used.

Composition of container soil: 48% fen peat, 32% fluvial sand, 10% raised bog peat and 10% perlite. We used black buckets having rigid walls, with a fill volume of 10 litres.

Plants had two stems and 4 of them were planted on each m<sup>2</sup>.

Drip irrigation and fertigation were possible in accordance with plant requirements.

In the course of plant care operations after the two stem shaping pruning the main shoots were wound around the string and only branching lateral shoots were broken off above 2-3 internodes.

A preventive plant protection was used in the plastic tunnel against eventual infection by aphids, greenhouse whitefly, cotton bollworm, trips and powdery mildew. (Consequently, no yield loss from pests was observed.)

Picking dates according to the respective treatments are included in *Table 1*.

**Table 1. Picking dates according to the respective treatments**

Treatment	04.08.	18.08.	01.09.	15.09	29.09.	13.10.	27.10.	10.11.
SP1/1	X	X	X	X	X	X	X	X
SP2/1	X		X		X		X	X
SP3/1		X	X	X	X	X	X	X
SP4/1					X			X

At the pickings, in order to observe vegetative plant development, the longer main stem of each plant was measured.

Pickings were carried out in the state of biological maturity of fruits. The number and total weight of fruits picked per plot was registered, the healthy and ill (Ca deficient) fruits were separated from each other. In the investigations, calculations were made using the healthy fruits. Due to the prolonged vegetation in the case of SP4/1 treatment, instead of the planned single harvest we harvested twice.

## RESULTS AND CONCLUSIONS

Though no statistical difference can be observed between the treatments, the highest yield, both in terms of fruit number and weight, was produced by the treatment SP3/1 (harvests at two week intervals) (*Figures 1-2*). In this treatment, yield per square meter was as high as 135 fruits in number and 3 kg in weight. In the case of the treatment SP2/1 where harvests occurred at four week intervals, fruit number was slightly increased, but yields were lower than in the former treatment. The treatment SP4/1 with one picking produced almost the same fruit number (111 fruits/m<sup>2</sup>) as the treatment SP1/1 until the same date (29th Sept) with five pickings. Considering fruit weight, it was inferior to the former two treatments, amounting to 2.3 kg/m<sup>2</sup>.

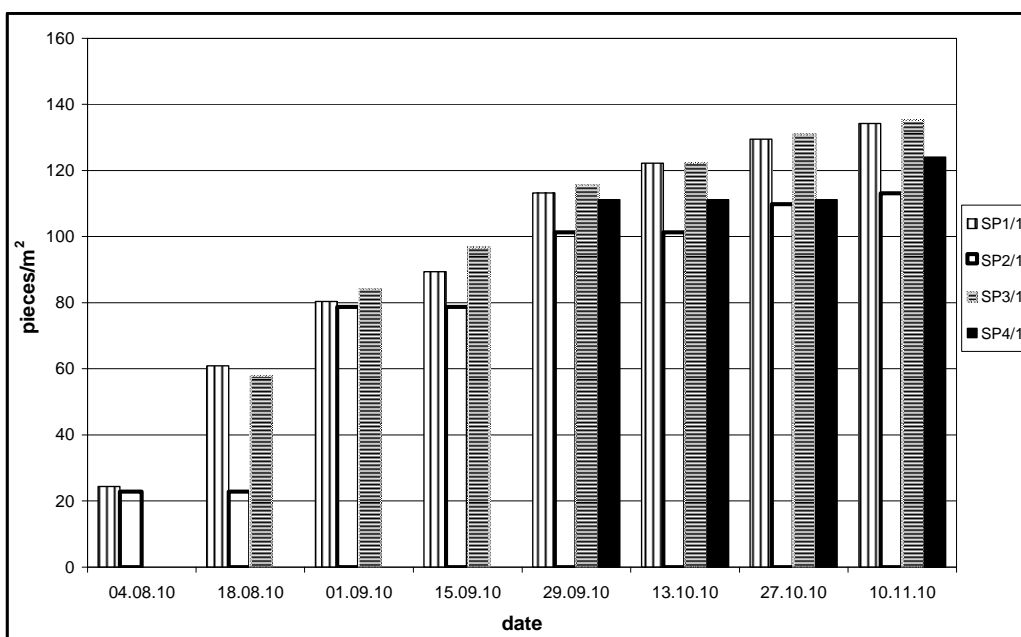


Figure 1. Effect of pickings on fruit number

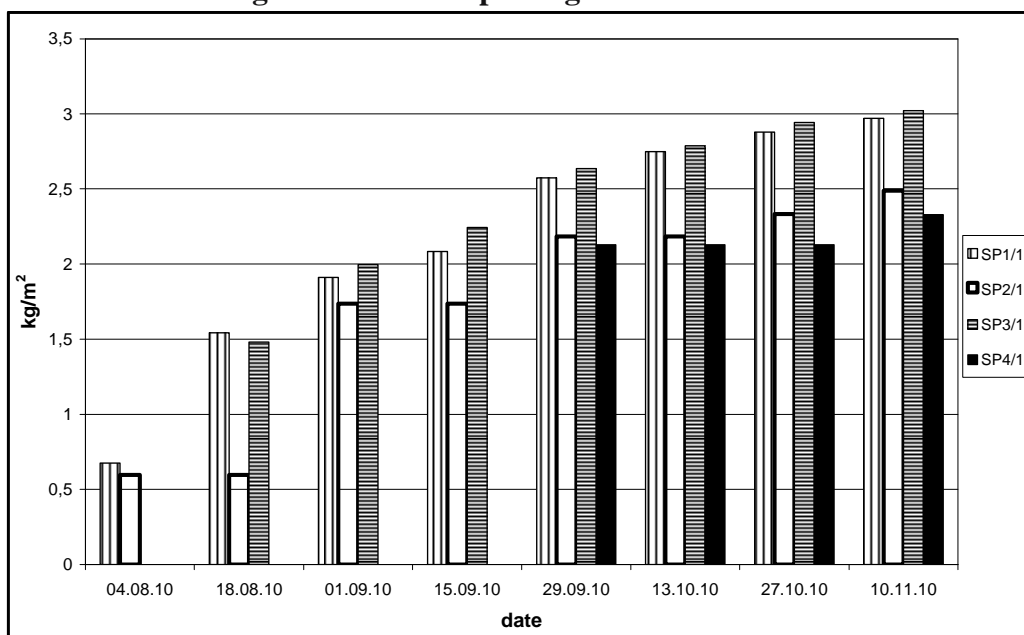
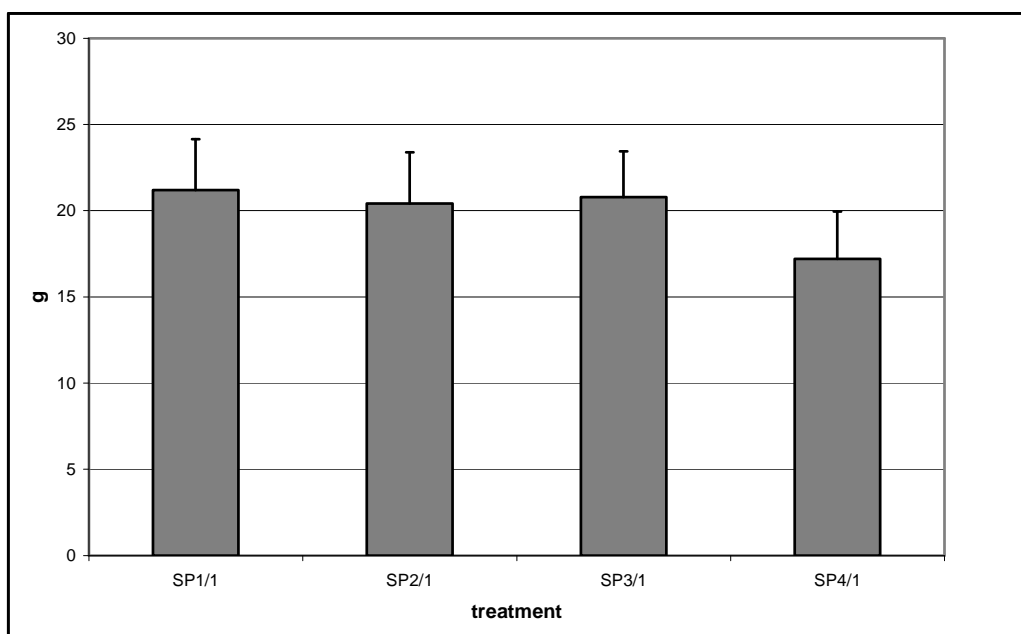


Figure 2. Effect of pickings on yields

In terms of average fruit weight, the higher fruit weights were produced by the harvests with two week intervals (SP1/1, SP3/1) (figure 3.). The fruits picked at 4 week intervals did not result in significantly lower yields, the difference was only 0,5 kg/m<sup>2</sup>. Statistical results confirm that the frequency of harvests has strong effect on fruit number.



**Figure 3. Average fruit weights per treatment**

#### **ACKNOWLEDGEMENT**

Research work was supported by the grant TAMOP-4.2.1/B-09/1/KMR-2010-0005.

#### **REFERENCES**

- ANCHONDO, J.A. ;WALL, M.M. ;GUTSCHICK, V.P. ;SMITH, D.W. (2001). Pigment accumulation and micronutrient concentration of iron-deficient chilli peppers in hydroponics. *HortScience*.36(7):1206-1210.
- BELAKBIR, A., RUIZ, J.M., ROMERO, L. (1998): Yield and fruit quality of pepper (*Capsicum annuum* L.) in response to bioregulators. *HortScience*. 33(1): 85-87.
- BOSLAND PW, VOTAVA, EJ (2000): Peppers Vegetable and Spice Capsicums. CABI Publishing, Oxon New York. ISBN 0 85199 335 4. p. 204
- DASGAN, H.Y., ABAK, K. (2003): Effect of plant density and number of shoot on yield and fruit characteristics of peppers grown in glasshouses. *Turkish Journal of Agriculture and Forestry*. 27 (1): 29-35.
- DUROVKA, M., LAZIĆ, B., BAJKIN, A., POTKONJAK, A. MARKOVIĆ, V., ILIN, Ž., TODOROVIĆ, V. (2006): Proizvodnja povrća I cveća u zaštićenom prostoru. Grafomark, Laktaši, Bosnia. ISBN 86-7520-087-0 p. 510.
- Fruitveb (2010): A zöldség és gyümölcs ágazat helyzete Magyarországon. Magyar Kertészeti Tanács, Budapest.
- GYÖKÖS E., DUDÁS L., HODOSSI S., KAPITÁNY J. (2009): A betakarításkori érettség és az utóérlelés hatása a fűszerpaprika festéktartalmára. *Agrofórum*, 20(9): 56-59.
- GYÚRÓS J., SZŐRINÉ Z. A. (2005): Paprika. In: In: Terbe I. , Hodossi S., Kovács A. (szerk): Zöldségtermesztés termesztőberendezésekben. Mezőgazda Kiadó, Budapest. ISBN 963 286 204 X. p.133-152.



- IRINYI B., KAPITÁNY J. (2004): A káliumtrágyázás szerepe a fűszerpaprika terméshozamának és minőségének növelésében. *Kertgazdaság*, 36(1):14-19.
- IRINYI B., SLEZÁK K. (2006a): Lombtrágyázás hatása a fűszerpaprika termésmennyiségére és minőségére. *Zöldségtermesztés*, 37(3):24-28.
- IRINYI B., SLEZÁK K. (2006b): Lombtrágyázás hatása a fűszerpaprika fontosabb beltartalmi tulajdonságaira. Magyar Táplálkozástudományi Társaság XXXI. Vándorgyűlése. Keszthely, 2006. október 5-7. Proc. 35.
- TERBE I. (2009): A hajtattott fűszerpaprika igény szerinti víz- és tápanyag-ellátása. *Zöldségtermesztés*. 40(1): 5-6.
- ZATYKÓ L. (2000): Paprika. In: Balázs S. (szerk.): *A zöldség-hajtattás kézikönyve*. Mezőgazda Kiadó, Budapest. ISBN 963 9358 03 7. p. 195-243.

## **ANALYSIS OF THE CAP BY THE BASIS OF THE HUNGARIAN FARMERS**

**LENDVAI EDINA**

University of Szeged – Faculty of Engineering  
H-6724 Szeged, Mars tér 7.  
Assistant professor  
[lendvai@mk.u-szeged.hu](mailto:lendvai@mk.u-szeged.hu)

### **ABSTRACT - Analysis of the cap by the basis of the Hungarian farmers**

*In the 90s agriculture experienced serious changes in Hungary. Both internal and external markets narrowed down, besides, the structures of ownership and production transformed considerably. As a purpose of our research we set to get more knowledge about the operation, structure and possibilities of the system of the Common Agricultural Policy, and last but not least, about its effects on the Hungarian economy and farmers.*

**Keywords:** *Common Agricultural Policy, Hungary, survey*

### **INTRODUCTION**

In the 90s agriculture experienced serious changes in Hungary. Both internal and external markets narrowed down, besides, the structures of ownership and production transformed considerably. The price gap between agricultural and industrial products widened, and prices in agriculture could hardly follow the inflation. Increase in price experienced from 2000 only partly compensated for the earlier loss. Measures in agrarian policy only partly balanced the unfavourable effects and the decreasing conditions brought about a decline in production. (Pete, 2004)

In 2004 our country became member of the European Union. With it, our country became concerned in the common cooperation, as well. Among the common policies concerning the member countries, the Common Agricultural Policy affects Hungary highly, being a traditional agricultural country.

As a purpose of our research we set to get more knowledge about the operation, structure and possibilities of the system of the Common Agricultural Policy, and last but not least, about its effects on the Hungarian economy and farmers.

That is why we made some in-depth interviews, and besides, we carried out a questionnaire survey in order to get a picture about how farmers, ventures consider the situation of their own farms-ventures and that of the Hungarian economy in this Common system.

### **THE COMMON AGRICULTURAL POLICY (CAP)**

The Common Agricultural Policy is one of the most complicated fields of the European integration. In debates before the Treaty of Rome even the possibility for the CAP was questioned.” (HALMAI, 2007)

Among the policies of the European Union, it is the CAP that was established in the beginning. Its principles were determined in the Treaty of Rome, in 1957. The CAP is one of the most complicated fields of the Union policies. It was started in 1962. By today

several reforms and changes have been realized in it, and there are still points to be clarified in the future, too. The CAP and its subsidies highly affect our country, as a traditional agricultural country. After our joining, a part of our agricultural society has adapted and still adapts to the real trends, however, the other part refuses everything which could imply growth and improvement of production. In the years after our joining our old weaknesses manifested themselves, first of all, when farmers suddenly faced up with a strong contest. On one side, in case of relatively big and well-organized holdings, increasing subsidies, improving production results and good income position can be exhibited. On the other side, a number of negative effects have appeared: organization and equipment of low level, deficient logistic systems, outdated structure of land use. It can be stated that the Hungarian agricultural is in another stage of development than its competitors in the old member countries. Conditions of survival, so that of entering the market have become more difficult for several holdings and families. It is advisable to spend the significant ratio of the sources coming from both the Union and the country on preservation of the subsistence and strengthening competitiveness. (PALÓCZ ET AL, 2010) The treaty of 1957 which established the European Economic Community put the basic principles of the Common Agricultural Policy on record in the 39th paragraph.

The purposes were:

- To increase productivity of the agricultural production
- To assure the standard of living for people who live on agriculture
- To stabilize the market for agricultural products
- To guarantee the security of food supply
- To make it sure that consumers can buy the food for a reasonable price

In 1958 the member states accepted the principles of the operation of the Common Agricultural Policy, in the meeting of Stresa.

The basic principles were the following:

- The principle of the unified market
- The principle of the community preference
- The principle of financial solidarity

According to the three principles, the unified agrarian policy of the EU started to operate in 1962, it was then that the financial funds of the agrarian policy, which is still working, was established: the European Agricultural Guidance and Guarantee Fund – EMGGF (BERNEK ET AL, 2003).

Future of the Common Agricultural Policy will depend closely on its costs, since a significant part of the present common budget is spent on the this common policy (53 billions EUR a year which is 0,43% of the EU's GDP). In the future several debates can be expected in connection with the grade of financing and its refund. There should be radical changes, sustainability should be placed in the centre of the CAP in social, economic and environmental sense, too. The next overall reform is planned in 2014. The CAP's share from the EU's budget is continuously decreasing, since it was 71% in 1984, it is expected to become 33% by 2013. When accepting the financial framework for 2014-2020 it will be clear which purposes how much subsidies will obtain. The member states agree on that there should be certain changes and the first step should be to define the purposes and tasks (KÁLMÁN, 2009).

It is an important aspect in connection with the future objectives to form a unified CAP which is about not only farmers but also each citizen in the EU. To achieve this aim it is necessary to hold social debates in each member states in order to let different opinions

form the Common Agricultural Policy after 2013. (KAP reformmal kapcsolatos konferenciasorozat, 2010).

The way how the Common Agricultural Policy changes is of great importance for Hungary, too. The common aim is that in the following programming period of seven years the country could get as much or more subsidy than in the previous period. The amount of subsidies will change but the question is what will be spent more or less on. To determine it the Commission of the European Communities expect suggestions from the inhabitants of the member countries. From 2014 considerable changes can be expected in the CAP, so our country has to take part in it, in order to assert her interests, mainly because at the time of the professional debate, in 2011, our country will be the president. It is very important for us to assert our interests since the biggest part of our farmers' income come from the financial funds of the CAP. 80% of the subsidy frame provide the direct subsidy given to the farmers and market regulation \CAP 1st pillar\. The remaining 20% support regional development (umvp.eu).

Thus, the future Common Agricultural Policy and its formation are in our common interest and task.

## **MEANS AND METHOD**

During the primary research we executed the following tasks:

- In-depth interviews- 10 people- with some farmers/ventures from the small subregions of Bácsalmás and Jánoshalom
- Questionnaire and data collection in the small subregion of Bácsalmás and Jánoshalom
- Making an interview with the village agronomists and leaders of the community of wine-growers of some settlements and towns of the mentioned small subregions.

During the research work 100 questionnaires were filled in by the farmers of the small subregions of Bácsalmás and Jánoshalom, which were then assessed in order to get a picture about the size of the holdings in the subregions and about their changes, and also to survey what information they have regarding the CAP. We used the program Statistica 8.0 for assessment and summary of results.

## **RESULTS AND THEIR ASSESSMENT**

From the primary research with in-depth interviews the following conclusions can be drawn:

- the number of farmers is decreasing in the small subregions
- a lot of farmers do not know anything about the CAP, the number of those who know anything about it is very low
- they consider our joining the EU unfavourable
- they can obtain the subsidy with difficulties, and if they manage to do it, the amount of the subsidy is small
- farmers with a small holding are pushed to the background
- the farmers' situation is much worse than that of the farmers abroad
- lack of information about possibilities, subsidies

Demographic data of people who filled in the questionnaire are shown in *Tables 1-2*.

20-30 év		30-50 év		50-65 év		65 év felett	
fő	%	fő	%	fő	%	fő	%
4	4	39	39	42	42	15	15
<b>Összesen 100 fő (100%)</b>							

**Table 1. Division of people questioned according to age**

*Source: my own survey*

**Table 2. Division of people questioned according to their qualification**

School qualification	Person	%
Elementary	41	41
Secondary	36	36
High	23	23
<b>Altogether</b>	<b>100</b>	<b>100</b>

*Source: my own survey*

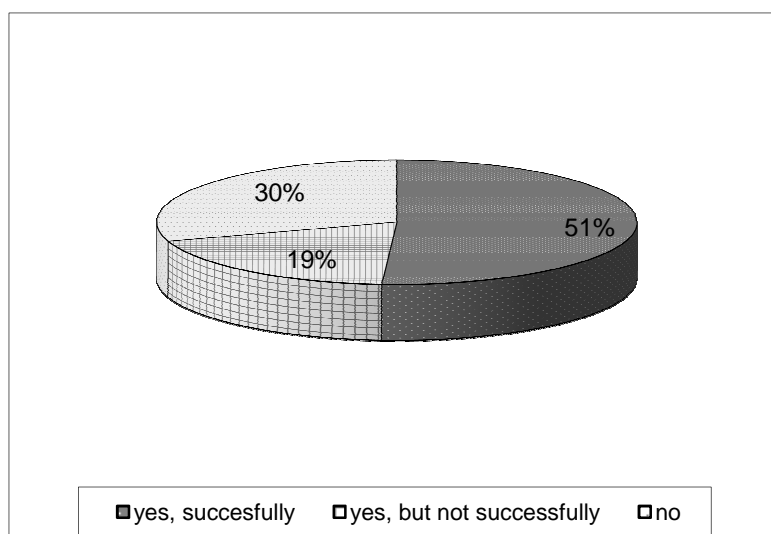
It can be seen from the answers that there are much more farmers who have or cultivate a propriety of 5 ha or of smaller size. Majority of the farmers (36%) have been working in the agriculture for more than 16 years, they are followed by those who have been working in this sector for 11-15 years (28%). The younger farmers who entered this field 6-10 years ago actually continue the family holdings or the economical and farming activities started earlier. The answerers strive to stand on more pillars, so in the interest of their survival they work in more sectors of agriculture, it is demonstrated in *Table 3*.

**Table 3. Division of people working in different fields of agriculture**

Categories	Number of answers*
Livestock breeding	40
Cultivation	81
Service	46
Others	-

\* More options were possible.

After the general data let's see the knowledge on the CAP! 94% of the answerers have heard about the CAP somehow. It was mainly the TV, radio and the specialized press which gave them information on this subject. We examined with the next question how much these people are aware of the timeliness of the CAP, and if they know which reform version is valid at present. Majority of the answerers (58%) is well-informed in this subject and they know which of the reform versions is in force. 22% thought that they know it but they gave a wrong answer (eg: there were people who wrote 1999, 2002, 2004 or 2006, too.) The remaining 20% could not answer the question. Diagram 1 shows the answers which are connected to data and information collection.



**Diagram 1. Division of answers according to the success of information collection connected to the changes in agriculture after joining**

*Source: my own survey*

It is interesting and also sad that 30% of the answerers did not even try to get to know what changes and novelties joining and the connecting agricultural changes bring for them. It can be seen clearly from the results that 19% of the farmers could not get the necessary and important information though they tried to obtain it.

In the questionnaire survey we asked some questions about financial supports, being curious to know if our farmers and venturers are aware of what differences can be experienced between our country and other member states regarding the intensity of subsidies. The data can be seen in *Table 4*.

**Table 4. Division of answerers according to their knowledge about the differences in subsidies granted by Hungary and the EU**

*Source: my own survey*

Possibilities	Person	%
Yes, it gives less	85	85,00
Yes, it gives more	0	0,00
Haven't heard about it	15	15,00
<b>Altogether</b>	<b>100</b>	<b>100</b>

## SUMMARY

As a conclusion we are listing here some suggestions made by the farmers in the in-depth interviews:

- There should be a harmony between farmers and the state
- Flow of information towards farmers should be supported
- Local forums should be organized to give information instead of forums in the towns
- There should be more subsidy

- There should be a co-operation between farmers
- Subsidies should be aimed at the smaller holdings and farmers, too
- There should be someone locally who could give information about current events, information
- To pay in advance, instead of financing afterwards, on order to be able to realize the plans
- Assistance in case of the successful application for subsidy to make realization efficient
- Smaller farmers should get subsidies of bigger amount

## REFERENCES

- BERNEK Á. – KONDOROSI F. – NEMERKÉNYI A. – SZABÓ P. (2003): Az Európai Unió  
Cartographia Kft
- HALMAI P. (2007): Átalakulóban az EU Közös Agrárpolitika – Hazai kihívások és  
válaszok. Profconsul Kft, Budapest
- KAP reformmal kapcsolatos konferenciasorozat, 2010
- KÁLMÁN Z. (2009): Milyen Közös Agrárpolitika legyen 2013 után? Az Európai Unió  
Agrárgazdasága 14. évf. 19, sz. pp.11-12
- PALÓCZ É. – BARTHA A. – GÉM E. – GYUKICS R. – KLAUBER M. – MATHEIKA Z. – NAGY Á.  
– NAGY K. – VAKHAL P. (2010): A világgazdaság és a magyar gazdaság helyzete és a 2010.  
évi kilátásai. Konjunktúrakutatási Intézet, Budapest
- PETE N. (2004): A Magyar mezőgazdaság és az Európai Unió – tanulmány. Magyar  
Köztársaság Külügyminisztériuma.
- <http://umvp.eu/?Q=magazin/kap-vita-osszegzes-0> (letöltve: 2010. szeptember 9)

## **FINANCIAL SUPPORT MECHANISMS FOR ROMANIAN FARMERS BEGINNING WITH 2007**

**MONICA OCNEAN, LIVIU SAMBOTIN**

Banat's University of Agricultural Sciences and Veterinary Medicine from Timisoara  
Calea Aradului, no.119, 300645, Timisoara, Romania  
monicaocnean@gmail.com

### **ABSTRACT- Financial support mechanisms for Romanian farmers beginning with 2007**

Romanian agriculture refreshment, respectively its harmonization with the common exigencies in this field, represents a long-term process that requires the integrated application of measures specific to the general orientations of the Common Agricultural Policy.

In these terms, it is necessary to improve rural infrastructure (roads and public facilities), and this process should be correlated with the creation of an attractive investment environment, with the organization of producer groups in agriculture, etc.

**Keywords:** Common Agricultural Policy (CAP), financial support, direct payments per hectare, complementary national payments, rural development funds, governmental support

## **INTRODUCTION**

Because Romania is an EU-member country since 2007, obviously it must, in concordance with the adhesion agreement, „align” to the financing systems of agriculture and rural development practised in the European Union. Under the context of the financial CAP reforms, available for our country, too, the financing of the Romanian agriculture is made with European Union funds, and also with funds from the state budget (public funds) directed in supporting programs for farmers. (FEHER, 2009)

## **MATERIAL AND METHOD**

Starting with 2007, Romania, as European Union-member state, must implement CAP mechanisms for farmer support. From this viewpoint the paper is based on the provisions of the Common Agricultural Policy.

## **RESULTS**

The main financial support mechanisms for the Romanian farmers, for the period 2007-2013, may be synthetically presented as follows.

### **1. Direct Payments per Hectare**

The Direct Payments per Hectare introduced in 2007 are supported by the European Union funds.

The sum offered in 2007 was approximately 50 Euros/ hectare. This sum will increase step by step, every year, until 2013, when it will be more than 200 Euros/ hectare/ year).



The money is given to those who work the land – owners or tenants – under the following conditions:

- ◆ the agricultural land area cultivated (arable land, pasture, vineyard, orchard, etc.) should be at least 1 ha, divided in parcels of at least 0.30 ha
- ◆ the land should be registered in Farm Register
- ◆ the owner or the tenant should apply until 15th May 2007.

The institution administrating the direct payments per ha is the Agriculture Payments and Intervention Agency (APIA). There are several centres of this agency in each county of Romania, where farmers may obtain information related to the money they will receive.

## **2. Complementary National Payments**

The Complementary National Payments, introduced in 2007, too, come besides the Direct Payments per Hectare. The difference between them is that the Complementary National Payments will be paid by the Romanian Government from the Ministry of Agriculture's budget.

The Complementary National Payments will be calculated per area cultivated, respectively per animal capita, according to the European model.

The Complementary National Payments will get to farmers through the Agriculture Payments and Intervention Agency (APIA). They can be increased in concordance with the budgetary resources and farmers' needs.

## **3. Rural Development Funds**

The Rural Development Funds represent the financial support offered Romania by EU for investments in agriculture and rural development. According to the negotiations between Romania and European Union, our country will benefit by about 8.1 billion Euros for the period 2007 – 2013, meaning 1.07 milliard euros per year. This sum is supplemented with the Romanian Government's contribution, according to investment type. The Rural Development Funds resemble the SAPARD funds, with the differences that:

- they are about 6-fold bigger;
- aim at more beneficiaries, including small farmers and enterprisers;
- they can be much easily obtained.

The Rural Development Funds are intended for small farmers, farmer associations, young persons, small and medium enterprises from the agricultural and forest sectors (and also for services and small industry), processing units, forest owners, farmers from mountain regions and local councils.

These funds are classified in 4 major directions. Each direction (axe) includes several measures, as follows:

### **A. Competitiveness increase in the agricultural and forest sector = 3.219 billion Euros (42.2% of the total)**

- ◆ support for semi-subsistence farms (about 85,000 small farms will receive 1500 Euros/ year, for 3 years, if they make a modernization plan)
- ◆ farm modernization (16,000 farms will receive about 70,000 Euros/project)
- ◆ foundation of farms by farmers younger than 40 years old (up to 40,000 Euros/farm, according to the project applied)
- ◆ support for farmer associations (750 groups of producers will receive approximately 250,000 Euros/project)
- ◆ professional formation and information (140,000 farmers will be trained).

**B. Environmental improvement and agricultural land and forest management = 1.907 billion Euros (25% of the total)**

- ◆ support per area for disfavoured regions, especially in mountains (about 370,000 farmers will receive a supplement of 25 - 250 Euro/ hectare/ year)
- ◆ support for pastures and hayfields (about 95 Euro/ hectare / year)
- ◆ support for the first land afforestation (36,000 hectares will benefit by funds of 5,000 Euros/ hectare)

**C. Life quality improvement in rural area and rural economy diversification = 2.007 billion Euros (26.3% of the total)**

- ◆ diversification of non-agricultural activities (handicrafts, traditional products, rural tourism) (19,000 beneficiaries will receive 10,000 Euros/ project)
- ◆ investments in small enterprises in rural area – hairdressers’, agricultural machine maintenance, etc. (3,800 small enterprises will be financed with 20,000 Euros/ project)
- ◆ village renovation (approximately 1200 local councils will receive 1 million euros each for roads, water supply, restoration of historic and cultural buildings, etc.).

**D. LEADER Program = 0.188 billion Euros (2.5% of the total).**

This will finance the creation of Local Action Groups, which will support the rural development projects.

There is a special fund for fishing – European Fisheries Fund (EFF) of 263 million Euros for the period 2007 – 2013. The biggest part of this sum will be allocated for:

- ◆ creation of fish farms
- ◆ modernization of boats and cogs
- ◆ fisher associations.

**4. Governmental Support**

The Rural Development Funds are financed through the Payments Agency for Rural Development and Fisheries (PARDF – the former SAPARD Agency). PARDF has 42 county offices, where projects may be applied starting with the spring of 2007.

The Governmental Support represents the subsidies and credits offered by the Ministry of Agriculture, starting with 2007, to support land cultivation and animal breeding.

The Governmental Support is directed to:

- credits for agricultural production, support for seeds and planting material, subsidies for phyto-sanitary treatments, bonuses for crop insurances, support for vineyards and orchards starting, subsidies for irrigations (in the vegetal sector);
- support for breed and reproduction animals purchase, credits for production, subsidies for sowing centres in the case of producer associations (in the animal-breeding sector).

The Governmental Support will be distributed through the Agriculture Payments and Intervention Agency (APIA) and the Rural Development Agencies (ARDA).

### **Market Mechanisms**

The Market Mechanisms represent the actions protecting agricultural producers against the competition outside the European Union and also against the price changes that occur at agri-food products.

The main market mechanisms applied in Romania after the adhesion to the European Union are:

- **Intervention price.** This represents the Government's action of purchase or sale, on the market, of certain product amounts, in order to protect producers and market under conditions of over-production or sub-production. This mechanism is stipulated mainly for cereals and it will provide the producer a correct wheat price.

- **Export subsidies.** These represent sums of money offered to the Romanian producers that export agri-food products outside the European Union, if the sale price outside EU is smaller than the price available within EU.

The market mechanisms are submitted to the Agriculture Payments and Intervention Agency (APIA).

During 2007 – 2013, European Union will offer approximately 12 billion Euros for agriculture and rural development. The sum represents 40% of the total funds allocated by European Union for Romania for this period.

These funds could be attracted only if the farmers or authorized institutions would have the possibility to apply eligible projects for various investments.

### **CONCLUSIONS**

The Payments and Intervention Agency cannot offer the payments per hectare if the applicant is not recorded in Farm Register. The Farm Register is very important because it represents a data base including all farms from Romania.

Romanian agriculture refreshment, respectively its harmonization with the common exigencies in this field, represents a long-term process that requires the integrated application of measures specific to the general orientations of the Common Agricultural Policy.

In these terms, it is necessary to improve rural infrastructure (roads and public facilities), and this process should be correlated with the creation of an attractive investment environment, with the organization of producer groups in agriculture, etc.

Farm modernization aims at the purchase of modern equipment, which should reduce production costs, and also at the attraction of young farmers to farms with real potential, to face the competition pressure.

Moreover, in order to provide incomes that should favour farm modernization, the Romanian farmers benefit, from the European Union budget, by:

- direct payments per land area;
- restitutions to the agricultural products exports to third countries;
- interventions for agricultural market regulation;
- funds for rural development measures.

## REFERENCES

FEHER ANDREA (2009): “Finanțarea agriculturii și dezvoltării rurale. Politici Comunitare - Financing of agriculture and rural development. Community Policies”, Orizonturi Universitare Publishing House, Timisoara

GOȘA V. (2005): ”Management financiar în agricultură și turism rural – Financial management in agriculture and rural tourism”, Mirton Publishing House, Timișoara

OTIMAN P. I. coordinator (2006): “Dezvoltarea rurală durabilă în România” - Sustainable rural development in Romania, Publishing House of Romanian Academy, Bucuresti

SÂMBOTIN L. (2008): “Management agrar”, Agroprint Publishing House, Timișoara

ZAHIU LETIȚIA ET AL. (2005): ”Politici și piețe agricole - reformă și integrare europeană.”, Editura Ceres, București

The official website of the European Union: <http://europa.eu/>

The website of the Romanian Ministry of Agriculture and Rural Development: <http://www.madr.ro>

The website of the Romanian Agriculture Payments and Intervention Agency: <http://www.apia.ro>

## **AVALUATION OF SUSTAINABLE DEVELOPMENT INDICATORS FOR ROMANIA AND HUNGARY**

**MORARIU<sup>\*</sup>, LUCIAN, DIANA BLAGA<sup>\*</sup> RUXANDRA GAIȚĂ<sup>\*</sup> NICOLETA MATEOC-SÎRB<sup>\*</sup>**

lucian.morariu@uex-usamvbt.org

**Abstract** - Avaluation of sustaineble development indicators for Ramonia and Hungary

The Sustainable Development Indicators (SDIs) are used to monitor the EU Sustainable Development Strategy (EU SDS). They are presented in ten themes. Of more than 100 indicators, eleven have been identified as headline indicators. They are intended to give an overall picture of whether the European Union has achieved progress towards sustainable development in terms of the objectives and targets defined in the strategy. Each indicator can be analyzed and presented for each country in the EU. In this study we evaluated some of the indicators for Romania and Hungary, two neighbor countries with similar natural conditions, but with different results as we can conclude after this research. The purpose of this paper is to understand how regional disparities can influence the development of countries.

**Keywords:** economic development, social inclusion, public health

### **INTRODUCTION**

The [EU Sustainable Development Strategy](#) (SDS) sets out a coherent approach to how the EU will more effectively live up to its long-standing commitment to meet the challenges of sustainable development. It reaffirms the overall aim of achieving continuous improvement of the quality of life and well-being on earth for present and future generations, through the creation of sustainable communities able to manage and use resources efficiently and to tap the ecological and social innovation potential of the economy, ensuring prosperity, environmental protection and social cohesion.

The key objectives of the [EU Sustainable Development Strategy](#) are the following:

- **Environmental Protection.** Safeguard the earth's capacity to support life in all its diversity, respect the limits of the planet's natural resources and ensure a high level of protection and improvement of the quality of the environment.
- **Social Equity And Cohesion.** Promote a democratic, socially inclusive, cohesive, healthy, safe and just society with respect for fundamental rights and cultural diversity that creates equal opportunities and combats discrimination in all its forms.
- **Economic Prosperity.** Promote a prosperous, innovative, knowledge-rich, competitive and eco-efficient economy which provides high living standards and full and high-quality employment throughout the European Union.
- **Meeting International Responsibilities.** Encourage the establishment and defend the stability of democratic institutions across the world, based on peace, security and freedom.

## EVALUATION OF MAIN SUSTAINABLE DEVELOPMENT INDICATORS

The SDI framework is based on ten themes, reflecting the seven key challenges of the strategy, as well as the key objective of economic prosperity, and guiding principles related to good governance. The themes follow a general gradient from the economic, to the social, and then to the environmental and institutional dimensions. They are further divided into sub-themes to organise the set in a way that reflects the operational objectives and actions of the sustainable development strategy. With this paper we decided to analyze the theme indicators for Romania and Hungary, to understand the impact and effect of different economic and social actions on the local communities.

**A. Socio-economic development theme.** Sustainable socio-economic development is a core element of the European Union's Sustainable Development Strategy (EU SDS). The strategy sets out the objective of promoting a prosperous, innovative, knowledge-rich, competitive and eco-efficient economy, which provides high living standards and full and high-quality employment throughout the European Union.

The following table presents the evolution of GDP per capita as a percentage of the previous period. We can see that over the analyzed period, both at EU level and in Romania and Hungary has been a continuous growth of this indicator until 2009, when due to the global crisis, GDP declined by 6.9 % for Romania and 6.5% for Hungary, compared with 2008.

**Table 1. Real GDP per capita, growth rate and totals – percent change previous period**

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
EU-27	3,6	1,7	1	0,9	2	1,5	2,8	2,5	0,1	-4,6	1,6	1,5	1,9
Hungary	5,2	4	4,4	4,3	4,8	3,4	3,8	0,9	1	-6,5	1,2	2,9	3,3
Romania	2,5	5,8	8	5,5	8,8	4,4	8,1	6,5	7,5	-6,9	-1,7	1,7	4

From *Table 2* we can see that GDP per capita increased from 1,800 euros in 2000 to 2900 euros in 2009 for Romania. Although Hungary's GDP didn't increased as much, we see that throughout the analyzed period, the GDP per capita of Hungary has been and remains at levels two times higher compared to Romania.

**Table 2. Real GDP per capita, growth rate and totals – euro/ inhabitant**

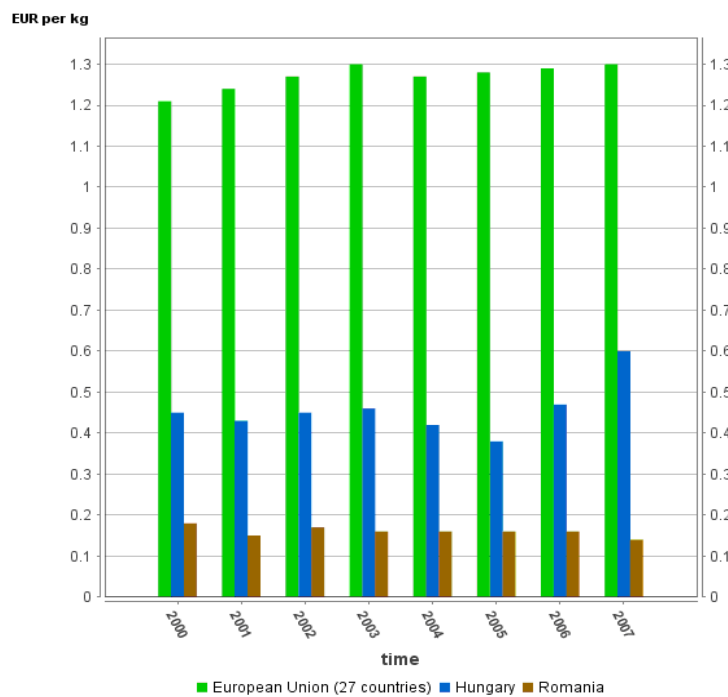
	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
EU-27	19100	19400	19600	19800	20200	20500	21000	21600	21600	20600
Hungary	5000	5200	5500	5700	6000	6200	6400	6500	6500	6100
Romania	1800	1900	2100	2200	2400	2500	2700	2900	3100	2900

**B. Sustainable consumption and production theme.** The EU Sustainable Development Strategy (EU SDS) sets out the objective of promoting sustainable consumption and production patterns. Addressing social and economic development within the carrying capacity of ecosystems and decoupling economic growth from environmental degradation is an essential requirement for sustainable development. The indicator is expressed in Euro/Kg (the quantity of raw materials extracted from the domestic territory of the focal economy, plus all physical imports minus all physical exports).

**Table 3. Resource productivity EURO/kg**

	2000	2001	2002	2003	2004	2005	2006	2007
European Union (27 countries)	1,21	1,24	1,27	1,3	1,27	1,28	1,29	1,3
Hungary	0,45	0,43	0,45	0,46	0,42	0,38	0,47	0,6
Romania	0,18	0,15	0,17	0,16	0,16	0,16	0,16	0,14

Regarding this indicator, we observe that in particular Romania and Hungary, the values are very low compared to EU average, this being due primarily to a inefficient process of use of resources.



**Figure 1. Resource productivity**

**C. Social inclusion theme.** Overall Objective: To create a socially inclusive society by taking into account solidarity between and within generations and to secure and increase the quality of life of citizens as a precondition for lasting individual well-being.

Table 4 shows the population at risk of poverty. While this indicator for EU average is 23.1% in 2009, in Hungary it reaches 29.9% and for Romania recorded the highest percentage of 43.1%.

**Table 4. Population at-risk-of-poverty or exclusion - %**

	2003	2004	2005	2006	2007	2008	2009
European Union (27 countries)	-	-	26	25	24,5	23,6	23,1
Hungary	-	-	32,1	31,4	29	28,2	29,9
Romania	-	-	-	-	45,9	44,2	43,1

The value of this indicator is concern for Romania, reflecting the fact that almost half of our country's inhabitants live in precarious conditions, quality of life and standard of living are strongly affected by the low level of income, commercial facilities, etc.

**D. Demographic changes theme**

Table 5 presents the employment rate of older people. Regarding this indicator, we notice that 46% of elderly people (55-64 years old) in the EU were employed in 2009, in Hungary the figure is 32.8%, while in Romania it was 42.6%. This indicator reflects the fact that older people can find a job with real opportunities to have a place where they can work.

**Table 5. Employment rate of older workers - %**

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
EU-27	36,9	37,7	38,5	40	40,7	42,3	43,5	44,6	45,6	46
Hungary	22,2	23,5	25,6	28,9	31,1	33	33,6	33,1	31,4	32,8
Romania	49,5	48,2	37,3	38,1	36,9	39,4	41,7	41,4	43,1	42,6

**E. Public health theme**

Overall objective: To promote good public health on equal conditions and improve protection against health threats

The indicator examined in Table 6 expresses the number of years lived by a person in good health, without requiring special care or intensive treatment for various age-specific diseases. As for Romania, this indicator is 62.6 years for women and 60 years for men.

**Table 6. Healthy Life Years**

	2003	2004	2005	2006	2007	2008
EU-27 women	-	-	-	-	62,3	-
Hungary women	57,8	-	53,9	56,97	57,6	58
Romania women	-	-	-	-	62,3	62,6
EU-27 men	-	-	-	-	61,5	-
Hungary men	53,5	-	52	54,2	55	54,6
Romania men	-	-	-	-	60,4	60

The table below shows the life expectancy at birth. Note that the highest value is recorded by the EU women, they lived on average 82.37 years, while women in Hungary live 78.25 years, and 77.22 years in Romania (for 2008). The men still live a few years less than women. However note that during the period under review, there is an increased life expectancy, regardless of gender or region.

**Table 7. Life expectancy at birth**

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
EU-27 women	-	-	80,87	80,82	81,49	81,54	82,01	82,2	82,37	-
Hungary women	76,16	76,65	76,74	76,69	77,16	77,17	77,76	77,76	78,25	78,4
Romania women	74,75	74,88	74,7	75,04	75,53	75,7	76,18	76,86	77,22	77,39
EU-27 men	-	-	74,51	74,62	75,23	75,4	75,84	76,06	76,37	-
Hungary men	67,55	68,24	68,34	68,37	68,73	68,69	69,2	69,38	69,97	70,26
Romania men	67,74	67,54	67,35	67,66	68,25	68,68	69,21	69,71	69,71	69,83

**F. Climate change and energy theme.** Overall Objective: To limit climate change and its costs and negative effects to society and the environment.

Greenhouse gas emissions - index base year = 100

This indicator shows trends in total man-made emissions of the "Kyoto basket" of greenhouse gases. It presents annual total emissions in relation to "Kyoto base year". In



general the base year is 1990 for the non-fluorinated gases and 1995 for the fluorinated gases.

**Table 8. Greenhouse gas emissions - index base year = 100**

	2000	2001	2002	2003	2004	2005	2006	2007	2008
EU-27	90,9	91,9	91,1	92,5	92,5	91,9	91,6	90,5	88,7
Hungary	79,2	81,3	79,1	82,2	81,2	82	80,3	77,8	75,1
Romania	56,3	58,2	60,8	63,5	64,2	61,8	63,7	63,1	60,3

From the table above we see that the index of emissions of greenhouse gases is the lowest in Romania's case, its value being 60.3 in 2008, while for Hungary is 75.1 and for the EU the index value being 88.7. This reduced index in Romania may be due to a steady decline in the industrial sector in our country. However, while this figure has declined over the period for the EU and Hungary, in Romania, the trend was increasing from 56.3 in 2000 to 60.3 in 2008.

**G. Sustainable transport theme.** Overall Objective: To ensure that our transport systems meet society's economic, social and environmental needs whilst minimising their undesirable impacts on the economy, society and the environment.

**Table 9. Energy consumption of transport relative to GDP - Index 2000 = 100**

	2000	2001	2002	2003	2004	2005	2006	2007
EU-27	100	99,1	98,7	99	98,9	97,6	96,7	95,5
Hungary	100	100,5	101,4	101,4	100,1	104,5	112,1	110,9
Romania	100	113,9	115,5	109,9	120,7	94,1	90,1	91

**H. Natural resources theme.** Overall Objective: To improve management and avoid overexploitation of natural resources, recognising the value of ecosystem services. This is an area where there is clearly unsustainable trends. There have been positive developments in areas such as water and air, although further efforts are needed. There is a growing demand for natural resources, which exceed the carrying capacity of Earth. This is a challenge to be addressed urgently. Biodiversity is declining worldwide and in the EU, due to damage ecosystems and the objectives set for 2010 were not met.

**I. Global partnership theme.** Regarding this theme, targets under the EU SDS focus on promoting sustainable development actively worldwide and ensure that the European Union's internal and external policies are consistent with global sustainable development and its international commitments. Official development assistance (ODA) consists of grants or loans that are undertaken by the official sector with promotion of economic development and welfare in the recipient countries as the main objective. From the next table we can see that ODA for the UE is 0,42% of GNI, while for Hungary this is only 0,09% and for Romania 0,08%.

**Table 10. Official development assistance as share of gross national income - %**

	2003	2004	2005	2006	2007	2008	2009
EU-27	-	-	0,41	0,41	0,37	0,4	0,42
Hungary	0,03	0,07	0,1	0,13	0,08	0,08	0,09
Romania	-	-	-	0	0,07	0,07	0,08

**J. Good governance theme.** Good governance issues are addressed in the EU Sustainable Development Strategy (EU SDS). The objective is to promote coherence between local, regional, national and global actions in order to enhance their contribution to sustainable development.

The operational objectives and targets for this theme are:

- Policy coherence and effectiveness
- Openness and participation
- Economic instruments

## CONCLUSIONS

There are several disparities but also some similarities regarding Romania and Hungary, two neighbor countries. We can see that even if the natural conditions are almost the same, there are other factors that can have an impact on the economic and social areas. The evaluation of progress since 2000 based on the headline indicators shows a rather mixed picture:

- Changes since 2000 are clearly favourable for GDP per capita in Hungary and Romania, and also at EU level. The resource productivity is also favourable for Hungary and EU, but in Romania we see a decrease regarding this indicator;
- Moderately favourable changes for energy consumption of transport in Romania and EU, while in Hungary the index has increased to 110,9; employment rate of older workers is favourable for Hungary and EU, while in Romania the rate has dropped from 49,5% in 2000 to 42,6% in 2009 ;
- The risk of poverty rate remained broadly stable but in Romania this rate is very high (43,1%) compared with the EU average (23,1%);
- Moderately unfavourable changes for Romania regarding greenhouse gas emissions, where the index is rising from 56,3 in 2000 to 60,3 in 2008, but this value is still under the EU (88,7) or Hungary (75,1) level.

## REFERENCES

Eurostat - [http://epp.eurostat.ec.europa.eu/portal/page/portal/eurostat/home/GDP and beyond - Measuring progress in a changing world](http://epp.eurostat.ec.europa.eu/portal/page/portal/eurostat/home/GDP_and_beyond_-_Measuring_progress_in_a_changing_world)

Sustainable development in the European Union - 2009 monitoring report of the EU sustainable development strategy

## **ASPECTS REGARDING CROSS-BORDER COOPERATION PROGRAM ROMANIA HUNGARY**

**LUCIAN MORARIU\***, **DIANA BLAGA\***, **CAMELIA MĂNESCU\***, **CARMEN DUMITRESCU\***,  
**NICOLETA MATEOC-SÎRB\***

lucian.morariu@uex-usamvbt.org

### **Abstract - Aspects regarding cross-border cooperation program Romania Hungary**

Between 2007 and 2013, Romania and Hungary participates in the conduct of some programs related to European Territorial Cooperation objective. CBC (Cross Border Cooperation) programs funds accessibility projects environment and risk prevention, economic and social development and "people to people" actions. The eligible area covers the south-eastern border of Hungary and north-western part of Romania. The number of people exceeds 4 million, half of Romania's territory and half in Hungary. It is obvious that the border area has a multiethnic population, and therefore rich multicultural traditions. This is reflected by regular cross-border interaction of local communities, providing a solid foundation for strengthening relations and promoting integrated development of border area. On the other hand, however, the existence of state borders limits the possible areas of cooperation.

**Keywords:** social cohesion, common sustainable development, local economy

## **MATERIALS AND METHODS**

For this paper we analysed the official documents released by Romania, Hungary and by the European Union, regarding the CBC programs in this area. In order to simplify the information so this is useful as a general information for the reader, we selected and processed the data in order to obtain a short, easy to understand package of informations about CBC Program Romania-Hungary.

## **RESULTS AND DISCUSSIONS**

The eligible border area covers the South-Eastern and Eastern part of Hungary and the North-Western and Western part of Romania. It consists of **four neighbouring counties** in Hungary and in Romania, respectively. Counties covered in Hungary: Szabolcs-Szatmár-Bereg, Hajdú-Bihar, Békés and Csongrád; counties covered in Romania Satu Mare, Bihor, Arad and Timis.

These 8 counties (NUTS III level) belong to 4 regions (NUTS II level), as follows:

- Szabolcs-Szatmár-Bereg and Hajdú-Bihar counties belong to the North Great Plain Region (Hungary)
- Békés and Csongrád counties belong to the South Great Plain Region (Hungary)
- Arad and Timis counties are part of the Western Region (Romania)
- Satu Mare and Bihor counties are part of the North-Western Region (Romania).



**Figure 1. The programme area**

*Source: Megakom Consulting*

**The overall level of economic development of the co-operation area is very low comparing to the EU25 average.** The GDP per capita of the programme area is very low; moreover, there is some difference between the Hungarian and Romanian parts. In the more developed, Hungarian part of the area this indicator is about 23%, while in the Romanian part it is about 13% of the EU25 average.

**The border area is characterised by modest to high level of unemployment, with significant intraregional differences.** With Romania's accession to the European Union, however, part of the response to the unemployment problems may lay in a more integrated approach to the labour market in the area. Such an approach would help to tackle structural issues and bring closer the demand and the supply side. This would certainly require more coordinated actions and regular share of information of labour market institutions.

Regarding the health system, the differences in the national regulations, funding mechanisms and rates hinder a more active co-operation in this field. Given that the potential exists, it would be useful to implement small scale projects of pilot nature, which then could be mainstreamed and applied on a much wider basis.

**The higher education infrastructure is well developed** in the eligible border area, and the scientific and research human resources potential is also significant. On both sides of the border one of the major strengths is the extensive network of various higher education institutions, characterised by high quality, traditional education and academic activities. Major, famous universities are located here, such as University of Szeged, University of Debrecen, Western University of Timișoara, Banat's University of Agricultural Sciences and Veterinary Medicine Timișoara, University of Oradea, Aurel Vlaicu University in Arad and Timișoara Polytechnic University. Besides, in the other county-cities operate colleges that play an important role and possess significant capacities in the teaching of some professions. For example: the College of Nyíregyháza or Tessedik Sámuel College in Békéscsaba; furthermore Western University "Vasile Goldis" in Arad and its branch in Satu Mare, or the College of Local Public Administration of the "Babes-Bolyai" University Cluj also in Satu Mare.

**National parks and the landscape protection areas (LPA)** in Hungary account for nearly 9% of the total co-operation area. There are two national parks: the Hortobágyi National Park (which is also part of the World Heritage), and Körös-Maros National Park; and 6

landscape protection areas, including the Bihari-Sík LPA, the Hajdúsági LPA, the Közép-Tiszai LPA, the Szatmár-Beregi LPA, the Mártélyi LPA and the Pusztaszeri LPA. In Romania, the total surface covered by Natural Parks (13) and Biosphere Reserves (“Danube Delta”) is 1.687.512 ha (121.780 ha maritime surface), which represents 7% of the total terrestrial country surface. In the programme area, there are parts of Natural Park Apuseni (Bihar county), the Natural Park of the Low Meadow of Mures (Arad county) and more than 40 small areas indentified under the Natura 2000 Programme.

Looking at the **Romanian visitors to Hungary**, the following key features become obvious:

- Romanian visitors represent the highest rate among visitors from all the European countries, with a share of 20,3% out of the total number of visitors. (Followed by Slovakia and Austria.)
- The total number of the visitor-days spent by Romanian tourists in Hungary is the highest, although it is not much higher than that of the German and the Austrian tourists’. The total expenditures of Romanian tourists, however, is only the third highest.
- Motives of travel are diverse. More than 50% of the Romanian visitors are transit passengers. Nearly 25% arrive to Hungary with shopping purposes, and a mere 20% come with touristic purposes.
- Finally, the per capita expenditure / day of the Romanian visitors was 4.600 HUF in 2004, this being the least amount among visitors from European countries.

The proposed strategy is the evolution of the strategy underpinning the Community Initiative Programme Hungary-Romania and Hungary-Serbia&Montenegro, 2004-2006.

The core element of the strategy remained unchanged: to bring the different actors – people, economic actors and communities – closer to each other, in order to better exploit the opportunities offered by the joint development of the border area. The proposed strategy, therefore, is centred around making use of this one-time opportunity, mainly through:

- Improving the key conditions of co-operation through addressing the most important obstacles;
- Supporting the actual co-operation initiatives of various actors.

**The Overall strategic goal is to bring the people, communities and economic actors of the border area closer to each other in order to facilitate the joint development of the co-operation area, building upon the key strengths of the border region.**

#### **Specific objectives**

The overall aim of the programme, with the core elements of the strategy derived from the SWOT analysis, together lead to the formulation of the following specific objectives:

- Specific objective No. 1: **Improved transport infrastructure** to facilitate better access within the border area.
- Specific objective No. 2: **Better flow of information** on joint opportunities within the border area
- Specific objective No. 3: **Common natural resources efficiently used**, natural values protected in the border area.
- Specific objective No. 4: **Economic connections reinforced in the border area** to boost sustainable economic development building on comparative advantages.
- Specific objective No. 5: **Social and cultural coherence** strengthened among people and communities.

The *table 1* shows the allocation of structural funds for the Cross-border cooperation Programme Hungary-Romania, throughout the duration of the program.

**Table 1. Financial plan of Program giving the annual commitment of European Regional Development Fund (EUR)**

	Structural Funding ERDF (EUR)
2 007	32 524 831
2 008	29 095 155
2 009	29 418 787
2 010	31 318 733
2 011	32 045 938
2 012	34 017 133
2 013	36 054 358
<b>Total</b>	<b>224 474 935</b>

#### **Identification of the priority axis**

The proposed strategy is built upon two main pillars. Two priority axis have been identified to implement the proposed strategy presented above; Priority axis 1 relates to the first pillar, while Priority axis 2 relates to the second pillar. A third Priority axis has also been identified, aimed at enhancing the efficiency and effectiveness of programme implementation through the provision of technical assistance.

**Priority Axis 1:** Improve the key conditions of joint, sustainable development of the cooperation area. Funds allocated to this Priority axis will be used to improve the key conditions of joint development in the co-operation area. This includes the **development of the transport and communication infrastructure** as well as public transport facilities of the area, which are instrumental to facilitating cross-border passenger and freight transport and proper flow of information. Besides these, the Priority axis also includes interventions aimed at **prevention and protection of the relative pure natural environment**, as the elemental condition of any kind of human operation.

Interventions proposed under this axis are:

- Improvement of cross-border transport facilities;
- Improvement of cross-border communication;
- Protection of the environment.

**Priority Axis 2:** Strengthen social and economic cohesion of the border area . Priority axis 2 is aimed at promoting and supporting the actual co-operation initiatives in various key areas in order to jointly develop of the border area and strengthen social and economic cohesion. The overall aim of the Priority axis is to enhance the economical competitiveness of the area by development of the business environment, and improvement of the human resources.

Interventions proposed under this axis are:

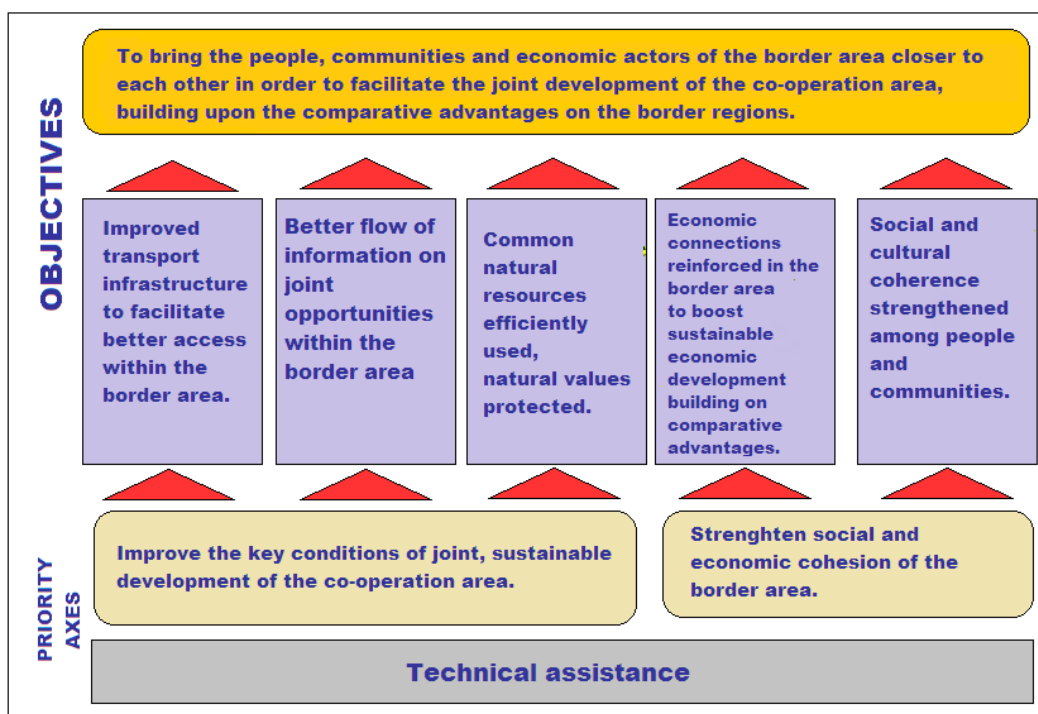
- Support for cross-border business cooperation;
- Promotion of cooperation in the field of research, development and innovation;

- Cooperation in the labour market and education – joint development of skills and knowledge;
- Health care and prevention of common threat;
- Cooperation between communities.

**Priority Axis 3:** Technical Assistance. The Priority axis aims at supporting the implementation of the programme and increase capacity of institutions and beneficiaries in the programme area for cross-border action.

The Priority axis seeks in particular to achieve two specific objectives:

- Secure the core management for the implementation of the programme (Implementation of the programme and contracting, preparation, implementation, monitoring, evaluation and inspection);
- Implement accompanying activities to support the generation and implementation of high quality, result oriented cross-border projects and partnerships.



**Figure 2. Priority axes and the objectives of the Romania-Hungary Cross-border Cooperation Programme**

Cross-border cooperation program is financed by EU funds and national public funds, co-financing rate is 0.85% for Priority Axes 1 and 2, and 0.50% for Priority Axis 3 - Technical Assistance. Most funds are allocated to Priority Axis 1 - Improving the key points shared by the sustained development of the cooperation. The following table set out in detail, the axes, the amounts that make up the funds related to this program, both community and national ones.

**Table 3. Financial plan of the operational program (EUR)**

	<b>Community Funding (a)</b>	<b>National Public funding (b)</b>	<b>National private funding (c)</b>	<b>Total funding (d) = (a)+(b)+ (c)</b>	<b>Co-financing rate % (e)=(a)/(d)</b>	<b>EIB Contributions</b>	<b>Other funding</b>
<b>Priority Axis 1</b> Improvement of the key conditions of joint, sustainable development in the co-operation area	114 482 217	20 202 744	0	134 684 961	85	0	0
<b>Priority Axis 2</b> Strengthen social and economic cohesion of the border area	96 524 222	17 033 686	0	113 557 908	85	0	0
<b>Priority Axis 3</b> Technical Assistance	13 468 496	13 468 496	0	26 936 992	50	0	0
<b>Total</b>	<b>224 474 935</b>	<b>50 704 926</b>	<b>0</b>	<b>275 179 861</b>		<b>0</b>	<b>0</b>

*Source: Hungary - Romania Cross-border Co-operation Programme, 2007-2013*

## CONCLUSIONS

In the co-operation area, there is a certain disparity between male and female occupational segregation, activity rates and pay. As a consequence, women face greater problems e.g. access to transport, childcare, education and training, start up funds. Equal opportunities are promoted throughout the programme cycle. This principle has been fully respected in the partnership process of the preparation of the Programme.

Socio-economic development and integration of the border regions are to be conducted in such a way that socio-economic and environmental sustainability is ensured. The respective strategic framework, based on the SWOT analysis requires that all measures recognise and appropriately utilise the environmental strengths of the border regions, without harming the environment of the area.

The entire programme promotes the concept of a special form of partnership: cross-border partnership: only joint projects of Romanian and Hungarian partners can be supported. The application of the Lead partner principle also enhances partnership.

## REFERENCES

1. Hungarian Central Statistical Office
2. Hungary - Romania Cross-border Co-operation Programme, 2007-2013
3. National Institute of Statistics (Romania)



*ABSTRACTS*

## **FEED PREFERENCE AND GENERAL BEHAVIOUR OF ALPACAS IN SZEGED ZOO**

**BODNÁR<sup>1</sup> ÁKOS, ANDREA PRÁGAI<sup>1</sup>, RÓBERT VEPRIK<sup>2</sup>, ANDREA K. MOLNÁR<sup>3</sup>**

<sup>1</sup>International Development and Tropical Department, Szent István University, Faculty of Agricultural and Environmental Sciences. Páter Károly u. 1., H-2100 Gödöllő, Hungary, [bodnar.akos@mkk.szie.hu](mailto:bodnar.akos@mkk.szie.hu)

<sup>2</sup>Szeged Zoo. Cserepes sor 47., H-6725 Szeged, Hungary, [info@zoo.szeged.hu](mailto:info@zoo.szeged.hu)

<sup>3</sup>Research Institute for Animal Breeding and Nutrition, Gödöllő Research Institute. Isaszegi u. 200., H-2100 Gödöllő, Hungary, [amolnar@katki.hu](mailto:amolnar@katki.hu)

### **ABSTRACT - Feed preference and general behaviour of alpacas in Szeged Zoo**

Feed preference trials and behaviour observations were done with four alpacas (1 male and 3 female) in Szeged Zoo, Hungary. Alpacas are kept in zoos and wild animal parks as exotic animals in Hungary. However, due to the producing of wool for high quality textiles, it can be expected to keep alpacas as livestock animals, too. Nowadays, special wool producing alpaca farm was founded in the east-western part of Hungary. According to this, it could be very important to observe general behavioural patterns and accommodation ability of these animals. Based on the previous results of several Hungarian zoos one can tell that alpacas have adapted well to the local climate, and also show very well results in reproduction.

Portions of the 32 different feedstuffs (4 similar kind of feeds, 1 kg from all at the same time) were laid at the entrance of the yard, next to the gate where the animals left their stable. Free choice of the alpacas was ensured by 1-1.5 m distance between the different portions. Based on the results, one can tell the tubercles, fruits and vegetables can be given to the alpacas anytime, because the animals can utilize their vitamin and carbohydrate content very well. It is necessary to pay attention to the low dry matter and fibre content of these kinds of fodders when eaten up. To feed these fodders is advised only together with fodder with a high dry matter and fibre content (hays, chopped dry corn-stalk etc.). It was found that the alpacas preferred the different hays and the alfalfa pellet, but the pellet is a very expensive fodder. Therefore, the grass or alfalfa hay should be the basic fodder because these can provide the suitable amount of dry matters, fibre content and crude protein for the animals.

Due to the general behaviour of alpacas it was found, that the animals showed a very moderate behaviour in the herd. Alpacas used special vocalization and body movement to communicate during the observation. Compared to other literatures, same results were found according to the social behaviour of alpacas. They are very social and the herd should be handled as a unit by the stockperson. Alpacas have strong hierarchy which can be observed before and during feeding.

## **THE CHARACTERISTICS OF THE ROE DEER'S GROUP FORMATION IN AN AGRICULTURAL HABITAT**

**JUHÁSZ VERA, BLEIER NORBERT, CSÁNYI SÁNDOR**

Szent István Egyetem, Vadvilág Megőrzési Intézet  
2100 Gödöllő, Páter K. u. 1.  
bnorbi@ns.vvt.gau.hu

### **ABSTRACT- The characteristics of the roe deer's group formation in an agricultural habitat**

The appearance of the roe deer in agricultural areas can be done in the beginning of the 1950th years. The forest and agricultural habitats differ from each other in innumerable characteristics. The aim of our examinations to describe in a descriptive way the characteristics of the group formation of roe deer living in open agricultural area, and its changes occur during a year. Furthermore we examined if there is a temporal agreement between the change of the group size and the degree of the habitat's density. We did visual observations with weekly regularity through a year and noted every roe deer what we have seen and recorded the parameters of the vegetation. We calculated the proportion of the parts of the area providing a covering to each single month and then we characterize them with this value. Based on the groups' observations we calculated potential- and counted middle values per month and categorised the seen groups based on their greatness. We compared the parameters of the vegetation and the characteristics of the group sizes with each other.

According to our results the formation of roe deer group showed substantial differences in the course of the year. The year can be split into two well-separable parts, which alternate with temporary periods. From May to July the proportion of lonely individuals dominated, in August and in September the groups consisting of 2-3 individuals were the most typical ones. In October there were groups consisting of more than 10 individuals, from November to February the groups consisted 4-5 or more individuals, occasional there were groups over 50 individuals. In March the proportion of the smaller and bigger groups equalised, then from April the incidence of lonely individuals increased. The increase of the group greatness followed delayed the decrease of the degree of the covering the autumn temporary period. There were the largest groups in the period providing the lowest covering. In spring the increase of the covering didn't unambiguously synchronized with the establishment of group sizes. The groups started breaking up before the covering of the area would have showed an increase. This indicates that in this period other factors play a more important role than covering. To understand this we examined the structure of the groups, the number and sex of lonely individuals in April and May. We deduce from the results that the reason of the groups' decomposition might be the territorial behaviour of the bucks.

**Keywords:** agro ecosystem, behaviour, territory, antler cycle, testosterone level

## **CHANGES OF THE RED FOX POPULATION IN THE EASTERN PART OF HUNGARY BETWEEN 1970 AND 2009**

**HELTAI MIKLÓS, NAGY ANNA, SONKOLY KRISZTINA**

Szent István University, Institute for Wildlife Conservation  
2103 Gödöllő, Páter Károly u. 1  
[heltai.miklos@gmail.com](mailto:heltai.miklos@gmail.com)

### **ABSTRACT - Changes of the Red Fox Population in the Eastern Part of Hungary Between 1970 and 2009**

Red fox (*Vulpes vulpes*) is the most widely distributed, and from the game management point of view the most important predator species in Hungary. This is why the population and its changes are crucial management and, often, emotional factors. The status of the red fox population was believed to be fairly stable until the 1990's, then it showed a sharp increase due to the immunisation against rabies, as well as environmental and habitat changes. This trend is supported by the annual hunting bag data of the National Game Management Database ([www.ova.info.hu](http://www.ova.info.hu)), along with the data of the estimated population sizes given in the questionnaires of previous years, emphasising that there is no direct cause-and-effect relation between immunisation and population growth (summarised in: Heltai, M. (ed.) 2010. Emlős ragadozók Magyarországon. {Mammal Predators in Hungary - in Hungarian} Mezőgazda Kiadó, Budapest 240 pp.). In our research we tried to find out whether the changes of the population in the Eastern regions of predominantly small game areas, where immunisation started significantly later (after 2001) than in Transdanubia (where it started in 1992), are in correspondence with the national tendencies. Our research is based on the annual hunting bag data (from 1970 to 2009) and the annual estimation data (from 2004 to 2009) of the National Game Management Database, as well as the data of the estimated population sizes from the mail questionnaire surveys carried out earlier (between 1987 and 2006) by SZIU-IWC. When assessing the results, we assumed that the changes of the hunting bag data also reflect the changes of the population. We found that the changing patterns of the population are far more diverse in the examined areas than it is demonstrated in the national data. The most important differences are the following: (i) Obvious population growth started in the 1970's both in the Eastern (Tiszántúl) and in the Central (Duna-Tisza köze) region of Hungary, in contrast with the relative stability typical of the national data of this period. The rate of increase had a greater variety in Tiszántúl, whereas the Central region showed a relatively even growth. (ii) During the course of the complete studied period, a sharp increase could be observed from the mid 1990's, especially in Tiszántúl. At that time immunisation had not started in that area yet. By 2002 the hunting bag data of Tiszántúl show an increase of almost 300 % (in 1994: 9751, in 2002: 28771), while those of the Duna-Tisza region demonstrate a growth of more than 200 % (in 1994: 8553, in 2002: 17785). (iii) Following the peak of 2002, significant decrease, then – besides a few minor drops – population growth can be observed, which is in correspondence with the national tendencies.

**Keywords:** red fox, population changes, immunisation

**MANAGERIAL TECHNIQUES IN THE FIELD OF CONTINUOUS TRAINING  
OF HUMAN RESOURCES AT MICROECONOMIC LEVEL**

**GHERMAN REMUS; DUMITRESCU CARMEN; DINCU ANA MARIANA**

Banat`s University of Agricultural Sciences and Veterinary Medicine Timișoara  
Faculty of Agricultural Management, Calea Aradului 119, 300645, Timișoara, România  
carmen02dumitrescu@gmail.com

**ABSTRACT - Managerial techniques in the field of continuous training of human resources at microeconomic level**

The last decade of the 20th century represented a historical moment that resulted in deep changes in the inner and outer environment of organisations as well as in the way world economy works. The main cause was the globalisation of economy and the development of society based on knowledge. A knowledge society asks present organisations leadership to fundament strategies based on the implementation of a continuous training behaviour.

Human resource needs not only to have a basic training since knowledge, skills, and attitudes acquired have become deeply volatile. Thus, numerous successful employers have started to send their staff more and more often to conferences, training courses, and specialisation courses. During the last decade all the countries have intensified their research work and the experimentation of different methods of planning, organising, carrying out, monitoring, and assessing social and economic effects in the training of human resources.

**Keywords:** training, management, methods and techniques, database, efficiency

## **HUMAN RESOURCES DEVELOPMENT IN TOURISM**

**GHERMAN REMUS, DUMITRESCU CARMEN, DINCU ANA MARIANA**

Banat`s University of Agricultural Sciences and Veterinary Medicine Timișoara  
Faculty of Agricultural Management, Calea Aradului 119, 300645, Timișoara, România  
carmen02dumitrescu@gmail.com

### **ABSTRACT- Human resources development in tourism**

Tourism represents an activity which results depend essentially on the contribution of human resources attracted in this sector. In Romania tourism can become an activity with influence on economical and social development of the country through its multiplier effect.

Despite the crisis phenomena actually manifested globally, the tourism has a lightly ascending evolution in Europe and also in the whole world. That is why the employment of human resources in tourism even in the critic periods from economical point of view contributes to diminish the global unemployment rate. Globally tourism development is approached more and more under durability aspect with the aim of preserving natural environment and cultural inheritance, the human resources from tourism being those which have to assure the observance of durability principle.

**Keywords:** training, tourism, competences, standards, labour force quality.

## **ROLE OF CAPITAL AND INVESTMENTS IN AGRICULTURAL DEVELOPMENT**

**OCNEAN, MONICA – SAMBOTIN, LIVIU**

Banat's University of Agriculture Sciences and Veterinary Medicine Timisoara, Faculty of Agricultural Management, Calea Aradului, no. 119, 300645, Timisoara, Romania  
Phone: + 40722577433, e-mail: monicaocnean@gmail.com

### **ABSTRACT - Role of capital and investments in agricultural development**

In market economy, the capital belongs to private and public companies and also to the individuals the usufruct and risk imminently come to. The right for property on capital confer holders the capacity to amortize, use and manage it as they consider, without defying the law or the discretion of the other economic agents. The goods comprised by the capital present market value; they can be sold and bought for prices considered acceptable by the supply and demand agents. Furthermore, the capitalist society's name derives from its definitive possibility of having and obtaining profit on capital.

**Keywords:** capital, working capital, agricultural products, investments, tractors

## **SEWAGE SLUDGE – A POSSIBLE FERTILIZING RESOURCE IN AGRICULTURE**

**ALINA LAȚO, ISIDORA RADULOV, K. LAȚO, F. CRISTA, ADINA BERBECEA, L. NIȚĂ**

University of Agricultural Sciences and Veterinary Medicine of Banat Timisoara, Romania  
Calea Aradului, 119, 300645 Timișoara, Romania

[alina\\_anitzei@yahoo.com](mailto:alina_anitzei@yahoo.com)

### **ABSTRACT – Sewage sludge – a possible fertilizing resource in agriculture**

The possibility to distribute sewage sludge in agriculture appears because of the increasing price, in each year, of the chemical fertilizers and because of the higher quantities of sewage sludge worldwide. In Romania are in present 732 stations for waste water cleaning and 416 stations are in main industrial cities. The paper present the chemical properties of sewage sludge from the Waste Water Treatment Station Timisoara and the content in valuable nutrients.

**Keywords:** sewage sludge, organic resource, nutrients, heavy metals, fertility.



**A konferencia szervezőbizottságának tagjai:**  
**The members of the organizing committee of the conference:**

Dr. Bodnár Károly elnök/chairman  
Dr. Horváth József titkár/secretary  
Prof Dr. Goşa Vasile  
Prof. Dr. Csosz Ioan  
Dr. Feher Andrea  
Benk Ákos  
Dr. Bodnárné Skobrák Erika  
Galgóczi-Deutsch Márta  
Galyas Dagmar Jutta  
Hódiné Szél Margit  
Kopunovicsné Bodor Márta  
Mikóné Józsefné Jónás Edit  
Németh Anita  
Tóthné Kardos Ágnes

**A konferencia tudományos bizottsága:**  
**The scientific board of the conference:**

Prof. Dr. Tanács Lajos elnök/chairman

Dr. Avasiné Dr. Kucsera Judit  
Dr. Bai Attila  
Prof. Dr. Benet Iván  
Dr. Benkő-Kiss Árpád  
Dr. Bodnár Károly  
Dr. Csanádi József  
Dr. Eszes Ferenc  
Dr. Fodor Dezső  
Dr. Gál József  
Dr. Gyeviki János  
Dr. Horváth József  
Dr. Király István  
Dr. Komarek Levente  
Dr. Kristó István  
Dr. Lantos Csaba  
Dr. Majzinger István  
Dr. Mészáros Attila  
Dr. Mihály Róbert  
Dr. Monostori Tamás  
Prof. Dr. Nemessályi Zsolt  
Dr. Oláh Judit  
Dr. Pakurár Miklós  
Dr. Pauk János  
Dr. Posta László  
Prof. Dr. Sas Barnabás  
Dr. Soós József  
Dr. Süli Zakar Timea  
Dr. Szabó Bernadett  
Dr. Szórádi Tibor  
Prof. Szűcsné Dr. Péter Judit  
Dr. Teszárné Dr. Nagy Mariann  
Dr. Tóth Beáta  
Dr. Vincze-Lendvai Edina