Review on Agriculture and Rural Development 2014. vol. 3 (1) ISSN 2063-4803

EFFECT OF PRUNING AND SPRAYING GROFALCS AND ZEATIN ON VEGETATIVE GROWTH, YIELD AND QUALITY OF FIG TREE CV. "WAZIRI" (*FICUS CARICA* L.)

[1]ABBAS MOHSIN SALMAN AL-HAMEEDAWI, [2]ALI HOSAN JASIM, [3]RUQAYAH MANOON HASAN AL–NOMANI

[1]Coll. Agric, University of Kufa, [2]Coll. Agric, University of Babylon, [3]Coll. Edu. University of Kufa, Iraq
alihjassim@yahoo.com

ABSTRACT
An experiment was conducted in a private orchard at Abbasyia, Najaf Governorate during the growing seasons of 2011/ 2012 on fig cv. Waziri.
The branches at the age of one year were pruned at level of 25, 50% and sprayed Grofalcs and Zeatin at concentrations of 250 mg/L for each at 15 March for the tow growing seasons. Results showed that pruning treatments and spraying Grofalcs and Zeatin treatments and their interactions caused a significant increase in GA3, IAA, Zeatin, total chlorophyll in leaves, total yield of tree, total soluble solids, vitamin C and fruit firmness, and decrease in fruit fall, fruit cracking percentage compared with control treatment. There was a significant effect between treatments. Treatment of pruning of branches at the age of one year as 50% + spraying Grofalcs and Zeatin, in concentrate 250 mg/L gave a significant effect and the best results for the two years of the experiment.

Keywords: pruning, Grofalcs, Zeatin, fig

INTRODUCTION

Fig trees are deciduous fruits, belong to genus "Ficus", which is follows to the Family "Moracea", where it believed that its origin is Arabian peninsula and spread to the subtropical regions, fig fruits are infected by a number of physiological damages, and the foremost damage is crack, the ratio of which increased due to the increase in periods of irrigation (IBRAHIM, 1996). AL-RAWI (1999) noticed that, the spraying of GA_3 concentration (50 and 100 ppm) on fig trees cv. Aswod Diala at depressed period reduced the proportion of fruit cracking and increased the firmness, leaf area, total chlorophyll, percentage of carbohydrate. This was agreed with BYERS ET AL. (1990) when apple trees cv. Styman sprayed with GA_3 conc. of 200 mg/L on 27 July, 1987 reduced cracking rate to 24.35%, while this ratio reached to 50.61% in the fruits of control treatment.
ABO-ZAID (2000) mentioned that spraying of GA_3 at conc. of 100 and 150 ppm on pear trees in Egypt has increased the vegetative growth and fruit firmness.
AL-DULAIMI (1999) observed that pomegranate trees cv. Salami when applied at 200 mg/liter GA_3 increased total soluble solids, total sugar, vitamin C and reducing percentage of crackings compared with control treatment. AL-NOUMANI (2013) found that spraying local apple after 50 days from full bloom with Grofalcs at concentrations of 200, 300 and 400 mg/L led to reduction in percentage of fruit dropping and cracking and increased total soluble solids, total sugar, vitamin C and firmness at ripening. AL-HMEEDAWI ET. AL. (2012) noticed that spraying fig tress cv. "Waziri" after one week from rest period of fruits with Zeatin at concentrations of 100, 150 mg/L caused a significant increased the leaf area, content of leaves of total chlorophyll, hormones, IAA, GA_3, Zeatin compared to control treatment. AL-UAJJANI (2011) noticed that, the pruning of fig trees cv. Aswod Diala at level 25 and 50% at 15/1/2009 and spraying fig tress with BA at concentrations 100, 150 mg/L at 15/3/2009 reduced the proportion of fruit cracking, percentage of dropping fruit

and increased the total percentage of carbohydrates, total soluble solids, vitamin C and firmness of fruits compared to control treatment. AL-HMEEDAWI AND AL-NUMANI (2012) mentioned that pruning trees of Fig cv. Aswod Diala at percentage 20, 40 and 60% increased the total soluble solids, total sugar, vitamin C, percentage of carbohydrate and firmness of fruits and reduced the type of cracking and total cracking on ripe fruits during the months of 7 and 8. The main objective of this investigation is to study the effect of using pruning, Grofalcs and Zeatin on vegetative growth and fruits quality during ripening of fig trees cv. "Waziri".

MATERIAL AND METHOD

This study was conducted in a privat farm at Abbasiya / Najaf governorate for the 2011 and 2012 seasons on fig trees cv. Waziri, 36 at same size and growth trees were selected with 10 years of age, that were planted on 5 x 5 m, they were watered every five days, and fertilized by nitrogen and phosphorous in two periods in March and May of each year at a rate of 500 g per tree, as well as by manure for the two years. The experiment included 12 treatments with three replicates. It is adopted according to Randomized Complete Block Design (RCBD), and the results were statistically analyzed according to LSD test at the probability level of 5% (AL-RAWI AND KHALF ALLAH, 2000). The branches at the age of one year were pruned at level of 25 and 50% on 15/01/2011 and 2012 and anther trees sprayed with Grofalcs (these were discs of GA_3 50% from the production of Green River Company, India) and Zeatin at a concentration of 250 mg/L for each at 15/3 for both seasons. Spraying was done early morning until wetness was full addendum. Tween 20 was added at a concentration of 1 cm^3/L as spreader material.

The experiment involved the following 12 treatments:

1- Control treatment (no pruning and sprayed with tap water)
2- Pruning the branches at the age of one year at level of 25%
3- Pruning the branches at the age of one year at level of 50%
4- Grofalcs as foliar sprays at concentration of 250 mg/L
5- Zeatin as foliar sprays at concentration of 250 mg/L
6- (Grofalcs + Zeatin) as foliar sprays at concentration of 250 mg/L
7- P 25% + Grofalcs as foliar sprays at concentration of 250 mg/L
8- P 25% + Zeatin as foliar sprays at concentration of 250 mg/L
9- P 50% + Grofalcs as foliar sprays at concentration of 250 mg/L
10- P 50% + Zeatin as foliar sprays at concentration of 250 mg/L
11- P 25% +(Grofalcs + Zeatin) as foliar sprays at concentration of 250 mg/L
12- P 50% +(Grofalcs + Zeatin) as foliar sprays at concentration of 250 mg/L

GA_3, IAA and Zeatin in leaves (mg/Kg dry weight) according to NURAY ET AL. (2002). Total chlorophyll in leaves mg/100 g according to AOAC (1985). Ten normal fruits were taken at random on 1/7/2011 and 2012 from each tree for quality determination. The juice was extracted and the total soluble solids were determined by hand refractometer. Total and reducing sugar % and vitamin C mg/100 ml juice according to AOAC (1985). Firmness was measured on two sides of each fruit with an Effegi penetrometer (Model NI, McCormick Fruit Tech,Yakima,WA) fitted with an 11.1mm tip. The percentage of total cracking was calculated during the months of July and August for both seasons.

RESULTS AND DISCUSSION

The content of leaves from GA_3, IAA, Zeatin, total chlorophyll

Data in *Table 1* and *2* shows that, pruned at level of 25, 50% and spraying Grofalcs and Zeatin and combination treatments led to increase in the content of leaves from GA_3, IAA, Zeatin, total chlorophyll, that gave the highest rates 31.47, 24.83, 27.22 mg/Kg dry weight and 23.15, 19.11, 17.37 mg/Kg dry weight and 122.44 and 121.99 mg/100 g in the treatment P 50% + (Grofalcs + Zeatin) 250 mg/L in comparison to the lowest values of 15.80, 15.62, 13.17 mg/Kg dry weight and 17.36, 16.47, 12.96 mg/Kg dry weight and 113.21 and 151.43 mg/100 g in control treatment for the 2011 and 2012 growing season, respectively. Above mentioned treatments led to the root system in absorption of the nutrient elements in which some of them are parts of chlorophyll which led to increase its quantity in comparison control treatment. This process increases photosynthesis an activate plant growth which led to enhance hormones synthesis (JUNDI, 2003).

The percentage of dropping, total cracking and total yield of fig fruits

Data in *Table 1* and *2* show that pruned at level of 25, 50% and spraying Grofalcs and Zeatin and combination treatments led to the reduction in the percentage of dropping and cracking of fruits and increasing total yield of trees significantly compared to control treatment that gave the lowest values of 9.33%, 16.00%, 17.45 Kg/tree, 11.10%, 13.64%, 19.45 Kg/tree, while the lowest percentages of 3.65%, 5.09%, 4.00%, 4.46%, and the highest yield of 23.50 Kg/tree and 24.76 Kg/tree in the treatment P 50% + (Grofalcs + Zeatin) 250 mg/L. The pruning and spraying with Grofalcs and Zeatin led to increase in the content of leaves from growth hormones and total chlorophyll, these led to increase the length and number of branches and carbohydrates in fruits. These factors due to decrease the percentage of dropping and cracking of fruits and then increasing production of trees

Total soluble solids, vitamin C, and firmness of fig fruits

Pruning and spraying with Grofalcs and Zeatin in single way or combination has led to a significant increase in the percentage of total soluble solids, vitamin C and firmness of fruits for both seasons compared to control treatment. The highest significance result were recorded with treatment P 50% + (Grofalcs + Zeatin) 250 mg/L, that gave the highest percentages of total soluble solids, vitamin C and firmness of fruits, they were 19.43%, 9.03 mg/100 ml juice and 0.374 Kg/cm^2 and 19.07%, 8.78 mg/100 ml juice and 0.428 Kg/cm^2 comparison with 17.23%, 8.18 mg/100 ml juice and 0.361 Kg/cm^2 and 16.53%, 7.50 mg/100 ml juice and 0.370 Kg/cm^2 in control treatment for the two year of study, respectively. Increasing fruits from total soluble solids, vitamin C and firmness of fruits which results through pruning due to the fact that this compound reduces vegetative growth and thus encourages the accumulation of carbohydrate materials in fruits leading to increased content of these materials (FERGUSON ET AL., 1999).

CONCLUSIONS

It could be concluded from this experiment that pruning and spraying trees with Grofalcs and Zeatin in single way or combination led to increase in the content of leaves from GA_3, IAA, Zeatin, total chlorophyll, and the content of fruits from total soluble solids, vitamin C, firmness of fruits and total yield of trees and reducing percentage of dropping and cracking of fruits compared with control treatment for both growing seasons.

Table 1. Effect of pruning and spraying with Grofalcs and Zeatin on vegetative growth and fruits quality of fig fruits cv. Waziri for seasons 2011 and 2012

	GA_3 in leaves mg/Kg dry weight	IAA in leaves mg/Kg dry weight	Zeatin in leaves mg/Kg dry weight	Total chlorophyll mg/100g	% dropping fruit	% total cracking	Total yield Kg/ tree	% total soluble solids	Vitamin C mg/100 ml juice	Firmness Kg/cm^2
Control	15.80	15.62	13.17	113.21	9.33	16.00	17.45	17.23	8.18	0.361
P 25%	17.03	18.00	14.71	114.90	8.60	14.23	19.30	17.55	8.29	0.375
P 50%	19.13	18.68	14.89	116.59	7.72	13.64	19.69	17.79	8.35	0.385
Grofalcs 250 mg/L	23.30	20.37	15.56	117.75	5.37	9.58	20.12	18.00	8.50	0.389
Zeatin 250 mg/L	20.48	16.59	25.86	117.43	6.75	10.25	20.87	18.22	8.53	0.382
(Grofalcs + Zeatin) 250 mg/L	22.71	21.16	18.98	119.36	5.13	8.39	22.20	18.15	8.41	0.380
P 25% + Grofalcs 250 mg/L	26.45	21.96	24.67	11818	5.81	8.73	19.90	18.50	8.71	0.385
P 25% + Zeatin 250 mg/L	22.65	17.37	20.29	118.84	5.11	9.43	20.52	18.89	8.54	0.377
P 50% + Grofalcs 250 mg/L	27.92	22.80	21.78	119.93	4.88	7.84	22.63	18.95	8.80	0.384
P 50% + Zeatin 250 mg/L	23.30	19.32	26.95	120.62	4.60	8.69	21.46	19.01	8.69	0.405
P 25% + (Grofalcs + Zeatin) 250 mg/L	28.08	22.71	26.90	119.80	4.18	6.65	22.82	19.19	8.85	0.370
P 50% + (Grofalcs + Zeatin) 250 mg/L	31.47	24.83	27.22	122.44	3.65	5.09	23.50	19.43	9.03	0.374
LSD 0.05	0. 66	1.12	0.30	0.49	0.51	0.78	0.61	0.12	0.05	0.009

Table 2. Effect of pruning and spraying with Grofalcs and Zeatin on vegetative growth and fruits quality of fig fruits cv. Waziri for seasons 2011 and 2012

	GA_3 in leaves mg/Kg dry weight	IAA in leaves mg/Kg dry weight	Zeatin in leaves mg/Kg dry weight	Total chlorophyll mg/100g	% dropping fruit	% total cracking	Total yield Kg/ tree	% total soluble solids	Vitamin C mg/100 ml juice	Firmness Kg/cm^2
Control	17.36	16.47	12.96	115.43	11.10	13.64	19.45	16.53	7.50	0.370
P 25%	17.98	17.09	13.48	115.89	9.83	11.20	20.21	16.91	7.89	0.377
P 50%	18.09	17.35	14.09	116.26	8.42	9.42	20.89	17.21	7.94	0.379
Grofalcs 250 mg/L	21.90	18.00	14.46	116.95	6.54	7.34	22.34	17.43	8.00	0.384
Zeatin 250 mg/L	18.83	17.59	15.70	117.05	7.18	9.57	20.52	17.20	8.11	0.388
(Grofalcs + Zeatin) 250 mg/L	22.45	18.16	15.98	118.68	6.00	6.39	22.81	18.00	8.15	0.390
P 25% + Grofalcs 250 mg/L	20.37	18.28	14.64	119.32	6.31	623	21.65	17.88	8.36	0.382
P 25% + Zeatin 250 mg/L	19.26	17.71	16.22	119.50	5.87	8.14	20.96	18.52	8.30	0.389
P 50% + Grofalcs 250 mg/L	22.75	18.43	15.48	119.77	5.62	6.81	23.16	17.91	7.99	0.395
P 50% + Zeatin 250 mg/L	20.89	17.90	16.83	119.85	4.13	7.08	23.40	18.67	8.50	0.399
P 25% + (Grofalcs + Zeatin) 250 mg/L	22.89	18.84	17.24	120.48	4.22	5.33	24.28	18.90	8.67	0.415
P 50% + (Grofalcs + Zeatin) 250 mg/L	23.15	19.11	17.37	121.99	4.00	4.46	24.76	19.07	8.78	0.428
LSD 0.05	0. 21	0.23	0.13	0.36	0.75	0.91	0.84	0.12	0.07	0.011

REFERENCES

ABO-ZAID, A.N. (2000): Plant Hormones and Application Agricultural . Arabic home for putolishing . Cairo .

AL-DULAIMI, R.M. (1999): Influence of some Factors effection on the splitting of pomegranate fruits. Ph.D. Thesis. Dept. Hort. Agric. Coll. Univ. of Baghdad, Iraq

AL-HMEEDAWI, A.M., AL-NUMANI, R.M. (2012): Effect of Pruning and spraying with Paclobutrazol and Zinc sulphate on fruits quality of fig cv. Asowd Diala and percentage of cracking. The International Journal for Sciences and Technology (IJST). 7 (4): 5-10.

AL-HMEEDAWI, A.M., AL-NUMANI, R.M., W.H. MEZIAL AL-SHEMMERYI (2012): Effect of Pruning and spraying Zeatin on vegetative characteristics and biochemical containing of Fig cv. Kadota (*Ficus carica L*.). J. Jordan of Agricultural Science 8 (3): 500-510.

AL-NUMANI, R.M.H (2013): Effect of spraying with Salicylic acid and Grofalcs on physical and chemical characteristics of local apple fruits. J. Alphart of Agricultural Science 5 (1): 34–39.

AL-RAWI, K.M., A.M. KHALF ALLAH (2000): Design and Analysis of Agricultural Experiments . College of Agric. Univ. Mosel, Iraq

AL-UAJJANI, Z.A. (2011): Effect of Pruning and spraying of some of regulators on growth and yield of fig trees (*Ficus carica* L .) cv. Aswad Diala. Ph.D. Thesis. Dept. Hort. Agric. Coll. Univ.of Kufa, Iraq

ASSOCIATION OF OFFICIAL ANALYTICAL CHEMIST (1985): Official Methods of Analysis. 13th Ed. APAC. Washington DC, USA

BYERS, R.E., D.H. CARBOUGH, C.N. PRESLEY (1990): Stayman Fruit cracking as affected by surfactants, plant growth regulators and other chemicals. J. Amer. Soc. Hort. Sci. 115 (3): 405–411.

FERGUSON, L., T.J. MICHAILIDES, H.H. SHOREY (1999): The California Fig Industry. Univ. California, USA

IBRAHIM, A.M. (1996): Deciduous Fruit , Growth and Production. College of Agric. Univ. Alex. Egypt

JUNDI, H.M (2003): Physiology of tree fruits. Arabic home for putolishing. Cairo.

NURAY, E., E. ERGON, N. FATIH, Y. ATILLA (2002): Auxin (Indol-3-acetic acid), Gibberellic acid (GA_3), Abscisic acid (ABA) and Cytokinin (Zeatin) production by some species of Mosses and Lichens. Turk. J. Bot. 26: 13-18.

Review on Agriculture and Rural Development 2014. vol. 3 (1) ISSN 2063-4803

THE AGRICULTURAL SYSTEM FROM THE ȘAGU VILLAGE AREA, ARAD COUNTY

ADALBERT ÖKRÖS, SIMONA NIȚĂ, CASIANA MIHUȚ, ELISABETA KOCIS, ANIȘOARA DUMA COPCEA

Banat University of Agricultural Sciences and Veterinary Medicine
"King Mihai I" from Timişoara
Calea Aradului No. 119. Timișoara, Romania
adalbertokros@yahoo.com

ABSTRACT
The economic and social importance of agriculture, as single source providing for the satisfaction of some basic human needs – food and clothing – and without which one cannot consider normal social peace and economic development, is known in countries all around the world.
The purpose of this paperwork is to present a common agriculture in Șagu with the land, crop structure and companies in the agriculture of the village, soil types and subtypes of the Șagu village area, environmental factors that influence these traits, the study of important processes and soils of the area was investigated. The objective of this study was to present the agricultural system and the improvement of the city and its possibilities. As research materials and methods were field observations, discussions with farmers and agricultural engineers from the Șagu village. The results obtained were identified agricultural system with real opportunities for improvement.

Key words: soil, Șagu, agriculture, agricultural systems, land fund,

INTRODUCTION

The economic and social importance of agriculture, as single source providing for the satisfaction of some basic human needs – food and clothing – and without which one cannot consider normal social peace and economic development, is acknowledge in countries all around the world. The considerable increase in number to 5 million agricultural owners, of which 1.2-1.5 million active, raises complex problems regarding the accomplishment of efficient agricultural exploitations, which should ensure decent incomes for the family and accumulation possibilities for its modernization. Considering the fact that, at a national level, the average size a property is under 2 ha and of 2.6 ha in the Hunedoara county, there is a need for further studies regarding the establishment of a minimum exploitation size, which should be efficient from an economic and social point of view. Nowadays, in the agricultural field, most Central and Eastern European countries are confronted with the new experience of the transition towards a market economy. Today, Romanian agriculture finds itself, from the point of view if agricultural structures, in a similar situation as most European countries some 40 years ago.
All these processes create difficulties with regards to the agricultural production growth, the viability and competiveness of agricultural exploitations, endangering the country's food security.

MATERIAL AND METHOD

For the elaboration of the present paper, we used data obtained from MADR and INSSE. The share of agriculture within Romania's economy decreased constantly since 1990 (the decrease rhythm being more slowly during the first transition years and more rapid after 1997). The regional distribution of agricultural land according to its usage is differentiated in relation to the relief conditions, with the pedo-climatic and crop suitability characteristics. As a whole, only 25% from the land total observe a superior quality and a good and very good productive potential.

RESULTS

„Situated in the south-western part of the Arad county, on DN 69, the Şagu village, residence of the township bearing the same name, is located at a 13 km distance from the town of Arad and 37 km from the town of Timişoara. The Şagu township is extended on a 10602 ha surface, of which 9476 ha represent agricultural land. In its administrative composition one can find the following villages: Şagu, Cruceni, Fiscut, Firiteaz and Hunedoara Timişană.

The annual average temperature is of 10.80C (Arad station), and annual average precipitations range between 580-600 mm at Şagu, Cruceni and Hunedoara Timişană and between 620-640 mm at Fiscut and Firiteaz (Climatologic Atlas, 1966). The land unit (U.T.) dominant soil types:

Table 1. Soil percentage from Şagu township total

	Soils	Percentage
1	Black carth	17.5 %
2	Faeoziom	25.3 %
3	Preluvosoils	25.4 %
4	Luvosoils	17.2 %
5	Gleysoil	12.1 %
6	Erodisoil	2.5 %

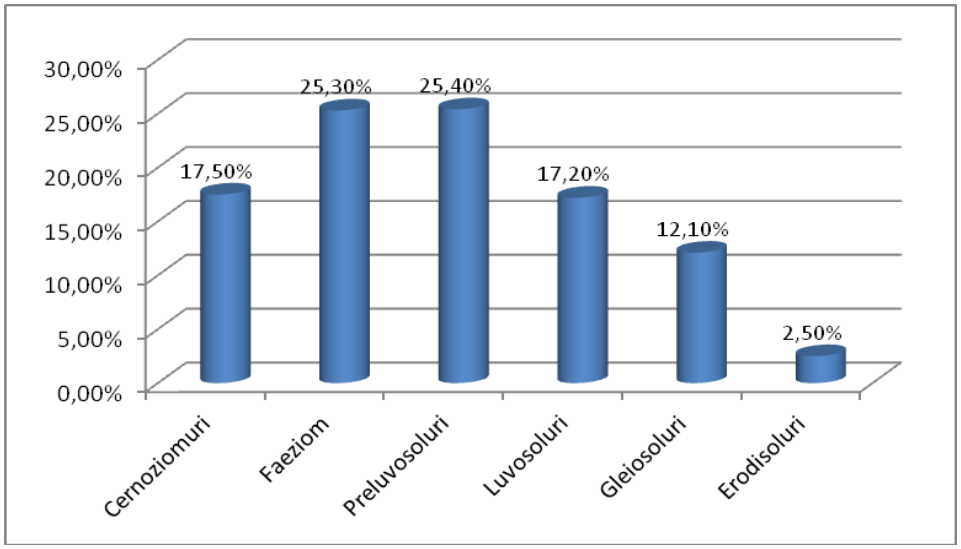


Figure 1. Soil percentage from Şagu township total

The township's agricultural land is used as follows: 8596 ha plough land, 785 ha grass land, 288 ha meadow land, 22 ha vineyards, 9691 ha total agricultural land. Regarding the distribution into quality (fertility classes), for the "plough land" usage category, the situation is as follows: cl. I 4388 ha (46.3%), cl. II 1876 ha (19.8%), cl. III 2008 ha (21.2%), cl. IV 137 ha (11.9%) and cl. V 76 ha (0.8%). Limitative factors, which significantly influence the soil surface quality, are dimensioned by the humus fund (small on 2.3% of the surface), fine texture (80%), compaction (66%), low bearing capacity (17%), surface erosion (2.7%), underwater humidity excess (11%), stagnant humidity excess (very strong 1.4%, strong 30%, moderate 16%, week 21%). In order to fight the limitations already mentioned, radical improving fertilization activities are required, as well as some deep soil loosening workings, ploughings on the level curve, the installation of grass bands, fighting humidity excess through surface drainage and mole drainage.
The land fund situation of the corresponding villages is the following:

~Sagu-5352 ha
~Cruceni-2396 ha
~Firiteaz-745 ha
~Fiscut- 798 ha
~Hunedoara Timisana-400 ha

Table 2. The Sagu township land fund situation in 2012

Usage	Surface (ha)
Plough land	8596
Grass land	785
Meadow land	288
Vineyards	22
Agricultural land total	9691

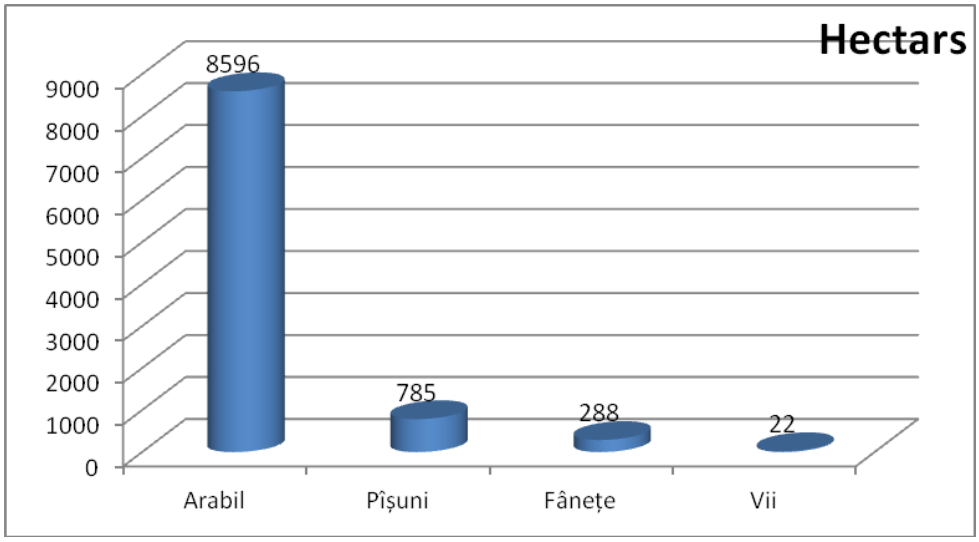


Figure 2. The Sagu township land fund situation in 2012

During the period 2010 - 2012 the crop structure was the following according to *Table 3.*

Table 3. Crop structure 2010 - 2012 (ha)

Crops	2010	2011	2012
Wheat	2473	2041	3115
Rye	53	80	69
Barley	200	158	74
Two-rowed barley	100	89	4
Corn	3460	2368	1963
Sun flower	1154	1604	1504
Rape	80	61	6
Potatoes	80	14	19
Tomatoes	10	8	1
Cabbage	15	5	1
Pepper	3	1	1
Lucerne	276	467	288

(Data delivered by the Șagu township mayor's office)

As one may observe from *Table 3*, the predominant culture is that of corn with a 3460 ha surface, followed by wheat with 2473 ha, sun flower with 1154 ha and lucerne with 276 ha. Vegetables occupy a quite significant surface of the Șagu township agriculture, with tomatoes cultivated on a 10 ha surface, cabbage 15 ha and pepper with a 3 ha surface. These surfaces occupied by vegetables, even if it represents only 0.3 % of the total agricultural land, bring an important benefit to producers because of the quantity and value obtained per hectare. The surface cultivated with vegetables has decreased dramatically as well, cabbage reaching 5 ha from 15 ha, tomatoes 8 from 10 ha, and pepper 1 from 3 ha. However, a green melon crop has occurred on a 2 ha surface.

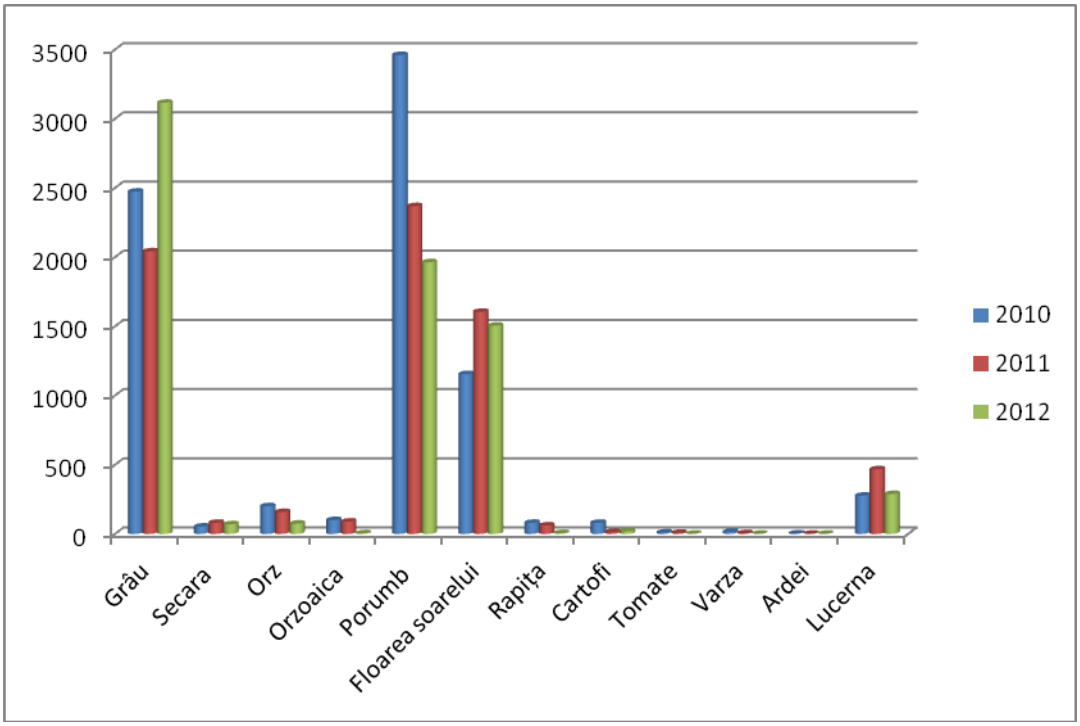


Figure 3. Crop structure during the period 2010 - 2012

As one may observe from *Table 3* and *Figure 3*, the crop culture has suffered a major change from 2010 and 2011, presenting surfaces cultivated with different crops as follows: wheat had a strong come-back and occupied a 3115 ha surface with 1130 ha more than in 2011 and 700 ha more than in 2010, corn occupied a 1963 ha surface, with 400 ha lower than in 2011 and 1497 ha lower than in 2010, sun flower occupies a 1504 ha surface with100 ha lower than in 2011.
Vegetables drop reaching 3 ha, from a 38 ha total in 2010. Fodder occupies a larger surface each agricultural year reaching 592 ha and mustard occurs as a crop on a 4 ha surface. In the Șagu township area a series of agricultural field firms activate, such as: The Agricultural Society Șagu, BIOFARMLAND BETRIEBS (bio products), S.C. AGROGIL S.R.L., S.C. DEMUTH AGRO, AGRIMAL CERES SRL.

CONCLUSIONS

In the Șagu village area, plough land is favourable for agricultural crops and allows the cultivation of a large range of crop plants. However, the lack of speciality knowledge, difficulties in market capitalization of the agricultural products and especially the low economic power of locals, determined the main crops to be straw cereals wheat, corn, sun flower and, on smaller surfaces, potato, vegetables and sugar cane, a culture which was dropped due to capitalization reasons.
Within individual households, there is a reduced number of animals, which capitalize a part of the vegetable production.
In most cases, agricultural systems developed by locals had subsistence character, without implying any economic performances.
In the mean time, local exploitation conditions associated with other problems of the transition period, which have profoundly affected this branch, led to a reorientation towards agriculture, many locals giving up working the land. A part of them has sold their land or have leased it to associations formed in time.

REFERENCES

ANASTASESCU, IULIA (1976): Cercetări privind schimbările morfo-fizice-chimice, produse sub influenţa irigaţiilor în solurile din Câmpia de Vest [Research Regarding Morpho-Physiological-Chemical Changes, Produced under the Influence of Irrigation in the Western Lowland Soils], PhD Thesis, Institutul Agronomic, Timişoara
BLAGA GH., RUSU I., UDRESCU S., VASILE D. (1996): Pedologie [Pedology], Editura Didactică şi Pedagogică. R. A., Bucureşti, 1996
MUNTEANU, I. (1994): Solurile României în sistemele de clasificare internaţională [Romanian Soils in International Classification Systems], Ştiinţa solului nr. 3-4, Bucureşti
NIȚĂ LUCIAN DUMITRU (2007): Pedologie [Pedology], Editura Eurobit, Timişoara, 2007
POSEA, GR. (1997): Câmpia de Vest a României (Cămpia Banato-Crişană) [The Romanian Western Lowland (Banat-Crisana Lowland)], Ed. Fundaţiei "România de maine", Bucureşti
TEACI, D. (1980): Bonitarea terenurilor agricole (Bonitarea şi caracterizarea tehnologică a terenurilor agricole) [Agricultural Land Bonitation (Agricultural Land Bonitation and Technological Characterization)], Ed. Ceres Bucureşti
*** Sistemul român de clasificare a solurilor [The Romanian Soil Classification System], I.C.P.A. Bucureşti, 1980,

http://www.apmtm.ro/timis.htm;
http://www.timisoreni.ro/info/date_geografice/Timisoara_Clima.html;
http://www.lumeasatului.ro/1016--agricultura-romaniei-pana-in-2013.html

Review on Agriculture and Rural Development 2014. vol. 3 (1) ISSN 2063-4803

AGRITOURISM IN THE DANUBE GORGE

ADALBERT ÖKRÖS, SIMONA NIȚĂ, CASIANA MIHUȚ, ELISABETA KOCIS, ANIȘOARA DUMA COPCEA

Banat University Of Agricultural Sciences And Veterinary Medicine
"King Mihai I" From Timişoara
Calea Aradului Nr. 119. Timișoara, Romania
adalbertokros@yahoo.com

ABSTRACT
We may say, without mistake that tourist journeys occurred during antiquity, and tourism activities in the rural space have been empirically carried out since the same period. Anyway, it is well known, that students largely participated in: visiting sacred places - Dadona (Zeus) and Delphi (Apollo) – curative baths or festive games periodically organized. After the '60ies, mankind has started to be more and more preoccupied with holiday destinations, tourism becoming one of the most important economic activities in the world. Simultaneously with manifesting first tendencies in more and more frequent holiday spending in the middle of nature, more and more tourists wished to spend relaxing time in the rural environment (space). Rural tourism is based on most receiving (reception) types existing within equipment largely found on private estates of the rural space inhabitants, who practice (as service providers) tourism activities. The practice of rural tourism grew more and more during the second half of the 20th century. On almost the whole of the European continent, a weekend or a holiday in the country side has become a habit for fresh air, nature and pure ecological space lovers.

Keywords: agritourism, tourism, rural development, Danube

INTRODUCTION

The transition of the Romanian agriculture to a market economy, the process of agricultural restructuring, and finding the best property and exploitation forms, as well as rational relations between these, has turned out to be a more complex process than initially assumed. Difficulties arise on the one hand from the lack of a clear, coherent and complex legislation in the field, and from the lack of a strict application of the legislation in effect, as well as from the lack of a social practice regarding the denationalization process, which proved to be much more complex than its reverse, socialization.
The transition process generates implications of:

- economic order: the necessity of massive investment for economy restructuring, of forming of competitive market economy mechanisms;
- social-political order: instability, social and ethnic disturbances;

The purpose of transition is the national economy restructuring, for the formation of specific market economy mechanisms, the choice of a theoretical model and the establishment of a concrete Romanian market type. Transition means profound restructuring of the entire economic, social and political life. The transition to a market economy generates major radical changes, the general renewal of the Romanian society, transformations which cannot be efficiently carried out unless by active state intervention in the organization and leading of economic, social and political activities. The state's intervention in agriculture is also necessary for the limited private sector initiatives, the insufficiency of its own resources, as well as of the social ones, not only in agriculture, but in the entire national economy. In Romania, circa 3000 villages await their organizers.

MATERIAL AND METHOD

The study was made based on field research and documentation. The Moldova Nouă town area is located inside the Occidental Carpathian Mountains area, the Banat Mountains with the Locvei Mountains subdivision.

Figure 1. Moldova Nouă overview

When thoroughly studying the area relief, we observe that a large surface is characteristic to the last Locvei Mountains ramifications, the rest of the surface displaying a very specific relief. In order to characterize it more easily, we have divided this relief in two areas: Moldova Nouă eastern part and Moldova Veche western part, north-west. Within the first area, the northern and eastern part include a relief which is an essential part of the Locvei Mountains, characterized by strongly declivitous versants, whose declines exceed 30-35%, with a western and south-western declivity. The maximum altitude is of 560 m and the minimum one of approximately 130 m. The northern and western part of this area generally includes a very special relief generated by its placement between the versant area and the Danube Meadow. This part may be considered a terrace of the Danube, but taking its stratigraphy into account, it can materialize as a very old dejection cone (proluvium), with coluvial layers of various thickness and skeleton quantity.

RESULTS

The studied surface (10,673.07 ha) presents various usage ways. The current situation of usage categories is as follows:

- plough land: 673.08ha
- grass land: 2,410.07 ha
- meadow land: 820.81 ha

- vineyards: 473.19 ha
- orchards: 38.24 ha
- agricultural land total: 4,415.39 ha

Other land usage
- waters: 39.80 ha
- unproductive: 360.89 ha
- roads: 25.40 ha
- construction sites: 287.90 ha

On the town's administrative territory there are 5,543.69 ha of forest.
The Porţile de Fier (Iron Gates) area is largely spread, exceeding the county borders. Within the county, it is located alongside the Danube Gorge, occupying significant parts of the Locvei and Almăj Mountains, as well as alongside the Cernei Valley. The area's charm is given by the Danube Gorge itself - the greatest gorge in Europe, the Iron Gates, as well as the Cernei Valley, which has no equal in the Romanian Carpathians.
Along the Gorge, the Danube runs through alternative broadenings (accentuated by accumulation lakes) and strictures, with their own specific, attracting tourists, either passing through the gorge by ship, or following the modernized highway Moldova Veche —Cozla. Here one can find the Moldova Veche isle, which represents a miniature Danube Delta because of its fauna richness and variety.
In the proximity of the gorge (within the county area) there are other tourist attractions, among which we remember the picturesque Valea Mare, Oreviţa, Berzasca and Sirinia canyons, and more northern, the Boiştei, Şuşarei (with its beautiful waterfall), Budăriei (with numerous water mills) and Putnei canyons. These canyons neighbour carst highlands or mild hills which, together, come to complete the beauty of the landscape.

2. MOLDOVA NOUĂ (Bordering town)
a) Localization
The town is situated at an altitude of ca. 300 m in the south-west of the Locvei Mountains.
b) Accessibility
- ✓ For Bucharest, sideways 4 km from DN 57 and 118 km from Orşova (Bordering city)

c) Tourist attraction elements
- ✓ the Moldova Veche isle
- ✓ the museum (history, archeology, etnography, folk art, natural sciences sections);
- ✓ the natural reservation Valea Mare (400 ha);
- ✓ the Roman-Catholic church (1780);
- ✓ attractive landscape;
- ✓ fish fund.

d) Tourism forms
- ✓ tourism for rest and relaxation;
- ✓ water sports and sports fishing;
- ✓ agritourism;
- ✓ Danube cruises (The only river which cuts through a chain of mountains parallel to the Equator)
- ✓ transit.

3. DUBOVA (Bordering village)

a) Localization

The village is situated to the south of the Almăj Mountains (maximum altitude is noted at 1224 m - Svinicea Mare Peak), on the shore of the accumulation lake Iron Gates I, in a picturesque gulf flanked by The Small and Big Canyons where the marvellous union of the Balkan and Carpathian Mountains occurs – the river reaching ocean depths - ca. 1 quarter of a km!)

b) Accessibility

- ✓ For Bucharest DN 57 - 25 km upstream from Orşova (Bordering city).

c) Tourist attraction elements

- ✓ unique, picturesque landscapes
- ✓ the Gura Ponicovei cave
- ✓ important fish fund

d) Tourism forms

- ✓ rest and relaxation;
- ✓ tourism for youngsters;
- ✓ water sports and sports fishing (in the Dubova Gulf);
- ✓ knowledge and scientific tourism;
- ✓ speotourism;
- ✓ agritourism;

e) Tourism structure proposals, other developments and services

These will be varied and placed in relation to the touristic resources.

I. In the Dubova Gulf area:

- ✓ Receiving structures:
  - o holiday village, 3 stars, 200 places: bungalows 100, camping 100;
  - o holiday houses
- ✓ Food structures:
  - o restaurant + beer houses (120 places, category I);
- ✓ Nautical Club: pontoon, boats with oars and engine, surfing, jollies, hangar;
- ✓ Recreation Club:
- ✓ Disco (linked to the restaurant) & cyber-room
- ✓ Fish Market;
- ✓ Euro-way parking.

II. In the civic centre area (at the exit, towards the cave):

- ✓ Receiving and Food structures (for transit and the Gura Ponicovei Cave):
  - o camping (2 stars), 60-80 camping places;
  - o buffet
  - o parking
  - o agritouristic farms and B&B’s.

III. Other developments

A) Ciucarul Mare Mountain:

- ✓ access alley for the mountain;
- ✓ belvedere point oriented towards the Danube canyon and Veliki Strbać (Pintenul Gigant) canyon from Serbia-Montenegro (Miroć MOuntains) signalling from DN 57 towards Ciucarul Mare;
- ✓ Euro-way parking (at DN 57);
- ✓ chairlift from DN 57 or cable tramway from the holiday village to the mountain plateau.

CONCLUSIONS

The sustainable development of the rural economy and, implicitly, of the rural environment is a reflection of the economy development, under every aspect, including environment protection.

The sustainable development of tourism is a point of interest for everyone and it means confronting the fact that life quality improvement researches represent an inherent constant: there is a limit to which human population and our planet's activity can resist. This theory produces a few unique challenges and opportunities for the tourism industry:

- ✓ the touristic demand is proportional to the touristic destination environment quality;
- ✓ tourism is often the one activity which protect the rural environment more than consuming industries such as: mining, constructions etc.;
- ✓ tourism leads to an increase in number of the destination area population;
- ✓ managed in an optimal way, touristic activity can be a strong force regarding environmental and cultural heritage preservation;
- ✓ sustainable tourism has become a cult for tourists, especially when it is developed in the form of ecotourism.

Tourism may have a positive and a negative impact, direct or indirect, tangible or intangible, upon the environment. And, starting from here, the effort to define and measure that which limits the implication in further fields, of some scientific and professional disciplines.

To conclude, the agritourism activity represents a complex economic-social process, carried out by the agricultural producer from the mountain area, in his household, with the purpose of acquiring supplementary income necessary for his family. The carried out activity, which may include boarding, food, recreation etc, constitutes a whole and can be identified in the touristic product components. In this case, it is compulsory to ensure an optimal correlation between quality, equipment and general boarding space aspect with those for food and recreation.

From this point of view, one must analyze the elements constituting the overall rural space development components so that it can become an integration and economic-social activity pole in mountain areas, with touristic vocation, which should attract part of the urban population in the area, not only to spend their spare time in conditions as natural as possible, specific for the rural environment, but also with a comfort acceptable for a modern and civilized tourism.

REFERENCES

BRAN, F., MARIN, D. (1997): Turismul rural – modelul European. [Rural Tourism – the European Model], ed. Economică

COSTE, I. (1986): Ecologie agricolă [Agricultural Ecology], curs IAT (LITO), Timişoara

CRĂCIUN, Ş. (1997): Agroturism- organizare şi eficienţă. [Agritourism – organization and efficiency], ed. Mirton

CSÖSZ, I. (1996): Agroturism montan. [Mountain Agritourism], ed. Mirton

EMILIAN, R. (2000): Managementul turismului durabil în ţările riverane Mării Negre". [Sustainable Tourism Management in Black See Countries], ed. All

BUCIUMAN, E. (1999): Economia turismului rural si a agroturismului [Rural Tourism and Agritourism Economy] Alba Iulia

MITRACHE, ŞT. ET AL. (1996): Agroturism rural. [Rural Agritourism], ed. Fox Press

Review on Agriculture and Rural Development 2014. vol. 3 (1) ISSN 2063-4803

THE FOREST-BASED SECTOR IN A NEW EU FOREST STRATEGY 2015-2020

ADAM CRĂCIUNESCU, ION CHISĂLIȚĂ MIHAELA MOATĂR, SORIN STANCIU

Banat's University of Agricultural Sciences and Veterinary Medicine, Timisoara
Calea Aradului, no. 119, 300645, Romania
sorinmstanciu@yahoo.com

ABSTRACT
The socio-economic importance of forests is high, but often underestimated. Forests contribute to rural development and provide around three million jobs. Wood is still the main source of financial revenue from forests. So the strategy also looks at the EU forest-based industries, subject to EU industrial policy. Wood is also considered an important source of raw material for emerging bio-based industries. Forest biomass is currently the most important source of renewable energy and now accounts for around half of the EU's total renewable energy consumption. The strategy 2015-2020 and the implementation should build on existing legislation and international initiatives and consider the special situation of small forest owners, and address market-based private-sector tools such as certification. To deliver on common objectives and improve coherence and synergies, coordination with and between Member States is important. Member States are asked to consider the principles and goals of this strategy when setting up and implementing their action plans and national forest programmes.

Keywords: forest, strategy, management, ecosystem, biodiversity

INTRODUCTION

Forests and other wooded land cover over 40 % of the EU's land area, with a great diversity of character across regions. Afforestation and natural succession have increased the EU's forest area by around 0.4 % per year over recent decades. Globally, however, forest area continues to decrease. Currently in the EU, only 60-70 % of the annual increment is being cut, therefore the growing stock of wood is rising. However, according to Member States' projections under Land Use, Land-Use Change and Forestry (LULUCF), harvest rates are expected to increase by around 30% by 2020 as compared to 2010. Some 60 % of forests are owned by several millions of private owners, with numbers set to rise as restitution of forest ownership in some Member States continues.
The remainder belongs to the state and other public owners. Forests are multifunctional, serving economic, social and environmental purposes. They offer habitats for animals and plants and play a major role in mitigating climate change and other environmental services. Nearly a quarter of the EU's forest area is protected under Natura 2000, and much of the rest is home to species protected under EU nature legislation. Forests also offer wide societal benefits, including for human health, recreation and tourism.
According to the National Renewable Energy Action Plans, biomass used for heating, cooling and electricity would supply about 42% of the 20% renewable energy target for 2020. If this is achieved, the amount of wood used for energy purposes in the EU would be equivalent to today's total wood harvest. Forests also provide a large range of other products, such as cork, resins, mushrooms, nuts, game and berries.

MATERIAL AND METHOD

Sustainable forest management means using forests and forest land in a way, and at a rate, that maintains their biodiversity, productivity, regeneration capacity, vitality and their potential to fulfill, now and in the future, relevant ecological, economic and social functions, at local, national, and global levels, and that does not cause damage to other

ecosystems. While the Treaty on the Functioning the EU makes no reference to specific provisions for an EU forest policy, the EU has a long history of contributing through its policies to implementing sustainable forest management and to Member States' decisions on forests.

Important developments include the Europe 2020 strategy for growth and jobs, the Resource Efficiency Roadmap, Rural Development Policy, Industrial Policy, the EU Climate and Energy Package with its 2020 targets, the Plant Health and Reproductive Materials Strategy and the Biodiversity and Bioeconomy Strategies. Based on subsidiarity and shared responsibility, the 1998 EU Forestry Strategy established a framework for forest-related actions that support sustainable forest management and are based on cooperative, beneficial links between EU and Member State policies and initiatives (CIOLOAC ET AL., 2011). The Forest Action Plan 2007-2011 was an important instrument for implementing the strategy and addressed four objectives: competitiveness, environment, quality of life and coordination and communication.

Co-financing of forestry measures under the Rural Development Regulation has been and will remain the main means of EU-level funding. An ex-post evaluation of the Forest Action Plan underlined the need for a new forest strategy that: develops and implements a common vision of multifunctional and sustainable forest management in Europe; defines action priorities and targets; links EU and Member State funding strategies and plans; strengthens coherent cross-sectorial activity planning, funding and implementation; establishes clear mechanisms for monitoring, evaluating and reporting; and revises stakeholder involvement. This Communication supports these recommendations by providing strategic orientations (BANU ET AL., 2011).

RESULTS

Why a new framework is needed? Over the last 15 years, significant societal and political changes have influenced the way EU society looks at forests and forestry. The overall situation is characterized by growing demands on and threats to forests. At the same time, the increasing number of forest-related Ministerial Conference on the Protection of Forests in Europe creates a complex and fragmented forest-policy environment.

The increasing links between international food, feed, fiber and fuel markets are also causing unexpected market disturbances (SOLOMONESC ET AL., 2012). A new framework is needed to:

- Ensure that the multifunctional potential of EU forests is managed in a sustainable and balanced way, enabling our forests' vital ecosystem services to function correctly;
- Satisfy the growing demand for raw material for existing and new products (e.g. green chemicals or textile fibers) and for renewable energy. This demand is an opportunity to diversify markets, but poses a significant challenge for sustainable management and for balancing demands. Demand for new uses in the bioeconomy and in bioenergy should be coordinated with traditional demands, and respect sustainable BOUNDARIES (IOSIM ET AL., 2013);
- Respond to the challenges and opportunities that forest-based industries face in resource and energy efficiency, raw materials, logistics, structural adaptation, innovation, education, training and skills, international competition, climate policy beyond 2020 and information and communication, to stimulate growth;
- Protect forests and biodiversity from the significant effects of storms and fires, increasingly scarce water resources, and pests. These threats do not respect national borders and are exacerbated by climate change;

- Acknowledge that the EU does not only rely on its own production, and that its consumption has implications for forests worldwide;

- Develop an adequate information system to follow-up on all of the above. The EU needs a policy framework that coordinates and ensures coherence of forest-related policies and allows synergies with other sectors that influence forest management. It needs a new forest strategy that is a key reference in forest-related policy development. EU forests and forest sector need to be positioned in a way that ensures their contribution to the EU's objectives and targets.

CONCLUSIONS

This proposal promotes a coherent, holistic view of forest management, covers the multiple benefits of forests, integrates internal and external forest-policy issues, and addresses the whole forest value-chain. It identifies the key principles needed to strengthen sustainable forest management and improve competitiveness and job creation, in particular in rural areas, while ensuring forest protection and delivery of ecosystem services. It also specifies how the EU wishes to implement forest-related policies. For this strategy to be meaningful to those policies that require or might require evidence of sustainable forest management and to reach its goals, objective, ambitious and demonstrable sustainable forest management criteria that could be applied to all uses of forest biomass are needed (LILE, 2010).

The strategy, and its implementation, should build on existing legislation and international initiatives and consider the special situation of small forest owners, and address market-based private-sector tools such as certification (BANU C. ET AL., 2011). To deliver on common objectives and improve coherence and synergies, coordination with and between Member States is important. Member States are asked to consider the principles and goals of this strategy when setting up and implementing their action plans and national forest programmes. Networking opportunities and ways of exchanging information and best practices should be developed. Guiding principles are:

- Sustainable forest management and the multifunctional role of forests, delivering multiple goods and services in a balanced way and ensuring forest protection; (ORBOI, 2012).

- Resource efficiency, optimizing the contribution of forests and the forest sector to rural development, growth and job creation.

- Global forest responsibility, promoting sustainable production and consumption of forest products. Europe has a long tradition of sustainable forest management, which is reflected in the Forest Europe principles applied by Member States' policies and supported by the EU, in particular through rural development policy. It is a dynamic concept with international, regional and local layers that need to be implemented by forest managers on the ground.

Member States are bound by Forest Europe commitments to manage their forests sustainable, according to their national forest policies and legislation. When implementing this strategy, they should address sustainable forest management baselines, improve information exchange and disseminate good practice.

In the forest sector, resource efficiency means using forest resources in a way that minimizes impact on the environment and climate, and prioritizing the forest outputs that have higher added-value, create more jobs and contribute to a better carbon balance. The cascade use of Pan-European political process for the sustainable management of the

continent's forests wood fulfils these criteria. In some cases, different approaches may be necessary, for example in cases of changing demand or environmental protection.

Society has a growing need for forests. Covering large parts of rural areas, forests are also vital for the rural population because they support economic welfare and jobs. A sustainable, trained and safe workforce is one of the pillars of a more competitive forest sector. Well-managed forests with qualified forest managers, workers and entrepreneurs pave the way for a sustainable and competitive forest sector that plays an important role in rural development and in the whole economy while providing societal benefits. The Commission considers that rural development funds should be used to support the implementation of sustainable forest management. (STANCIU S. AND TABĂRĂ AMĂNAR C., 2011).

Member States should use the opportunities given in the new Rural Development Regulation and priorities investments in: modernizing forestry technologies; optimizing the sector's contribution to the bio-economy; improving the resilience, environmental value and mitigation potential of forest ecosystems. Under the cascade principle, wood is used in the following order of priorities: wood-based products, extending their service life, re-use, recycling, bio-energy and disposal; achieving nature and biodiversity objectives; adapting to climate change; conserving genetic resources; forest protection and information; and creating new woodland and agro-forestry systems.

A strategy for forests and the forest sector is necessary since there is no common EU forest policy or guiding framework for forest-related issues. Since a growing number of EU policies are making increasing demands on forests, there is a need to coordinate sectorial policies. There is also a need for an agreed holistic strategic vision on forest issues, and for ensuring that linked EU policies are fully taken into account in national forest policies. This will strengthen the capacity of forests and the forest-based sector to respond to developments in various policy areas.

REFERENCES

BANU C., CRĂCIUNESCU A., CHISĂLIȚĂ I., ȘTEFAN CAROLINA, MOATĂR MARIA MIHAELA (2011): Area improvements with forest vegetation and sustainable development environment. Journal of Horticulture, Forestry and Biotechnology, Volume XV. Number 4. pp. 124-127.

CIOLAC RAMONA, CSOSZ I., PET ELENA, MARTIN SIMONA, DINCU ANA MARIA (2011): Research on the features witch customize areas with developed agritourism from Central Region of Romania. Lucrări ştiinţifice Management Agricol, Seria 1, Volume XIII. Number 4. pp.103-108.

CRĂCIUNESCU A., CHISĂLIȚĂ I., ȘTEFAN CAROLINA, MOATĂR MARIA MIHAELA (2011): Elements for the determination best age (age exploitability) which table can be harvest in stands wood household under regular forest treatment. Journal of Horticulture, Forestry and Biotechnology, Volume XV. Number 4. pp.124-127.

IOSIM IASMINA, IANCU TIBERIU, POPESCU GABRIELA, MARTIN SIMONA CRISTINA, MARIN DIANA, RADAC BIANCA (2013): The implementation of negotiating styles in agrotourism, Lucrări Ştiinţifice, Facultatea de Management Agricol, Seria I, Volume XV. Number 1. pp. 123-1228.

LILE RAMONA (2010): Calitatea şi managementul calităţii. Ed. Mirton, Timişoara.

ORBOI MANUELA-DORA (2012):Development of rural communities by diversification of rural economy in the context of sustainable development. Lucrări ştiinţifice, Facultatea

deZootehnie şi Biotehnologii, Simpozionul „Bioingineria resurselor animaliere”, USAMVB Timişoara. Volume 45. Number 1. pp.450-453.
SOLOMONESC A., CHISĂLIȚĂ I., MOATĂR MARIA MIHAELA, ŞTEFAN CAROLINA, FORA G.C. (2012): Issues of forest management in Reşiţa County.Journal of Horticulture, Forestry and Biotechnology, Volume16. Number 2. pp.243-246.
STANCIU S., TABĂRĂ AMĂNAR C. (2011): Comparative analysis of the offenses covered by forest legislation in Romania.Journal of Horticulture, Forestry and Biotechnology, Simpozionul "Explorarea și diversificarea biodiversității în horticultură și silvicultură" Ediția a II-a "Zilele Academice Timişene", Facultatea de Horticultură şi Silvicultură, USAMVB Timişoara. Volume 15 Number 1. pp.203-208,

Review on Agriculture and Rural Development 2014. vol. 3 (1) ISSN 2063-4803

RESEARCH REGARDING THE EUROPEAN UNION FORESTS FROM A GLOBAL PERSPECTIVE

ADAM CRĂCIUNESCU, ION CHISĂLIȚĂ, MIHAELA MOATĂR, SORIN STANCIU

Banat's University of Agricultural Sciences and Veterinary Medicine, Timisoara
Calea Aradului, no.119, 300645, Romania
sorinmstanciu@yahoo.com

ABSTRACT

At pan-European level, the focus is on the ongoing negotiations on establishing a legally binding agreement on forests, with the EU as a key actor. Through this agreement, the EU aims to improve sustainable forest management across the region. The new strategy forms a suitable vehicle for the implementation of the agreement. At global level, the EU is at the frontline of work on combating deforestation and forest degradation. It promotes sustainable forest management as a way of protecting biodiversity, fighting desertification and responding to climate change, whilst ensuring that forest ecosystems deliver goods and services. In this way it contributes to sustainable development and to eradicating poverty. REDD+, FLEGT and the EU Timber Regulation aim towards these goals. Mapping and assessing the state of forest ecosystems and their services requires better EU forest information. Relevant variables and parameters will be harmonised at EU level, based on cooperation between international, pan-European and national data acquisition systems, and on a detailed analysis of EU challenges.

Keywords: forest, management, strategy, biodiversity, climate change

INTRODUCTION

This strategy aims to ensure consistency between EU and Member State policies, objectives and commitments on forest-related issues at international level. It supports the EU and Member States formulating clear and coherent objectives.
Strategic orientations are:

- ensure consistency between EU and Member State policies and commitments on forest related issues at international level;
- promote sustainable forest management across Europe and globally, and the role of forests in the transition to a green economy in the context of EU development cooperation and external action;
- ensure continued support for global efforts to fight illegal logging through the FLEGT Action Plan;
- support developing countries in their efforts to improve forest policies and regulations, strengthen forest governance, value and monitor forest ecosystems, and address the drivers of deforestation and forest degradation through REDD+.

The Commission will assess the environmental impact of EU consumption of products and raw materials likely to contribute to deforestation and forest degradation outside the EU. If appropriate, it will consider policy options for limiting such impacts, including the development of an EU action plan on deforestation and forest degradation. It will do this in line with the 7th EU Environment Action Programme.

MATERIAL AND METHOD

Fostering the competitiveness and sustainability of the EU's Forest-based Industries, bio-energy and the wider green economy - Wood is a natural, renewable, reusable and recyclable raw material. If it is sourced from sustainable-managed forests, is processed and

used to minimise negative effects on climate and the environment while providing livelihoods, its role can be sustainable. Overall, 58% of harvested EU wood biomass is processed by EU Forest-based Industries, 12 representing about 7% of EU manufacturing GDP and nearly 3.5 million jobs, and contributing to achieving the goals of EU Industrial Policy. However, its future competitiveness requires new resource and energy-efficient, and environmentally-sound, processes and products (CIOLAC ET AL., 2013).

Advanced wood-based materials and chemicals are expected to play a major role in the EU bio-economy. A Staff Working Document describes the EU Forest-based Industries´ sub-sectors, their economic and technological outlooks, and identifies their major challenges and remedial actions (2013-2020) to help improve their global competitiveness.

Strengthening the forest knowledge base is needed to better understand the complex environmental and societal challenges facing the forest sector (STANCIU, 2012). Mapping and assessing the state of forest ecosystems and their services requires better EU forest information. Relevant variables and parameters will be harmonised at EU level, based on cooperation between international, pan-European and national data acquisition systems, and on a detailed analysis of EU challenges. EU programmes such as LIFE+ could help mobilise the resources needed. The Comăliţămission and Member States have developed a modular system for forest information, and work on biomass and biodiversity is ongoing.

RESULTS

Forests are vulnerable to climate change. It is therefore important to maintain and enhance their resilience and adaptive capacity, including through fire prevention and other adaptive solutions (e.g. appropriate species, plant varieties, etc.). (STANCIU ET AL., 2010). At the same time, forest management can mitigate climate change if forests' role as sinks in the carbon cycle is maintained or enhanced and by providing bio-materials that can act as temporary carbon stores or as 'carbon substitutes', replacing carbon-intensive materials and fuels.

The EU recently adopted rules for accounting, monitoring and reporting on LULUCF under which Member States will, for example, provide information on their plans for enhancing sinks and reducing forest-related emissions. The EU and Member States have also made LULUCF - related commitments to be achieved by 2020, the 2nd Commitment Period under the Kyoto Protocol. Forests also mitigate the impact of extreme weather events by moderating temperatures, and reducing wind speed and water run-off.

Forests provide ecosystem services on which rural and urban communities depend, and host an enormous variety of biodiversity (BANU ET AL., 2010). Pressures on forests, such as habitat fragmentation, spread of invasive alien species, climate change, water scarcity, fires, storms and pests call for enhanced protection (MARTIN ET AL., 2013). EU rules cover the movement and trade of certain plants, plant products and objects that can threaten plant health. Protection efforts should aim to maintain, enhance and restore forest ecosystems' resilience and multi-functionality as a core part of the EU's green infrastructure, providing key environmental services as well as raw materials.

Further emphasis should be put on preventing negative impacts on forests rather than on damage mitigation and restoration. For forests to be able to react to future threats and trends, genetic diversity must be enhanced and endangered genetic resources protected (BANU ET AL., 2011). Both the nature and the effects of certain threats are trans-boundary and therefore action at EU level is needed. Forest Management Plans (FMPs) or equivalent instruments based on the principles of sustainable forest management are key instruments in delivering multiple goods and services in a balanced way. FMPs are at the core of both

the EU 2020 Biodiversity Strategy and EU Rural Development funding. The strategy encompasses them and promotes and supports their use.

A coherent and ambitious EU forest-based research area is required to stimulate innovation across the forest sector. It should take into account forest specificities such as long timeframes. EU framework programmes for research and development support the forest sector (LILE, 2009).

The forest sector is more present in the 7th Research Framework Programme and in Horizon 2020, in line with the Bioeconomy Strategy for Europe. The goal is to enhance the sector's sustainability and its contribution to the rural economy through sustainable forest management, improve its capacity to face biotic and abiotic stresses, and develop better forestry production systems and products (MOATĂR ET AL., 2013).

Various crosscutting policy issues address forests, and their objectives sometimes differ. Coordination, cooperation and communication are therefore essential to achieving policy coherence and consistency. Various options to improve coordination and implementation were discussed with Member States, including a framework directive on sustainable forest management. However, no consensus on going beyond a voluntary approach was found. In any case, links with forest related policies must be improved.

The current EU forest governance structure relies on the Standing Forestry Committee (SFC). The SFC should remain the forum for discussing all forest-related issues, ensuring coordination and coherence of forest-related policies. However, improvements are needed to ensure that the SFC responds to inputs from other policies. The SFC worked with the Advisory Group on Forestry and Cork, the Habitat Committee and the Expert Group on Natura 2000 management to jointly prepare the guide on Natura 2000 and forests – this could be used as best practice (ORBOI ET AL., 2010).

Also, more emphasis could be put on the SFC's role of keeping forests multifunctional. The Advisory Committee on Forestry and Cork will remain the main multi-stakeholder platform for discussing issues related to forestry and sustainable forest management, and the Advisory Committee on Forest-based Industries will remain the main platform for issues related to industrial value chains. These should be the cornerstones for developing and following up on the new strategy.

Communication is a particular challenge for the sector, as the public is generally not aware of how significant sustainable forest management is, or of the various ways in which the forest sector contributes to the green economy.

CONCLUSIONS

Since the forest sector falls outside Article 42 of the Treaty on the Functioning of the EU, all competition rules fully apply to it. The remaining 42% is used for energy, accounting for about 5% of total EU energy consumption. According to the National Renewable Energy Action Plans, biomass will still be the main source of renewable energy in 2020. The Commission is currently assessing whether additional measures, including harmonised sustainability criteria, should be proposed to address sustainability issues related to using solid and gaseous biomass for heating, cooling and electricity. Thus, forest-based biomass, together with non-wood forest products, which are gaining market interest, provide opportunities to maintain or create jobs and diversify income in a low-carbon, green economy.

Other areas, in which Member States should advance further, such as preventing forest fires, combating pests and diseases, promoting sustainable wood and regional/cross-regional cooperation, will be identified. Forests and the forest sector currently receive

significant EU funding. Forestry measures under the Rural Development Regulation are the strategy's resource backbone (90% of total EU forestry funding).

According to the updated plans, €5.4 billion from the European Agricultural Fund for Rural Development have been earmarked for forestry measures in 2007-2013. Although it will depend on Member States' Rural Development Plans, a similar level of spending to that in the current period could be expected for 2014-2020. This spending should be dedicated to contributing to the objectives of this strategy, and in particular to ensuring that EU forests are demonstrably managed according to sustainable forest management principles. LIFE+ supports nature conservation, climate change adaptation, information and protection needs, the structural funds support cohesion projects and Horizon 2020 supports research and innovation actions, including the public-private partnership on bio-based industries.

Development and climate change policies also provide financing for third countries, in particular through EU development funds, REDD+ and FLEGT. Rationalising available resources and improving coordination between EU and national funding can contribute to the strategy's better implementation.

This strategy aims to put forests and the forest sector at the heart of the path towards a green economy and to value the benefits that forests can sustainable deliver, while ensuring their protection. Strong commitment and political support from all parties involved are needed for this. A review will be carried out by 2018 to assess progress in implementing the strategy.

REFERENCES

BANU C., CHISĂLIȚĂ I., FORA G., GRĂCIUNESCU A., ŞTEFAN CAROLINA, BĂLUȚĂ DANIELA (2010): Researches concerning wainscot surfaces evolution at the national level between 1989 and 2006. Journal of Horticulture, Forestry and Biotechnology, Volume XIV. Number 2. pp. 282-285.

BANU C, CRĂCIUNESCU A., CHISĂLIȚĂ I., ŞTEFAN CAROLINA, MOATĂR MARIA MIHAELA (2011): Area improvements with forest vegetation and sustainable development environment. Journal of Horticulture, Forestry and Biotechnology, Volume XV. Number 4. pp.124-127.

CIOLOAC RAMONA, IANCU TIBERIU, RUJESCU CIPRIAN, MILIN ANDA, MERCE IULIANA, MARIN DIANA, DÎNCU ANA MARIANA, STANCIU SORIN (2013): Agro-tourism in European Mountain Areas. Proceedings of the International Scientific conference "Rural Development: Innovations and Sustainability", Volume 6. Number 3. pp. 80-85.

LILE RAMONA (2009): Managementul calităţii în organizaţii. Editura Mirton, Timişoara.

MARTIN SIMONA CRISTINA, CIOLAC RAMONA, STANCIU SORIN, DIMITRESCU CARMEN, PALADE OANA (2013): Research of the Quality of Services as Expression of Social Efficiency in the Agro-tourist. ISI Proceedings of the International Scientific conference "Rural Development 2013: Innovations and Sustainability", Kauno raj., Lithuania, Volume 6. Number 1. pp. 241-246.

MOATĂR M. MIHAELA, STANCIU SORIN, CIOLAC RAMONA, ŞTEFAN CAROLINA AND RUJESCU CIPRIAN (2013): Water consumption by forest vegetation used for restoration of degraded land. Journal of Food, Agriculture &Environment, Finland,Volume 11. Number 3&4. pp. 2849-2853.

ORBOI MANUELA-DORA, BĂNEŞ A., PETROMAN I., MONEA MIRELA, BĂLAN IOANA (2010): Sociological dimensions of sustainable development. Lucrări ştiinţifice Facultatea de

Agricultură Simpozionul internaţional "Tendinţe de dezvoltare în agricultura europeană", USAMVB Timișoara. Volume 42. Number 3. pp. 749-755.

STANCIU SORIN, FEHER ANDREA, TABĂRĂ AMĂNAR C. (2010): The agricultural land fragmentation in Romania, Hungary and Bulgaria – a critical point of view. Scientific Journal of University of Szeged, Conference „Agriculture and Countryside in the Squeeze of Climate Change and Recession"**,** Hódmezővásárhely.Volume 5. pp. 101-105.

STANCIU SORIN (2012): Research on legal measures applied under the common Agricultural Policy of European union in 2012. Lucrări Ştiinţifice, Facultatea de Management Agricol, USAMVB Timişoara "Săptămâna Universităţii". Volume XIV. Number 3. pp. 69–73.

Review on Agriculture and Rural Development 2014. vol. 3 (1) ISSN 2063-4803

MONITORING OF UNGULATE IMPACT IN HUNGARIAN FORESTED NATURA 2000 SITES

ÁDÁM FEHÉR, KRISZTIÁN KATONA, NORBERT BLEIER, PÉTER HEJEL, LÁSZLÓ SZEMETHY

Szent István University
Institute for Wildlife Conservation
H-2100 Gödöllő, Páter Károly St 1., Hungary
feher.adam.hun@gmail.com

ABSTRACT
Ungulates have both, advantageous and disadvantageous effects in forest ecosystems. But predominantly, there is a one-sided negative opinion about their role and impact mainly based on economic damage caused by these game species. However, we should also always consider their ecological role in forested habitats as ecosystem engineers. We, therefore, aimed to establish a nationwide monitoring of ungulate impact assessing forest-ungulate interactions based on a reliable unified methodology. This monitoring includes measurements of understory woody plant supply and tree-trunk availability to and their utilisation by ungulates; moreover the estimation of forest regeneration and intensity of area use by ungulates. First field studies take place on special areas of conservation (SAC) in Mátra Mountains belonging to the Natura 2000 network and covering about 5000 hectares. Various forest stands will be examined along transects with 100 sample points in each SAC area to ensure the representativity of sampling. The collected data will characterize the relationships between the relative ungulate density and food availability to herbivores. In this way, the forest-game interactions can be also described. A new monitoring system based on our elaborated methodology will provide regular data from many parts of the Hungarian forests. The spatial and temporal comparisons of those values help us to understand how different ungulate species contribute to the maintenance of natural processes of our forest ecosystems.

Keywords: forest-game interactions, wild boar rooting, red deer, browsing effect, Hungary

INTRODUCTION

Ungulate species play an essential role in the forest ecosystems. They have effects on other animal and plant species and vegetation dynamics by their presence, activity, different behaviours; mainly by their feeding. Ungulates can regulate the interspecific competition among plants by their selective browsing (KATONA ET AL., 2009). They can spread various type of seeds shaping the forest vegetation structure and composition (GILL AND BEARDALL, 2001). But generally the negative impacts of ungulates (especially deer and wild boar) are emphasised, meanwhile the 'ecosystem engineer' function (SMIT AND PUTMAN, 2011) of these species remains neglected. Game damage as a universal term for negative effects of ungulate game species has a significant prejudicial, emotional content. The forest-game conflict reflects conflicting human interests (REIMOSER, 2001). A more holistic ecological approach on ungulate impact would be necessary to reveal the real role of ungulates in forest ecosystems, their benefits and the causes of the damage (REIMOSER AND PUTMAN, 2011).

In a recent ongoing project financed by Swiss-Hungarian Contribution our task, therefore, is to establish an ungulate impact monitoring system, to elaborate an appropriate and efficient methodology, and collect useful datasets related to forest-ungulate interactions in Hungary (KATONA ET AL., 2013A). First, we always need to identify unequivocally the signs of ungulate presence (tracks, faeces, bed-sites, etc.), and to make a clear statement whether the impact is caused by game or not (KATONA ET AL., 2013B). In most cases it is

not possible to determine the beneficial or disadvantageous consequences of these impacts by a momentary assessment. Thus, the long-term aim of this monitoring is to separate and evaluate the real negative effects (damage) and unoffending ones; and reveal essential regulatory impacts. Our applied methodology bypasses the economic approach; therefore it is not a game damage assessment. Our collected data not merely represent the extent of game damage, but also give answers how the ungulate species contribute to the long-term conservation of the forest ecosystems. Deeper understanding of the selection of large herbivores from forest supplies leads to better evaluation of the consequences of forest- and wildlife management practices on forest-game interactions.

MATERIAL AND METHOD

The most suitable monitoring method should be standard, repeatable, reliable, cost- and time effective and surveyable. Similar ungulate impact assessment systems (e. g. FRERKER ET AL., 2013; DAYTON AND O'HANRAHAN, 2011) must be studied to synthetize a well-based, comparable, widespread monitoring system of ungulate impact. Sufficient number of reliably measured data should be always collected instead of 'guesstimates'. Nevertheless, measuring the whole study area is uneconomical and often unreal to implement. The best solution is an estimation using only a minimum sample size needed. Accordingly, we can represent one or more attribution of the entire forest area by sampling areas typical to the whole described unit. Spatial diversity, heterogeneity of ungulate impact within the forest area is also very important question, and should be also expressed by mean values and standard deviations of different measured elements of ungulate impact. The accuracy of the estimation method should be adequate to the level of this heterogeneity and should also be tested.

Study areas of monitoring

After the successful methodological tests and elaboration of the sampling procedure in 2013 the field studies will be performed during summer in 2014 and 2015. For the first field application of ungulate impact monitoring method the mountain range of Mátra was designated. This region belongs to the North Hungarian Mountains as a part of the Carpathians. There the following 6 forested Natura 2000 sites (SAC, special areas of conservation) were selected for further investigations:

- Hegyes-hill of Recsk (HUBN20044; 161,5 ha);
- Mátra-North (HUBN20047; 780 ha);
- Világos-hill and Rossz-meadows of Gyöngyöstarján (HUBN20048; 326 ha);
- Mátrabérc – Fallóskút meadows (HUBN20049; 1506 ha);
- Gyöngyöspatai Havasok (HUBN20050; 324 ha);
- Mátra-West (HUBN20051; 1498 ha);
- Additionally the Sár-hill of Gyöngyös nature conservation area (189 ha) is also surveyed.

The monitoring will cover about 5000 hectares in the project. Any monitoring system can only be reliable at nationwide scale if the collected data are representative and reliable at lower scales, as well. The crucial point of this monitoring, therefore, is the optimization of sampling size (SZEMETHY ET AL., 2013). Based on our earlier calculations on minimum sample sizes each designated transect will include at least 100 sampling points; and will

represent together the Natura 2000 sites in the proportion of different forest stands available.

Applied methods of ungulate impact monitoring

Since ungulates take effects on the forest ecosystems in many ways, our methodology includes investigations from several different aspects. The monitoring consists of surveys on five greater components:

1. Woody plant food supply to and its utilization by ungulates in the understory
2. Tree sapling density and their utilization by ungulates
3. Tree trunk-availability and utilization by ungulates
4. Wild boar rooting
5. Intensity of area use of ungulates

WHAT AND WHY SHOULD BE MEASURED?

Understory supply and utilization by ungulates

If the available woody food supply in the understory contains diverse range of plants in case of relatively low game density, then ungulates can browse selectively. In this case the preferred plant species will be more intensively browsed; meanwhile several species will be avoided. If the game density becomes higher, less preferred plant species should also be consumed. Consequently, the vegetation will show the clear signs of overutilization. Similarly, when the diverse understory forage is lacking in the area (e.g. because of shrub removal by forest manager), ungulates will have no chance to follow selective feeding strategy. Therefore, game damage in homogeneous forests can raise high, even despite a low ungulate density.

Conducting vegetation surveys we can evaluate the relationship between ungulate pressure and plant food supply. We can decide whether the habitat offers a suitable place to ungulates, and ungulates actually maintain or destroy the habitat. To investigate the actual status of the vegetation, we use a special wooden frame of 50x50x30 cm (height x width x depth). This tool helps us to count the number of all and browsed woody shoots (as “food units” for large herbivores) up to 2m height at all sampling points. Differences in the browsing ratio among different woody species will reflect the selective browsing impact of ungulates. Finally, regulatory or threatening browsing effects on understory species can be evaluated in the light of food diversity.

Additionally, selective browsing impact will be also measured on the main tree species of the habitat. In every sampling point we investigate the browsing on individual saplings. Intensity and predicted importance of ungulate effect on individual tree growth will be described by different categories such as: “unbrowsed”, “only leaders browsed’”, “only the suckers browsed”, “both leaders and suckers browsed”, or ‘deformed’.

Tree trunk-availability and utilization by ungulates

Although ungulates primarily consume the shoots of understory woody plants, occasionally they can peel the bark from the tree trunks, as well. This behaviour is often related to starvation or unsatisfactory food quality. Trunks can also be injured from deer antler rubbing. It can be related to antler cleaning to remove velvet or even to antler casting. But tree trunks can also be injured during rutting season by aggressive attacks against the trunks. The seriousness of debarking can vary widely depending on the extension and the depth of the stripped surface. Injuries coming full circle around the trunk

usually represent the most serious damage, preventing the transport processes in the plant, and giving opportunities to secondary harmful organisms (fungi, insects) to attack the tree. However, in most cases deciduous and coniferous trees are able to survive such type of ungulate effects. The signs of debarking remain as scars on the bark for a long time. Ungulates select among the trunks of different tree species and they also show various utilization intensities according to the diameter of trunks. Selective debarking, therefore, might be a significant modifying impact both on tree individuals and forest structure.
We will describe the trunk availability and utilization by counting the accessible trunks of all woody species in every sampling point and measuring their trunk diameter. Debarking will be always registered and the causes will be determined (peeling or rubbing). Vertical and horizontal extensions of stripped bark surface will be measured to evaluate the seriousness of the injury. The obtained results will promote the identification of the real effects of debarking to plant growth and forest succession.

Wild boar rooting and intensity of area use of ungulates

The rooting behaviour of wild boar takes many regulatory effects in the forest ecosystems. It alters e.g. the properties of soil and the activity of soil organisms; or it affects directly the growth and survival of seedlings or saplings. The negative economic consequences of rooting are also widely described (e.g. grubbing of gardens and roads). These various effects make the fact clear: rooting has both negative and positive effects on the environment. Presumably wild boar rooting is as substantial function in shaping vegetation structure and dynamics as e.g. the individual growth of plants or the competition between them. We will estimate wild boar rooting (depth and extension), and we will also count the other signs of ungulates (e.g. beds, faeces) at sampling circles to characterize the intensity of their area use and their local impact within the habitat.

CONCLUSIONS

Collected data will be a good basis to characterize the forest-ungulate interactions in Hungarian forests. We will have better insight into the ecological consequences of ungulate effects of different types and intensities on structural and compositional diversity of the different forest habitats. Not only the actual forest conditions will be surveyed, but some simple ungulate regulatory effects will also be revealed; moreover some potential negative game effects can also be forecasted.
Our field guides on the identification of ungulate signs and effects and on ungulate impact monitoring are available to download from the website of our Institute (http://www.vmi.info.hu) or can be requested by e-mail from the authors.

ACKNOWLEDGEMENTS

The elaboration and implementation of the ungulate impact monitoring is supported by the Swiss-Hungarian Cooperation Programme as part of the project “Sustainable Conservation on Hungarian Natura 2000 Sites” (SH/4/8).
This paper was supported by the János Bolyai Research Scholarship of the Hungarian Academy of Sciences (to Katona, K.) and the Research Centre of Excellence- 17586-4/2013/TUDPOL.

REFERENCES

BIRÓ, ZS. KATONA, K. BLEIER, N. LEHOCZKI, R. ÚJVÁRY, D. SZILÁGYI, ZS. MARKOLT, F. SZEMETHY, L. (2012): A kőrösladányi vadaskert vaddisznó állományának hatása a védett növényekre. Természetvédelmi Közlemények, Volume 18. pp 67-76.

DAYTON, N. O'HANRAHAN, B. (2011): An assessment and evaluation of herbivore impacts on designated habitats at Foinaven SSSI/SAC. Scottish Natural Heritage, Commissioned Report No. 451, 42 pp.

Fehér, Á. Katona, K. (2013): Akácrágás: vadkár vagy vadhatás? Erdészeti lapok, Volume 148. Number 9. pp. 278-281.

FRERKER K., SONNIER, G., WALLER, D. M. (2013): Browsing rates and ratios provide reliable indices of ungulate impacts on forest plant communities. Forest Ecology and Management, Volume 291., pp. 55-64.

GILL, R. M. A., BEARDALL, V. (2001): The impact of deer on woodlands: the effects of browsing and seed dispersal on vegetation structure and composition. Forestry, 74(3): 209-218.

KATONA, K. BLEIER, N. HEJEL, P. FEHÉR, Á. SZEMETHY, L. (2013,A): Terepi módszertani segédlet a vadonélő patás fajok erdei élőhelyeken megfigyelhető hatásainak méréséhez. 18 pp.

KATONA, K. HEJEL, P. SZEMETHY, L. (2013,B): Terepi módszertani segédlet a vadonélő patás fajok jelenlétére, élőhely-használatára utaló jelek felismeréséhez. 20 pp.

KATONA, K. SZEMETHY, L. HAJDU, M. CSÉPÁNYI, P. (2009): A folyamatos erdőborítás és a vadállomány harmonikus kapcsolata a Pilis-tető bükköseiben. Erdészeti lapok, Volume 146. Number 2. pp. 49-51.

REIMOSER, F. (2001): Forest ungulate damage: integrating wildlife and forest management practices. In: FIELD, R., WARREN, J. R., OKARMA, H., SIEVERT, P. R. (eds.): Wildlife, land, and people: Priorities for the 21st century, International Wildlife Management Congress, The Wildlife Society, Bethesda, Maryland, USA, pp. 172-176.

REIMOSER, F., PUTMAN, R. (2011): Impacts of wild ungulates on vegetation: costs and benefits. In: PUTMAN, R., APOLLONIO, M., ANDERSEN R. (ed.): Ungulate management in Europe: problems and practices. Cambridge University Press, Cambridge. pp. 144-191.

SMIT, C., PUTMAN, R. (2011): Large herbivores as 'environmental engineers' In: PUTMAN, R., APOLLONIO, M., ANDERSEN R. (ed.): Ungulate management in Europe: problems and practices. Cambridge University Press, Cambridge. pp. 260-283.

SZEMETHY, L. KATONA, K. CSÁNYI, S. HAJDU, M. HEJEL, P. BLEIER, N. (2013): A vadhatás mérésének módszertani problémái. Erdészeti lapok, Volume 148. Number 11. pp. 360-361.

Review on Agriculture and Rural Development 2014. vol. 3 (1) ISSN 2063-4803

THE CONTRIBUTION OF MAGNETIC FLUID TO THE VARIATION OF THE CHLOPOPHYLL CONTENT IN WHEAT

AMEDEU PÎRVULESCU[1], **FLORIN SALA**[1*], **MARIUS BOLDEA** [2]

[1]Soil Science and Plant Nutrition Department, Banat University of Agricultural Sciences and Veterinary Medicine, "Regele Mihai I al României" from Timişoara, Romania
[2]Mathematics and Statistics, Banat University of Agricultural Sciences and Veterinary Medicine, "Regele Mihai I al României", Timisoara, Romania
[*]florin_sala@usab-tm.ro

ABSTRACT
The present research focused on the contribution of water-based magnetic fluid to the variation of the chlorophyll content in wheat by application associated with urea. Urea and magnetic fluid in various concentrations determined variations of the chlorophyll content in wheat plants, within the limits of 52.73±0.15 - 57.10±0.12 SPAD units, 48 hours after the treatment (R^2 = 0.955, $p<0.01$) and 52.87±0.43 - 55.53±0.57 SPAD units, 10 days after the treatment (R^2 = 0.994, $p<0.01$), respectively. The increase in the chlorophyll content caused by the two factors is variable, and urea has a faster effect than the magnetic fluid. The mathematical equations describing the change in chlorophyll have a high degree of safety. Multivariate analysis facilitated cluster grouping of the variants depending on the results generated, with obvious separation of the variants treated with magnetic fluid. The value of the cophenetic coefficient is 0.998, which provides high certainty to the orientation and cluster grouping of the variants.

Keywords: urea, magnetic fluid, chlorophyll, wheat

INTRODUCTION

The interest in the implications of magnetic fluids in the vegetal field has materialized in various studies. LOBREAUX ET AL. (1992) studied the influence of magnetic nanoparticles coated in perchloric acid on the growth of *Zea mays* plants in the early stages of development. They found that treatment with iron-based magnetic fluid induced changes in the accumulation of ferritin proteins in the roots and leaves of maize plantlets, for three days. SALA (1999) studied the influence of magnetic fluids on some metabolic processes such as seed germination, plant growth and development in the early vegetation stages.
CORNEANU ET AL. (1998) highlighted the stimulating effect of magnetic fluid on the accumulation of starch in the vegetal cell, and GODEANU ET AL. (1998) proved stimulating effects of magnetic fluids on plant growth. Running such a study on species *Mammilaria duwei* on growth medium treated with (water-based and petroleum-based) magnetic fluids, the authors found intensification of the metabolic activity in live tissues. MIHAELA RĂCUCIU and DORINA EMILIA-CREANGĂ (2007) showed the contribution of magnetic fluid to the revitalization of ageing tissue, to the decrease of necrosis and to acceleration of plantlet emergence.
PINTILIE ET AL. (2006) as well as MIHAELA RĂCUCIU, DORINA-EMILIA CREANGĂ (2007) studied the influence of magnetic fluids on vegetal pigments with an assimilating role, especially on the chlorophyll content (a, b) and carotenoids in maize leaves, given that iron is involved in the synthesis of chlorophyll.
In addition, certain phytotoxic effects of different types of magnetic nanoparticles on plant germination and growth in the early vegetation stages of *Cucurbita pepo* (STAMPOULIS ET AL. 2009) and *Cucumis sativus* (PENG ZHANG ET AL. 2012) were discovered.

Starting from the proven effect of ferrofluids on plants, a number of studies investigated the pervasion of magnetic nanoparticles into the vegetal organism, as well as their translocation and circulation to different vegetal tissues and structures (GONZALEZ ET AL. 2008, ZUNY ET AL. 2010, CORREDOR ET AL. 2010).
Recent research in the field of nanotechnologies has focused on the control of chemical substances that protect plants, nutrients respectively, by using magnetic nanoparticles (REMYA NAIR ET AL. 2010).
The present research deals with the contribution of water-based magnetic fluid to the variation in the chlorophyll content in wheat, by applying it in variable concentrations together with urea.

MATERIAL AND METHOD

The biological material was species *Triticum aestivum* ssp. *vulgare*, Alex cultivar. The crop presented high uniformity regarding plant density and the nutrition and vegetation state. The fertilizer used for foliar application, chosen for its fast effect on plants, was urea, in a concentration of 10% in aqueous solution. The magnetic fluid used was one based on water, biocompatible $\frac{\mathbf{MF}}{\mathbf{H_2O}}$, with saturation magnetization . The magnetic fluid was used in concentrations of 0.1%, 0.5% and 1% in urea solution. The variants were as follows: V_1 (Mt), V_2 – Urea 10%, V_3 – Urea10% + MF0.1%, V_4 – Urea 10% + MF0.5%, V_5 – Urea 10% + MF1%. The solutions were applied uniformly with a carried sprayer, during stem elongation (BBCH 35-37, flag leaf just visible).The determinations were made 48 hours and 10 days after the treatment. The indicator the study focused on was chlorophyll, a photosynthetic parameter in functioning of which both iron and nitrogen (nutrients supplied by the application of treatments) are involved. For this determination, SPAD 502 Plus (Konica Minolta Sensing Inc. Japan) was used.
Processing of experimental data was performed with the statistic module of application EXCEL of Office 2007 and with the programme called Past. Determinations of descriptive statistical analysis were made, as well as correlations, regressions and multivariate analysis.

RESULTS AND DISCUSSION

The urea and magnetic fluid in different concentrations determined variations in the chlorophyll content of wheat plants within the limits of 52.73±0.15 - 57.10±0.12 SPAD units 48 hours after the treatment, and 52.87±0.43 - 55.53±0.57 SPAD units 10 days after the treatment (*Table 1*). The distribution of the chlorophyll content based on the complex action of the two factors 48 hours after treatment application can be described by relation (1) in conditions of high statistical certainty ($R^2 = 0.955$; $p<0.01$) (*Figure 1*).

$$Y = -0.5632x^2 + 4.1918x + 49.112 \quad (1)$$

where: $x = U + LM$, representing the cumulative effect of the two factors

The individual contribution of the two factors in the chlorophyll content recorded 48 hours after the treatment is described by relation (2) in conditions of statistical certainty ($R^2 = 0.828$, $p = 0.171$).

$$Chl_{2\ days} = 52.71 + 0.3348U + 0.2621\ LM \quad (2)$$

where: $U = urea$, $LM = magnetic\ liquid$

Table 1. The variation of the chlorophyll content in wheat plants under the influence of urea and magnetic fluid

Chlorophyll / Experimental variant	Mean chlorophyll content (SPAD units)		
	Before the treatment	48 hours after	10 days after
Mt	52.71±0.16	52.73±0.15	52.87±0.43
Urea 10%		55.11±0.11	54.70±0.55
Urea 10% + LMA 0.1%		57.10±0.12	55.53±0.57
Urea 10% + LMA 0.5%		56.37±0.18	56.49±0.58
Urea 10% + LMA 1%		56.16±0.14	56.83±0.41

The distribution of chlorophyll content 10 days after treatment application, based on the complex action of the two factors – urea and magnetic fluid, is described by relation (3) with high statistical certainty ($R^2 = 0.994$; $p<0.01$) (*Figure 2*).

$$y = -0.2029x^2 + 2.1896x + 50.948 \quad (3)$$

where: $x = U + LM$ representing the cumulative effect of the two factors

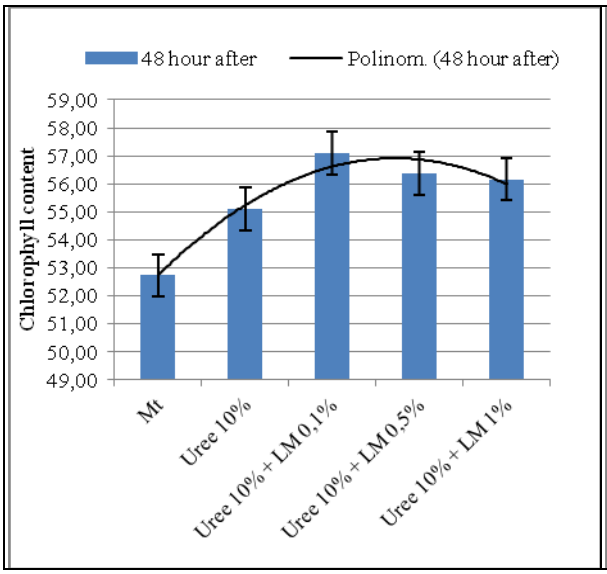


Figure 1. The distribution of the chlorophyll content in wheat plants 48 hours after treatment

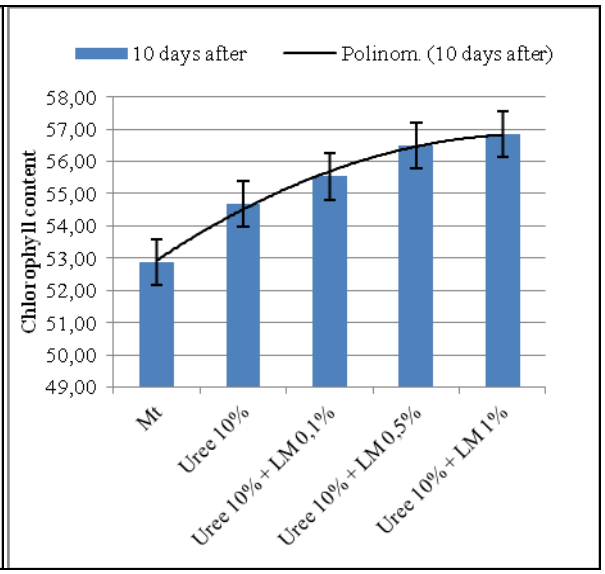


Figure 2. The distribution of the chlorophyll content in wheat plants 10 days after treatment

The individual contribution of the two factors to the chlorophyll content recorded 10 days after the treatment is described by relation (4), also with high degree of statistical certainty ($R^2 = 0.957$, $p = 0.04$).

$$Chl_{10\ days} = 52.87 + 0.2237U + 1.9530LM \quad (4)$$

where: $U = urea$, $LM = magneticliquid$

The comparative analysis of the experimental data shows that urea has a faster effect

towards the modification of the chlorophyll content in wheat leaves, while magnetic fluid has a slower influence, its potential being seen after a longer period of time and identified 10 days after treatment. This is proven by the values of the coefficients of the two factors (urea and magnetic liquid) in equations (2) and (4), as well as by the actual increase of the chlorophyll content. In the equation that describes the variation of the chlorophyll content in wheat leaves 48 hours after (2), the involvement coefficient of urea is 0.3348, while that of magnetic fluid is 0.2621. In equation (4), which describes the distribution of the chlorophyll content 10 days after treatment, the values of the coefficients for the two factors analysed are 0.2237 for urea and 1.9530 for magnetic fluid.

The importance of magnetic fluid in the increasing variation of the chlorophyll content can be accounted for by iron, in the form of the magnetite present in the structure of the ferrofluid, which enters into plant metabolism after being absorbed at foliar level. Iron is a precursor of chlorophyll and it plays an important part in nitrogen metabolization. MARSCHNER (1995) estimated that nitrogen (N) is one of the most important inorganic nutrients in plants because it is a major constituent of proteins, nucleotides, as well as chlorophyll and numerous other metabolites and cellular components. According to the same author, among the factors which may limit NO_3^- assimilation, iron (Fe) plays a crucial role, being a metal cofactor of enzymes of the reductive assimilatory pathway nitrate reductase (NR), nitrite reductase (NiR) and glutamate synthase (GOGAT), all requiring Fe as Fe-heme group or Fe-S cluster. ANDREA BORLOTTI ET AL. (2012) communicate that Fe deficiency has a differential effect on N metabolism in roots and leaves, with particular adaptive mechanisms to nutritional constraint acting at the whole plant level.

Table 2. Variation of the chlorophyll increase depending on the determination factors

Parameters / Variant	Urea (%)	LMA (%)	Before treatment	After 2 days					After 10 days				
				Chl	Total increase	Increase given by urea	Increase given by LM	ΔChl_{LM}	Chl	Total increase	Increase given by urea	Increase given by LM	ΔChl_{LM}
Mt	-	-	52.71	52.73	-	-	-	-	52.87	-	-	-	-
Urea 10%	10	0	52.71	55.11	2.38	2.38	0	0	54.70	1.83	1.83	0.00	0
Urea 10% + LMA 0.1%	10	0.1	52.71	57.10	4.37	2.38	1.99	1.99	55.53	2.66	1.83	0.83	0.83
Urea 10% + LMA 0.5%	10	0.5	52.71	56.37	3.64	2.38	1.26	0.73	56.49	3.62	1.83	1.79	0.96
Urea 10% + LMA 1%	10	1	52.71	56.16	3.43	2.38	1.05	0.21	56.83	3.96	1.83	2.14	0.34

48 hours after treatment application, the variation of the chlorophyll content was made with 2.38 – 4.37 SPAD units, with differentiated contribution of the two factors. Urea determined chlorophyll variation by 2.38 SPAD units, while magnetic fluid determined chlorophyll variation with values between 1.05 and 1.99 SPAD units, as shown in *Table 2*. In the same experimental conditions, in the control variant the chlorophyll content was 52.73 SPAD units, which served as reference for calculating the variation unit.

10 days after treatment application, the total variation of the chlorophyll content was made with 1.83 to 3.96 SPAD units, with differentiated contribution of the two factors. Urea determined an average general chlorophyll increase of 1.83 SPAD units, and magnetic fluid determined chlorophyll increase between 0.83 and 2.14 SPAD units, values that

increase together with the concentration of magnetic fluid (*Table 2*).
The gradient of chlorophyll increase given by magnetic fluid ΔChl_{LM} is on the decrease both 48 hours and 10 days after the treatment.
Multivariate analysis of the experimental results resulted in grouping the variants in two distinct clusters, depending on variant affinities in generating the result. One cluster includes only the control variant (V_1), and the second one includes the four treated variants, subgrouped into two clusters. Variant V_2, where only urea was applied, is positioned separately, while the other three variants ($V_3 - V_5$), where magnetic fluid was also applied, in concentrations of 0.01 – 1% are grouped together, as shown in Figure 3. The value of the cophenetic coefficient is 0.998, which gives high certainty to orienting and grouping the results based on the experimental data analysed.

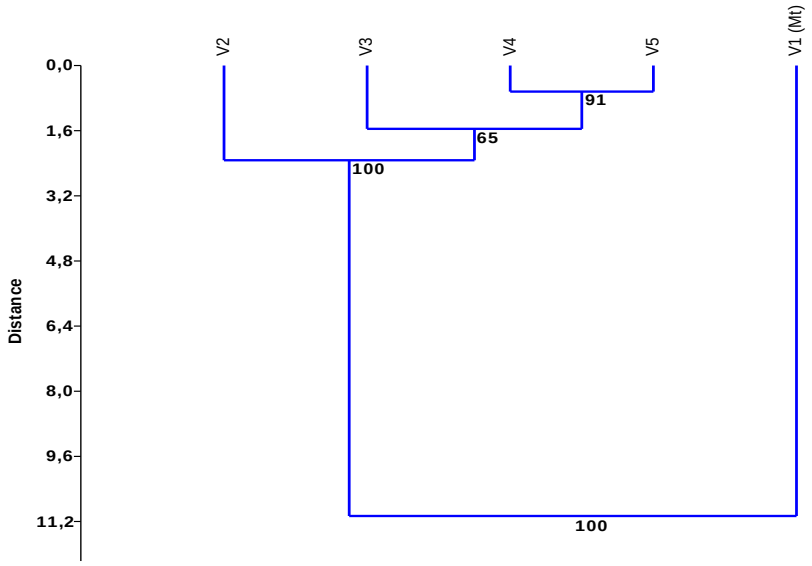


Figure 3. Cluster grouping of the variants based on Euclidean distances in relation to the results obtained

CONCLUSIONS

Associating water-based magnetic fluid with urea for extra-radicular application is possible, with effects on the upward variation of the chlorophyll content in wheat plants. The singular influence of the two products was quantified differently, it being faster in the case of urea and slower in the case of magnetic fluid. Using the two products together generates a synergetic effect on the variation of the chlorophyll content.
Magnetic fluid can be used for the control and directing of chlorophyll content in wheat by association with urea, and it enhances its effect.

ACKNOWLEDGEMENTS

The authors thank the Centre for Fundamental and Advanced Technical Research of the Romanian Academy, the Institute for Complex Fluids at the "Politehnica" University from Timișoara, and Dr. Ladislau Vekas, Senior Researcher, for supporting our research by providing the magnetic fluid. The biological material (wheat seeds, Alex cultivar) was provided by the Agricultural Research and Development Station, Lovrin, Romania.

REFERENCES

BORLOTTI ANDREA**,** VIGANI G., ZOCCHI G. (2012): Iron deficiency affects nitrogen metabolism in cucumber (*Cucumis sativus* L.) plants. BMC Plant Biology,12**, p.**189 – 204.
CORNEANU G.C., CORNEANU M., MARINESCU G., BADEA E., BĂBEANU C, BICA D., COJOCARU L. (1998): Effects of magnetic fluids on *Nigella Damascena* (*Ranunculaceae*) under conditions similar to extraterrestrial environment, Abstracts of VIII-th Int. Conf. Magn. Fluids, Timişoara, Romania, p. 447.
CORREDORE., MARIA C. RISUEŃO, PILAR S. TESTILLANO (2010): Carbon-iron magnetic nanoparticles for agronomic use in plants, Plant Signaling & Behavior, DOI: 10.4161/psb.5.10.13080, p. 1295 – 1297.
GODEANU A, GODEANU M., STANCA D., CIOBANU I. (1998): The effect of the magnetic fluids on the assimilative pigments biosynthesis of *Spirulina Platensis* (Nordst) Geitl, Abstracts of VIII-th Int. Conf. Magn. Fluids,Timisoara (Romania), p. 451.
GONZÁLEZ-MELENDI P., R. FERNÁNDEZ-PACHECO, M. J. CORONADO, E. CORREDOR, P. S. TESTILLANO, M. C. RISUEÑO, C. MARQUINA, M. R. IBARRA, D. RUBIALES, A. PÉREZ-DE-LUQUE (2008): Nanoparticles as Smart Treatment-delivery Systems in Plants: Assessment of Different Techniques of Microscopy for their Visualization in Plant Tissues, Annals of Botany 101: 187–195, doi:10.1093/aob/mcm283.
LOBREAUX S., O. MASSENET, J.F. BRIAT (1992): Iron induces ferritin synthesis in maize plantlets, Plant Mol Biol. 19(4), 563-575.
MARSCHNER H. (1995): Mineral nutrition of higher plants, London: Academic Press Ltd, Second Edition, p. 232-233, 314-319.
RĂCUCIU MIHAELA, DORINA-EMILIA CREANGA (2007): Influence of water-based ferrofluid upon chlorophylls in cereals, Journal of Magnetism and Magnetic Materials 311, 291–294.
RĂCUCIU MIHAELA, DORINA-EMILIA CREANGĂ (2007): Biocompatible Magnetic Fluid Nanoparticles Internalized In Vegetal Tissue, December 15, p. 115-124.
PINTILIE M., L.OPRICA, M. SURLEAC, C. DRAGUTIVAN, D.E. CREANGA, V. ARTENIE (2006): Enzyme activity in plants treated with magnetic liquid, Rom. Journ. Phys., Vol. 51, Nos. 1–2, p. 239–244, Bucharest.
REMYA NAIR, SAINO HANNA VARGHESE, BAIJU G. NAIR, T. MAEKAWA, Y. YOSHIDA, D. SAKHTI KUMAR (2010): Nanoparticulate material delivery to plants, Plant Science, Volume 179, Issue 3, p. 154–163.
SALA F. (1999): Magnetic Fluids Effect upon Growth Processes in Plants**,** Journal of Magnetism and Magnetic Materials, 201, Ed. Elsevier, North-Holland, p. 440-442. ISSN: 0304-8853.
STAMPOULIS D., SINHA S.K., WHITE J.C. (2009): Assay-dependent phytotoxicity of nanoparticles to plants, Environ Sci Technol., http://www.ncbi.nlm.nih.gov/pubmed/19924897 43(24):9473-9. doi: 10.1021/es901695c.
ZUNY, C., LAURA CUSTARDOY, J.M. DE LA FUENTE, CLARA MARQUINA, M. R. IBARRA, D. RUBIALES, A. PÉREZ-DE-LUQUE (2010): Absorption and translocation to the aerial part of magnetic carbon-coated nanoparticles through the root of different crop plants, Journal of Nanobiotechnology, doi:10.1186/1477-3155-8-26.
ZHANG PENG, YUHUI MA, ZHIYONG ZHANG, XIAO HE, ZHI GUO, RENZHONG TAI, YAYUN DING, YULIANG ZHAO, ZHIFANG CHAI (2012): Comparative toxicity of nanoparticulate/bulk Yb_2O_3 and $YbCl_3$ to cucumber (*Cucumis sativus*), Environ. Sci. Technol., 46 (3), p. 1834–1841, DOI: 10.1021/es2027295.

Review on Agriculture and Rural Development 2014. vol. 3 (1) ISSN 2063-4803

THE EFFECT OF THE LIQUID FERTILISER ON THE EMBRYOGENESIS OF PHEASANTS

ANDRÁS PALKOVICS

Department of Horticulture, Kecskemét College
Erdei Ferenc tér 1-3., 6000 Kecskemét, Hungary
palkovicsflora@t-online.hu

ABSTRACT
The human being pollutes the environment knowingly to improve in the quality for himself and for his domestic animals and cultivated plants. Use of modern fertiliser and its technology was part and parcel of the last one hundred years in the agricultural revolution. Quality problems of the environment constitute a violent contest to the individual interests, that's why the environment scientists have attacked that for years, to use the fertilisers. The aim of this study was to answer for these disputed questions, studying the toxic effect of liquid fertiliser on wild bird reproduction.
Birds were treated with blow-pipe per os, one part off eggs were injected through the air cap, another part were treated in bath tub. The birds were examined according to the following view points: time of the decease, production and fertility of the eggs. From eggs I conclude viability of embryos, malformations and I measured the body weight. Finally I can conclude that to use the fertiliser is not a very toxic agricultural method.

INTRODUCTION

Nowadays one of the greatest problems of mankind is the alarming pollution of the environment, the denaturation of the most exposed areas because of the increasing industrialisation, and the increased rate of vehicles and the chemicals used in agriculture.
The problems of the pollution of the environment are known to the public due to some works published in Hungarian that summarise the topic. During the modern production process of mankind numerous artificially produced and not natural chemicals get into the environment, and all over the world elements and chemicals spread that either could not have been found or existed only in traces in the biosphere. These unnatural substances do not fit into the normal metabolism of the living organisms, and even show toxic effects by disturbing the metabolism, therefore their accumulation gravely endangers the biosphere and mankind.
MINYEJEV (1988) claims that the study of the effects of the fertilisers and other chemicals on the environment and especially on the quality of agricultural products needs the complex research work of the experts of several related scientific areas such as agronomists, agrochemists, experts of the melioration, chemists, stock breeders, veterinarians, workers of the sanitary-epidemiological service, food-hygienists etc.

MATERIAL AND METHOD

Material

Eggs of the Shaver Starcross 288 layer hybrid were used in the test. The Damisol NPK fertiliser with 1:2:1 ingredient proportion is distributed by the Damisol Kft., Albertirsa. The fertiliser contains 100 g/l active ingredient. (25 g N, 50 g P_2O_5 and 25 g K_2O per litre) In practice the 1% solution is used. It can be applied in every field and horticultural culture in 5-15 l/ha quantity to promote intensive development. In case of winter cereals and

alfalfa the date of application is the same as the laying period of the birds that usually nest there. This may present a threat to the eggs of the birds that nest on the ground.

Method

The eggs were carried to the field 48 hours before the beginning of the test and after 24 hours of resting the experimental groups were formed and preparations for the test began.
From the fertiliser 10%, 1% and 0.1% solutions were prepared with lukewarm tap water.
Besides employing an untreated control group we also used a control group that was treated with tap water. The solution was applied to the eggs by two means (injected and sprayed). Thus 9 groups were created in total.
The control group contained 160 eggs, and each of the other groups contained 55 eggs. (600 eggs were used in total.) The eggs were marked with a pencil then were treated. When injecting, the eggs were bored above the air chamber with a pin, then 0.1 ml from the solutions were applied into the egg with a tuberculin syringe. The hole was sealed with histological paraffin.
In contrast with our first test where the eggs were bathed, this time the field conditions were modelled by the spraying of the eggs. The eggs were sprayed from a 30 cm distance with the solutions of different concentrations, using the dose applied in practice. The injection modelled the effects that occur when the agent surely gets into the egg, while spraying modelled the normal conditions.
After the treatment the eggs were rested for another 24 hours then were placed into the Eggstar 600 automatic incubator of the Bábolnai Ipari Kft. and were incubated for 10 days. The temperature of the incubation was 37.8 ºC (0.1 ºC), the humidity was 50-54%. The incubator automatically turned the eggs in every 2 hours by 45 grades.
The test lasted for the 10. day of the incubation. Each day 60 eggs were opened, 5 from each group, and 10 from the controls. Between the 1-4. days slides were created to examine abnormal development. The eggs were opened above the air chamber, the membranes were removed and the redundant egg-white was drawn by a syringe. A filter-paper was placed on the tread, the membrana vitellina was cut around and the embryo stuck to the filter-paper was put into a 38 ºC bird physiology (0.75% concentration) solution. The embryo was swam down from the paper and mounted on a slide. The slide was dyed and fixed with a 0.1% osmium-tetraoxide paint then glycerine-gelatine was dropped on the slide before covering it. The development stage of the embryos of the control group was examined under microscope and all embryos were compared to these controls. (To determine the differences in the development the Lille-scale was used as described by HAMILTON (1952).) The determination of the embryo mortality in the different treatment groups took place every day during the opening of the eggs.
On the 5-10. day the embryos were inadequate for making slides because of their increased size, therefore the effect of the treatments were determined after the wet and dry weight and the body organisation of the embryos. The embryos were removed from the egg, were deprived of the membranes then the development and the malformations were examined under microscope when the embryos were placed on a hollow slide. The abnormally developed embryos were placed into 4% formalin and the jars were marked individually. From the normally developed embryos the wetness was sponged up and they were placed into jars. Electrical scales of UWE NJW 150 type and a thousandth gram precision was used to determine the wet weight, then the embryos were placed into a vacuum exsiccator and were dried on 105 C till body balance. The dry weight was measured and the water content determined from the difference between the wet and dry weight. During the test a detailed record was made.

The statistical evaluation was made by computer. The mean wet and dry weight was determined for each day and group, the rate between fertile and infertile eggs, the dates and rate of embryo deaths, the incidence and types of abnormal development. The effect of the treatment on the wet and dry weight and the water content of the embryos were analysed by variance analysis.

RESULTS

Rate of embryo mortality

The toxic effect affecting the embryo may manifest as necrosis, depressed functional capacity, malformation or depressed growth (VÁRNAGY, 1985). First we would like to show the effects of NPK solutions of different concentration on the embryo mortality. The injection treatment which showed the effect of the amount of the chemical that surely gets into the embryo increased the rate of dead embryos to a greater extent than the spraying treatment. The greatest embryo mortality was observed at the injection of NPK of 1% and 10%, respectively (20-22%). This is seven times more as in the case of the controls. When spraying the fertiliser, a smaller amount of the agent got into the egg thus embryo mortality was also lower. In the eggs sprayed with different concentrations of fertiliser the rate of embryos did not increase significantly compared to the controls (the increase was only 1.85%). This means that the Damisol NPK fluid fertiliser presumably is not harmful to the viability of the eggs of birds that nest on the ground when applied according to the instructions. It is interesting that in the case of small concentration (0.1%) NPK solution, the embryo mortality was higher in the spraying treatment than at injection in contrast with the other groups.

Date of embryo mortality

At the control group the death of the embryos occurred at the 3., 4., 5., and 6. day, respectively. The rate of embryo mortality was the highest on the third day. At the groups injected with tap water also the third day proved to be the most dangerous. This date is critical in the development of the embryo since at this time it switches from the cytotypic developmental stage to the organotypic developmental stage. After the forming of the endoderm and entoderm the differentiation of the various tissues and organs begins. When using injection treatment with 0.1% solution embryos died on the 4. day, while spraying caused embryo mortality on the first and second day. By injecting a 1% solution embryo mortality spreads evenly on six days, and by injecting 10% solution the time of embryo mortality extends to seven days. We can see that by increasing the concentration – provided the agent gets into the egg – mortality is observable on more days. In the groups treated with spraying the few embryo deaths occurred at completely different dates. This is presumably due to the different permeability of the shell and the semipermeable membranes, which caused that the solutions of different quantity reached the embryo by different speed.

Types of developmental anomalies

In our tested groups 13 types of developmental anomalies could be separated. Some of them manifests as the complete or partial absence of the yolk venation, some as the dwarfness and deformity of the body and some anomalies affect the eyes, the brain and the somites. The most frequent anomaly were the poor yolk venation (25.9% of the abnormally developed embryos), the small body (17.2%) and the open cavity (12%). The rate of the spontaneous deformities was 12% compared to the total malformations, based on the

controls. The rate of the different types of anomalies was high in the groups treated with injection of 1% and 10% solution. Since several anomalies could be observed on one embryo, the rate of the anomalies in the groups is not the same as the rate of the abnormally developed embryos.

Effect of the agent on the growth of the embryo

The body weight of the embryos was measured up from the 4. day, for their size and weight enabled to study the effect of the fertiliser on the growth only from this date. As compared to the body weight of the untreated control on the 10. day, the mean wet weight on the 10. day differed significantly only in the groups injected with 10% solution. The weight of these embryos was only one-tenth the weight of the controls. Similarly, only in the group injected with 10% solution showed difference in the dry weight compared to the controls (the weight was also very low). In the other treatment groups no significant difference was observed in the mean wet and dry weight or in the water content.

Examining the 4-10. day as a whole we can say that during the examined period the wet weight became 30 times larger, the dry weight increased 40-fold and the water content increased 30-fold in the control group. In the groups injected with 0.1% NPK solution significant difference was observed in the dry weight.

By examining the rate of growth we found that the increase of the body weight is the highest between the 4. and 5. day and the 5. and 6. day in all of the groups. So the rate of growth was not affected by the NPK fertiliser.

CONCLUSIONS

The human use of modern fertilisers and its technology was part and parcel of the last one hundred years in the agricultural revolution. The aim of this study was to answer for these disputed questions, studying the toxic effect of liquid fertilisers on wild bird reproduction. From eggs I concluded the viability of embryos, malformations and I measured the body weight. Finally I can conclude that to use the fertilisers is not a very toxic agricultural method.

REFERENCES

HAMILTON, H.L. (1952): Lille's Development of the Chick. Holt, Rinehart and Winston, New York.

MINYEJEV, V.G. (1988): Agrokémia és környezetvédelem. Biológiai környezetünk védelme sorozat. Mg Kiadó Bp. p. 173

VÁRNAGY L. (1985): A peszticidek teratológiai hatása. in A biológia aktuális problémái 32. Medicina Könyvkiadó Bp. pp. 9-35

Review on Agriculture and Rural Development 2014. vol. 3 (1) ISSN 2063-4803

THE EFFECT OF ARSENIC (As) CONTAMINATION ON DOMESTIC VEGETABLES

ANDRÁS SZALAY[1], TOSHIAKI HASEBE[1], DÁNIEL HORVÁTH[1], LÓRÁNT KIRÁLY[2], ANDRÁS KÜNSTLER[2], ZSUZSANNA SZAKÁL[3], FERENC **LANTOS[3]**

[1]S-Metalltech'98 Kft., Hungary
[2]Plant Protection Institute, Centre for Agricultural Research, Hungarian Academy of Sciences, Hungary
[3]University of Szeged Faculty of Agriculture, Hungary
lantos@mgk.u-szeged.hu

ABSTRACT
Elemental arsenic and arsenic compounds are classified as "toxic" and "dangerous for the environment" in the European Union under directive 67/548/EEC. The International Agency for Research on Cancer (IARC) recognizes arsenic and arsenic compounds as group 1 carcinogens, and the EU lists arsenic trioxide, arsenic pentoxide and arsenate salts as category 1 carcinogens. Arsenic is easily absorbed by vegetables from irrigation water. The accumulation of arsenic in vegetables could pose a serious risk on the quality of vegetables and human health. The two forms of inorganic arsenic, arsenate/As(V) and arsenite/As(III), are easily taken up by plant root cells (e.g. *carrot, parsley, kohlrabi*). Once in the cell, As(V) can be readily converted to As(III), the more toxic form of arsenic. In the present research we have determined the level of arsenic contamination in two of the economically most important vegetables grown in Hungary (sweet pepper; tomato) and the irrigation water in an arsenic contaminated area. In order to eliminate arsenic, decontamination was achieved by use of a Japanese-developed special cerium filter.

Keywords arsenic contamination, domestic vegetables, irrigation water, cerium filter

INTRODUCTION

Arsenic (**As**, atomic number33) is a chemical element that occurs in many minerals, usually in conjunction with sulfur and metals, and also as a pure elemental crystal. Arsenic forms colorless, odorless, crystalline oxides, As_2O_3 ("*white arsenic*") and As_2O_5 which are hygroscopic and readily soluble in water to form acidic solutions (CULLEN AND REIMER, 1989). Arsenic is introduced into soil and groundwater during weathering of rocks and minerals followed by subsequent leaching and run off. It can also be introduced into soil and groundwater from anthropogenic sources (AMAYA, 2002). Arsenic was also used in various agricultural insecticides and poisons. For example, lead hydrogen arsenate ($PbHAsO_4$) was a common insecticide previously used on fruit trees, but contact with the compound sometimes resulted in brain damage among those working as sprayers. In the second half of the 20th century, *monosodium methyl arsenate* (MSMA, CH_4AsNaO_3) *and disodium methyl arsenate* (DSMA, $CH_3AsNa_2O_3$) – less toxic organic forms of arsenic – have replaced lead arsenate in agriculture (SZABÓ S. A. ET AL., 1987; NORDSTROM D. K., 2002). The two forms of inorganic arsenic, arsenate/As(V) and arsenite/As(III), are easily taken up by plant root cells (e.g. *carrot, parsley, kohlrabi*). The accumulation of arsenic in vegetables could pose a serious risk on the quality of vegetables and human health (FINNEGAN AND CHEN, 2012). The use of clean water that is free of e.g. arsenic contamination is extremely important for crop production.
During the test forcing period we controlled the arsenic contamination of irrigation water and vegetables. Our aim was to determine the concentration arsenic absorbed from irrigation water in two of the economically most important vegetables in Hungary.

MATERIAL AND METHOD

Experimental setup

Our measurements and observations were performed in the summer forcing period of 2013, on an area with arsenic contamination fairly above average levels in a private farm in Mezőkovácsháza (*Figure 1*). Vegetable forcing was performed in two neighboring plastic tunnel greenhouses of 50 m length, 9 m width and 450 m^2 floor area each. Sweet pepper and tomato were cultivated and tested in the two plastic tunnel greenhouses, respectively. During the test forcing period a drop irrigation system was used. One half of the plants were irrigated with unfiltered water, while the other half with filtered water. In order to eliminate arsenic, decontamination was achieved by use of a Japanese-developed special *cerium filter* distributed in Hungary by S-Metalltech Ltd. During forcing the Poli-feed complex fertilizer recommended for pepper and tomato forcing was used. Sweet pepper bells and tomato berries in biologically ripe status were harvested. During the test forcing period we have controlled arsenic contamination of both the irrigation water and the vegetables grown. (MSZ EN 14627:2005 6.1. by Food Analytica Kft. Laboratórium, Mezőkovácsháza). Results represent averages of four independent experiments.

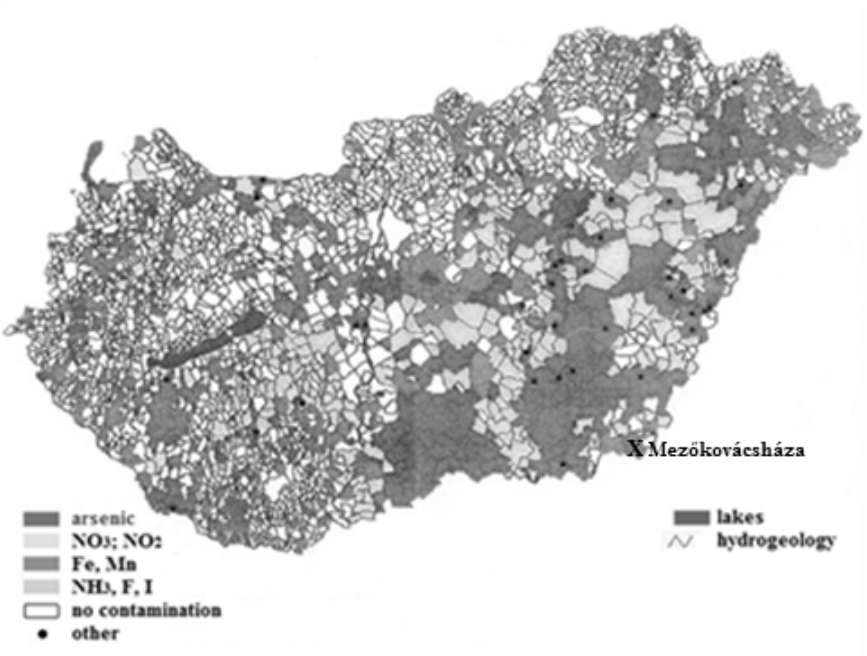


Figure 1. Arsenic contaminated sites of Hungary (OKI, 2007).

Cerium filter

Cerium is the most abundant rare earth element. Monazite and bastnasite ores are at present the more important sources of cerium. Applications: Pollution control technologies such as catalytic converters and fuel additives, glass polishing and UV shielding, water filtration, fluorescent lighting (LOS ALAMOS NATIONAL LABORATORY, USA).

RESULTS

Laboratory assays demonstrated that arsenic concentrations in unfiltered materials were higher than permitted (201/2001. (X.25.) Gev.decree). However, arsenic concentrations in filtered materials were significantly lower (*Table 1*). Our assays demonstrated that arsenic

contamination can be easily taken up from irrigation water and absorbed in cells of vegetables. Elevated arsenic concentrations in these crops were not detectable macroscopically, i.e. discoloration caused by arsenic was not observed.

Table 1. Averages of arsenic concentrations in controlled materials (100g)

Controlled materials	Filtered	Unfiltered
irrigation water	>1µg	3,8 µg
sweet pepper (*Capsicum annuum* L.)	1 µg	5,2 µg
tomato (*Solanum lycopersicum* L.)	<0,02 µg	1,9 µg

CONCLUSIONS

Based on literature data it seems that the southern part of the Carpathian Basin is an area of Hungary highly contaminated by arsenic. The primary objective of irrigation water filtering is to achieve production of healthy vegetables. Our research demonstrated that the cerium filter used by us can efficiently clean irrigation water. Levels of arsenic contamination of biological and cultivation factors (sweet pepper, tomato, irrigation water) can be held below toxic levels. By use of the cerium filter tested in this study the consumption of vegetables seems to be safe.

REFERENCES

AMAYA, A. (2002): Arsenic in groundwater of alluvi al aquifers in Nawalparasi and Kathmandu districts of Nepal. Master's thesis, Dept. of Land and Water Resources Engineering, Kungl Tekniska Hogskolan, Stockholm.

CULLEN W.- REIMER K. J. (1989): Arsenic speciation in the environment. Chem. Rev. 89. 713-764.

FINNEGAN P. M- CHEN W. (2012): Arsenic toxiciti.: The effect of plant metabolism. Front Physiol. 3: 182.

NORDSTROM D. K.(2002): Public Health.-worldwide occurrences of arsenic in ground water. Science 296. 2143-2145.

SZABÓ S. A.- REGIUSNÉ MŐCSÉNYI Á.- GYŐRI D.- SZENTMIHÁLYI S. (1987): Mikroelemek a mezőgazdaságban I. (Esszenciális mikroelemek). Mezőgazdasági Kiadó, Budapest, 1987. 235. ISBN 963 232 468 4.

http://www. Országos Környezetegészségügyi Intézet.hu 2007.

http://www.molycorp.com/resources/the-rare-earth-elements/cerium/

Review on Agriculture and Rural Development 2014. vol. 3 (1) ISSN 2063-4803

THE DEVELOPMENT OF RURAL ENTREPRENEURSHIP IN ROMANIA

ANDREA FEHER, VASILE GOŞA, TABITA HURMUZACHE, MIROSLAV RAICOV

Banat's University of Agricultural Sciences and Veterinary Medicine fromTimişoara
Faculty of Farm Management
Calea Aradului, no.119, 300645, Timişoara, Romania
feherandrea.usab@gmail.com

ABSTRACT
Small and medium enterprises play a vital role within the economy of a country, representing a source of entrepreneurial and innovation skills that greatly contributes to the achievement of gross domestic product and employs a large part of the labor force. The rural economy is more developed and dynamic, as it has a structure more diverse, and the share of non-agricultural economy is higher.
The purpose of this article is to perform a radiography on the business environment in Romanian rural areas by identifying the main strategic ways for stimulating entrepreneurial spirit.
Rural communities in Romania is mostly characterized by an aging population, declining birth rates and dependence on agriculture, especially the subsistence and semi-subsistence. Sources of income are reduced due to the low number of jobs and have major implications on quality of life in rural communities. Therefore, local authorities should be concerned about the development of their localities and improving the quality of life through the successful implementation of development programs and projects.

Keywords: entrepreneurship, SMEs, rural areas, rural economy, development

INTRODUCTION

Entrepreneurship is a multi-facet phenomenon, shaped by social and economic conditions. Entrepreneurship can be treated as an attitude or as a process. Being an attitude, entrepreneurship corresponds to a trait in people's character and stands for the readiness to face new challenges, to improve the existing components of the human environment and to take an active and creative stance towards one's surroundings. In turn, entrepreneurship understood as a process means the creation and development of a business entity (enterprise) (BABUCHOWSKA, MARKS-BIELSKA, 2013).
Entrepreneurship is recognized as a primary engine of economic growth. Without it other factors of development will be wasted or frittered away. Entrepreneurship stimulates economic growth through the knowledge spill over and increased competition of the entrepreneurs (CARREE, THURIK , 2005).
The accumulation of factors of production per se – be they knowledge, physical or human capital – cannot alone explain economic development. They are necessary inputs in production, but they are not in themselves sufficient for economic growth to occur. Economists, however, thought so for a long time and in centrally planned economies and many third world countries massive investments in human and physical capital did not produce much prosperity. Human creativity and productive entrepreneurship are needed to combine these inputs in profitable ways, and hence an institutional environment that encourages free entrepreneurship becomes the ultimate determinant of economic growth. Thus, the entrepreneur and entrepreneurship should take center stage in any effort to explain long-term economic development (ELLIASON, HENREKSON, 2011, HOLCOMBE, 1998).
Rural entrepreneurship is acknowledged as an important component that contributes to the economic development of a country (AHMAD, 2011, STATHOPOULOUS ET AL., 2004).

Rural entrepreneurship is one of the newest areas of research in the entrepreneurship field. It has become one of the significant supportive factors for rural economic development and agribusiness (WORTMAN, 1990). In opinion of Wortman rural entrepreneurship generally can be defined as creation of a new organization that introduces a new product, serves or creates a new market, or utilizes a new technology in a rural environment.
Entrepreneurship in rural areas include widening the base of a farm business to include all the non-agricultural uses that available resources can be put to or through any major changes in land use or level of production other than those related solely to agriculture (PETRIN, 1994). In this regards, rural entrepreneur is someone living in a rural location and contribute to the creation of local wealth. Many examples of successful rural entrepreneurship can already be found in literature. Diversification into non-agricultural uses of available resources such as catering for tourists, blacksmithing, carpentry, spinning, etc. as well as diversification into activities other than those solely related to agricultural usage, for example, the use of resources other than land such as water, woodlands, buildings, available skills and local features, all fit into rural entrepreneurship. The entrepreneurial combinations of these resources are, for example: tourism, sport and recreation facilities, professional and technical training, retailing and wholesaling, industrial applications (engineering, crafts), servicing (consultancy), value added (products from meat, milk, wood, etc.) and the possibility of off-farm work. Equally entrepreneurial, are new uses of land that enable a reduction in the intensity of agricultural production, for example, organic production.

MATERIAL AND METHOD

The work relies on an extensive documentation in the field. In the first part of the work the authors have presented a description of the entrepreneurship phenomenon in general and then of rural entrepreneurship, based on international literature in this field. The second part of the work deals with rural entrepreneurship in Romania and, in this respect, the study is based on processing of national and international statistical data. The authors also make some strategic ways to follow for stimulating rural entrepreneurial spirit in Romania.
The structure and dynamics of the business environment are analyzed on the basis of specific indicators designed to capture general trends in the quantitative and structural development of business initiatives and to highlight those characteristics of dynamics and structure on which corrective interventions are needed.

The indicators used in this analysis are the followings:

A. The density of active local units per thousand inhabitants is considered a good indicator to reflect the ability of a territory to be/ not to be attractive to business initiatives.

B. Dimensional structure of active local enterprises by number of employees, which reveals the ability of labor force absorption from the local market.

C. The structure of active local units by activity sectors, which reflects the diversification degree of business environment and thereby its ability to economically exploit the local resources.

RESULTS

The rural space of Romania consists of the administrative surface of the 2,861 communes which regroups 12,956 villages. The related surface for rural space as delimited in this way totals 223,055,000 ha, representing 87.1% of the country surface. The rural population is about 9.63 million people, meaning 44.9% of the total population. The number of rural households is of 3,311 thsd (45.0% of total households in the country) and the number of housing is 3860 thsd (45.8% of total number of housing) (NIS, 2011). This space is the repository of the vast majority of economic resources: raw materials for industry, agricultural resources, forestry, tourism and spas.

Of the 450,000 active SMEs nationally, only 14.0% operate in rural areas, which are mainly microenterprises, but without the absorption potential of labor force surplus, with a minimum contribution at the formation of rural economy.

The low density of rural SMEs relative to population, of about 7 SMEs /1000 inhabitants is six times lower than the European average (42 SMEs /1000 inhabitants in the EU- 27) and three times lower than the national average. Because a sufficiently large number of companies are not activating and there is a lake of a favorable frame for establishing and developing of them, rural SMEs do not contribute significantly at the sustainable economic development of rural areas (STERIU, OTIMAN ET AL., 2013).

Starting from the hypothesis that entrepreneurship leads to economic growth and new jobs creation, supporting it has become a priority as a solution to exit the economic crisis and mitigate the risk to continue emphasizing the underemployment of workforce and rural poverty. In the context where 45.0% of Romania population is in rural areas, encouraging the formation and development of non-agricultural businesses in rural areas should be an absolute priority.

The dimensional structure of the active local entreprises by number of employees is dominated, as was natural, by the businesses classified within the category of SMEs which represented in 2010, nationally 99.6% of the number of active local units (NIS, 2011), number with 0.2 percentage points higher than the European average (SCHMIEMANN, 2008). This percentage has remained relatively constant over the entire period before and during the global economic crisis. In dynamic still, by dimensional categories, the entreprises were affected differently by the economic crisis. Thus, the most stable ones were found to be smaller companies that seem to have a more flexibility and a greater ability to adapt to new economic contexts induced by the economic crisis. Thus, if the number of SMEs has decreased by 11.0% in 2010 compared with 2008, the number of large enterprises (with more than 250 employees) has decreased by almost 19.0%. Within the overall business environment from Romania, the greatest economic stability and ability to cope with economic crises occurs with small entreprises (10-49 employees), whose number has decreased by less than 9.0% during the period 2008-2010.

The structure of active enterprises by residence areas and activity sectors shows that businesses that have as activity object the production of goods and services of agriculture or forestry nature are concentrated primarily in rural areas (up to 2/3) while the businesses whose activity profiles are circumscribed to secondary and tertiary sectors are more concentrated in urban areas (up to 75.0%, respectively 80.0%). The economists recognize that the produced value added within the businesses from the primary sector of the economy (agriculture) is much lower compared to businesses that process these raw materials and those who provide services to companies and households. Therefore, this disproportionate distribution of economic activity sectors between the two areas, urban and rural, is unfavorable for the rural space, the opportunities of rural business environment to generate substantial profits being much lower than in urban areas.

The strategies to encourage rural entrepreneurship initiative must respond to three major challenges (STERIU, OTIMAN ET AL., 2013):

- aspects of economic structure - low employment opportunities in the primary sectors (especially agriculture) as a result of structural changes in the economy (focusing on agricultural land use, migration flows, financial crises, etc.), increased by legislative changes far too fast to could be assimilated by the rural population. It highlights thus the need to address the stimulation of economic activity in line with employment potential in rural areas;
- the characteristics of rural business environment - the difficulty of maintaining a critical mass of facilities in rural areas (infrastructure, market, tax incentives, etc..) to support economic development;
- the characteristics of rural population - accelerated aging of the population associated with extrarural exodus of young people and (re)turning to rural areas, especially of persons at retirement age, are social processes that negatively affect the chances of potential rural entrepreneurs occurrence.

Stimulating the entrepreneurial spirit, according to the Small Business Act for Europe (EC, 2011), is based on three pillars of action shown in *Figure 1*.

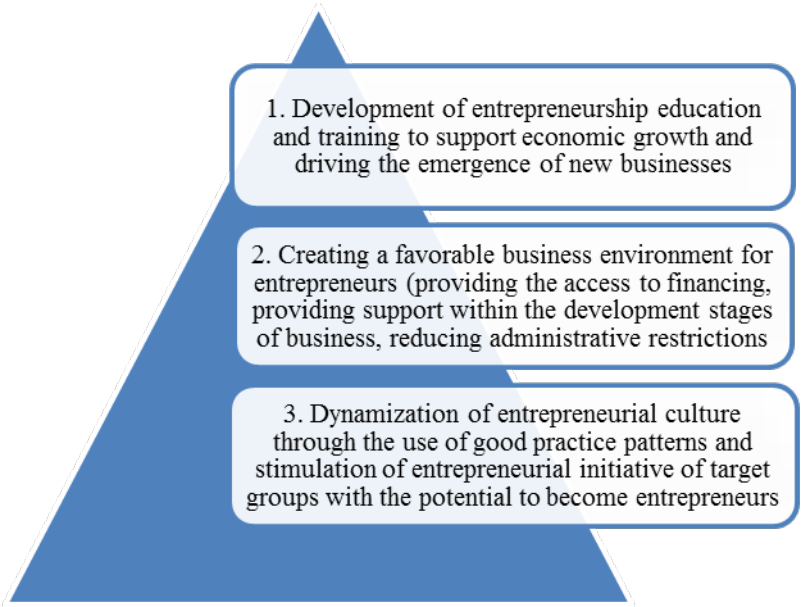


Figure 1. Pillars of Action of rural entrepreneurship development
Source: Processing after EC(2011)

1. The first pillar of action covers the following measures (STERIU, OTIMAN ET AL., 2013):

- including among the programs of primary, secondary, professional, and higher education, as well among the adult education, of needed disciplines for skills training necessary for an entrepreneurial spirit development;
- using structural funds for the revival of entrepreneurship education for youth;

2. The second pillar, of creating a favorable business environment for entrepreneurs, comprising the following steps:

- the access to financing by creating of some micro-credit schemes and loan guarantee for rural non-agricultural start -ups;
- providing support for entrepreneurs in the developmental stages of the business through: rural tax systems more favorable for businesses in the early stages; implement a new payment scheme of VAT at collecting for small businesses;

designing and implementing a system of adjustments for the payment timing of social contributions for a limited period of time based on some specific situations of the entreprises; providing support for accessing the European Programme for agriculture and Rural Development;

- reducing bureaucracy and administrative restrictions by: creating of a single point of contact at rural microzone level to obtain complete information for SMEs, licenses, financial support and public consultancy; simplifying the legislation regarding the employment and implementation of flexible programs of workforce employment.

3. The third pillar of action for the development of entrepreneurship refers to the following measures:

- stimulating the rural entrepreneurship initiatives by disseminating of successful models of businesses and of examples of good practice in order to limit the risks of failure for the small businesses and to increase the confidence of potentially new rural entrepreneurs;
- encouraging the creation of new businesses by the demographic groups under-represented in the entrepreneurial environment: (i) marginalized groups (women, unemployed) by encouraging them to change their perception on their chances of success, (ii) the group of migrants (migrant entrepreneurs and Romanian rural population contained in external temporary migration flows for employment) in order to induce the latter ones to return to the rural space of origine and to exploit the knowledge gained within the activities performed abroad.

CONCLUSIONS

Entrepreneurship development is weak represented in rural areas of Romania, as a result of insufficient exploitation of natural resources, poor education, low level of utilities, as well as of the phenomenon of massive migration to urban or externally, to other countries of the world, especially from the part of young population.

The development of a viable network of private small and medium entreprises (agricultural food, industrial, of local products processing, crafts, services etc.) within the rural areas has, in addition to the important economic function, an outstanding social component too, in the meaning of stabilizing the rural population, eliminating commuting and of using, by complementarity, the rural workforce. At the same time, these entreprises also have the role of boosting the rural economy, which contributes in this way, through the taxes that are paid to the local budget, to the economic, cultural and social development of communities.

We believe that urban-rural economic balance, without a real policy of economic and financial support and providing important tax breaks for the rural SMEs, still remains an unsolved problem for the Romanian rural area.

REFERENCES

AHMAD, A.R., WAN, Y., WAN, F., MD NOOR, H., RAMIN, A.K. (2011): Preliminary study of rural entrepreneurship development program in Malaysia, International conference on management (ICM 2011) Proceeding, pp. 537-545

BABUCHOWSKA, K., MARKS-BIELSKA, R. (2013): The growth of rural entrepreneurship in the context of the implementation of the Rural Development Programme in 2007-2013, Rural development 2013.The sixth international scientific conference proceedings, Volume 6, Book 1, pp. 493-498

CARREE, M., THURIK, R. (2005): Understanding the role of entrepreneurship for Economic Growth: Discussion paper on Entrepreneurship Growth and Public Policy. Max Planck Institute for Research into Economic Systems. Group Entrepreneurship, Growth and Public Policy, Germany

HOLCOMBE, R.G. (1998): Entrepreneurship and Economic Growth." Quarterly Journal of Austrian Economics 1 (2), pp. 45–62

ELIASSON, G., HENREKSON, M. (2003): William J. Baumol: An Entrepreneurial Economist on the Economics of Entrepreneurship , SSE/EFI Working Paper Series in Economics and Finance No 532

SCHMIEMANN, M. (2008): Enterprises by size class -overview of SMEs in the EU, EUROSTAT, Statistics in focus Industry, trade and services No. 31

STATHOPOULOU, S., PSALTOPOULUS, D., SKURAS, D. (2004): Rural entrepreneurship in Europe. A research framework and agenda, International Journal of Entreprenurial Behaviour & Research, Vol 10, No 6, pp. 404-425

STERIU, V., OTIMAN, P. I. (COORD.) (2013): Cadrul național strategic pentru dezvoltarea durabilă a sectorului agroalimentar și a spațiului rural în perioada 2014-2020-2030, Editura Academiei Române, București

PETRIN, T. (1994): Entrepreneurship as an economic force in rural development, Keynote paper presented at the Seventh FAO/REU International Rural Development Summer School, Herrsching, Germany

Avaible at http://www.fao.org/docrep/w6882e/w6882e02.htm#P359_61606

WORTMAN, M. S. (1990): Rural entrepreneurship research: An integration into the entrepreneurship, Agribusiness, Volume 6, Issue 4, pp. 329-344

EUROPEAN COMMISSION (2011): Communication from the Commission to the European Parliament, the Council, Economic and Social Committee and the Committee of the regions Review of the "Small Business Act" for Europe, Brussels, COM(2011) 78 final

NATIONAL INSTITUTE OF STATISTICS (2011): Romanian statistical yearbook

Review on Agriculture and Rural Development 2014. vol. 3 (1) ISSN 2063-4803

ANALYSIS OF THE TRANSCRIPTION AND OVEREXPRESSION OF THE MEVALONATE-ISOPRENOID BIOSYNTHESIS PATHWAY GENES IN *MUCOR CIRCINELLOIDES*

ÁRPÁD CSERNETICS, MIKLÓS TAKÓ, ANITA FARKAS, GÁBOR NAGY, CSABA VÁGVÖLGYI, TAMÁS PAPP

University of Szeged
Faculty of Science and Informatics
Department of Microbiology
H-6726 Szeged, Közép fasor 52., Hungary
pappt@bio.u-szeged.hu

Zygomycetes have a great practical significance in industrial-biotechnological and agricultural fields and also as opportunistic pathogens. *Mucor circinelloides* is a carotenoid producing filamentous fungus, which has been used as a model organism in various genetic, biochemical and molecular studies. Terpenes are synthesised by a side-route of the general mevalonate-isoprenoid biosynthetic pathway in fungi. Terpene-type metabolites (such as sterols, carotenoids, hormones/pheromones, functional groups of different proteins, e.g. farnesylated or geranylgeranylated proteins) are involved in the formation of the structure of the cell membrane, morphogenesis, electron transport, signal transduction, apoptotic processes, protection against free radicals, cell differentiation, adaptation to environmental changes, etc. Today, ergosterol and its synthesis is a major target of antifungal therapy.

Our aim is to reveal the function, regulation of the mevalonate-isoprenoid pathway genes in *M. circinelloides*. In this study, effects of cultivation time, light, salt stress, media, temperature, oxygen tension, and statin treatment on the transcription of six terpenoid pathway genes, encoding the the 3-hydroxy-3-methylglutaryl coenzyme A (HMG-CoA) synthase (*hmgS*), mevalonate kinase (*mvk*), diphospho-mevalonate decarboxylase (*dmd*), isopentenyl-pyrophosphate isomerase (*ipi*), farnesyl-pyrophosphate synthase (*isoA*) and geranylgeranyl-pyrophosphate synthase (*carG*), were analysed.

The nucleotide sequences of the genes and their regulatory regions, as well as the amino acid sequences of the encoded proteins were analysed. Autonomously replicating vectors, carrying one of the mevalonate-isoprenoid genes under the control of own and *Mucor* glyceraldehyde-3-phosphate dehydrogenase (*gpd1*) promoter and terminal sequences were constructed. The promoter of *gpd1* is very effective and can be induced by glucose. PEG/$CaCl_2$-mediated protoplast transformation with plasmids harbouring one of the isoprenoid genes (*ipi*, *isoA* and *carG*, respectively) was used to elevate the copy number of the examined genes in *M. circinelloides*. Viability and germination of spores, morphology, growth intensity and terpene production (e.g. carotenoid and ergosterol) of the resulting transformants were analysed. Investigation of the copy number of the introduced DNA, transcription of the overexpressed genes and effect of the elevated copy numbers on the transcription of the other terpenoid gene are in progress.

Árpád Csernetics, Miklós Takó, Gábor Nagy and Csaba Vágvölgyi are supported by TÁMOP 4.2.4. A/2-11-1-2012-0001 „National Excellence Program – Elaborating and operating an inland student and researcher personal support system convergence program” The project was subsidized by the European Union and co-financed by the European Social Fund. The infrastructure and research equipment was supported by TÁMOP-4.1.1.C- 12/1/KONV-2012-0014 and OTKA NN 106394.

Review on Agriculture and Rural Development 2014. vol. 3 (1) ISSN 2063-4803

DYNAMICS OF LIVESTOCK AND PRODUCTION OF SHEEP AND GOATS EXPLOITED IN FARMS FROM ROMANIA

CORNELIA PETROMAN, ANA LOZICI, IOAN PETROMAN, AKOS BENK, IOANA BALAN, DIANA MARIN, COSMINA CHIRILA, B. MOMIR

[1] Banat's University of Agricultural Sciences and Veterinary Medicine, Timisoara - Faculty of Agricultural Management,
Calea Aradului no 119, 300645, Timişoara, România
c_petroman@yahoo.com

ABSTRACT
With its about 10 million sheep and goats, Romania ranks third in Europe after United Kingdom and Spain. Though, in Romania, lamb consumption is significant only at Easter, at world level mutton is much appreciated. In Romania, according to the General Agricultural Census in 2010, there were 8,386,000 sheep, of which 8,152,000 (97.21%) on agricultural establishments with no legal personality and 234,000 (2.79%) on legal personality establishments. There were also 1,237,000 goats exclusively on farms with no legal personality. The domestic market, lamb demand has decreased these last years significantly because of the decrease of the purchase power of the Romanians and because of the better export price. Demands at world level ask Romanian sheep breeders to improve their animals in order to produce better meat and milk. Romania benefits from a series of factors that will allow it, in time, to achieve better performances both quantitatively and qualitatively, particularly in sheep.

Keywords: sheep, Romania, production, numbers, quality

INTRODUCTION

Sheep raising is a special branch of Romanian animal husbandry and the single one to have increased these years (we refer here to the number of animals) (ELOSEN I. 1999, PETROMAN I, 2007, PETROMAN I., 2000).
Taking into account the goals of raising sheep in time, sheep breeders have always worked to improve the breeds and to select only those animals that meet the goals (AVRAMESCU DANIELA ET AL., 2013, HARESING W. 1988, PETROMAN I. 1998). Thus, they have developed and specialised breed groups per production types: there are, nowadays, according to literature, over 750 sheep breeds on earth, each of which are specialised in either meat, milk, wool, skin, or fur.
The sheep breeds we raise in Romania nowadays are extremely heterogeneous from the point of view of their production, except for the sheep breed Merinos de Palas, famous for their good meat and fine wool (PADEANU I. 2002).
Even in these conditions, where we need to select the sheep, sheep breeders have made considerable profits in 2012 and the market still has an increasing potential. Sheep raising has ranked Romania 3 these last 2-3 years (it used to rank 6 in the past) in Europe in the number of sheep, overrating countries with a long-lasting tradition in the field such as France, Italy, or Greece. This is the reason why more and more Romanian farmers switch to sheep and goat raising for export.
In Romania, most sheep and all goats are owned by private farmers who use them to produce milk. Yet, these last years Romania has also known farms that raise sheep and goats for a few months after which they sell them for meat consumption on Arab markets.
Romanian consumers prefer lamb from young animals slaughtered when weighing 10-12 kg, unlike Western Europe, where they slaughter sheep when weighing 30-35 kg, with a

marble-like meat and with no obvious fat deposits (PAUNCHICI, 2004, PETROMAN, 1999, PETROMAN, 2007). Arab countries prefer fatter carcasses. In these conditions, sheep selection in Romania has to take into account the different trends depending on the destination country.

Improving sheep for meat should aim at improving fertility expressed as prolificacy, increasing precocity through improving growth speed and feed valorisation and, last but not least, improving carcass quality.

Improvement programmes include selection plans for sheep populations at the top of improvement pyramid, together with simple and double cross schemes on multiplication and commercial farm levels (PETROMAN, 2009). In Romania, sheep meat production should be obtained not only from meat sheep breeds because of low prolificacy, which makes the commercial produce more expensive. To increase the efficacy of the final produce, i.e. of the sheep carcass, it is recommendable to practice double crossing of prolific breeds (Romanov) in order to obtain not only higher quality lamb meat, by also larger numbers of lambs.

MATERIAL AND METHOD

The present research is necessary because of the low level of sheep productions and particularly because of the carcass quality and weight upon slaughter. This is the reason why, in the present scientific approach, we relied on data collected from statistics yearbooks and on information from different journals (*Business Resource Guide in the Meat Industry*), national studies of the Produce Association and of the Carcass Classification Commission, as well as results of our own investigations, data that we have processed and turned into tables and diagrams, which allowed us to draw our own conclusions and to make our own recommendations.

RESULTS AND DISCUSSION

In Romania, in 2011, the demand for lamb dropped significantly because of the low purchase power of the Romanians, and lamb price was about 20% higher than in 2010 (*Table 1*).

Table 1. Dynamics of sheep number and sheep meat production between 2001 and 2011

	UM	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Total number of sheep and goats	thousands of heads	7,776	7,945	8,125	8,404	8,921	8,406	9,334	9,780	10,059	9,623	11,331
Total live sheep and goat meat production	thousands of tonnes	114	118	135	166	114	101	110	104	104	100	150

Source: Ministry of Agriculture and Rural Development (in *Business Resource Guide in Meat Industry: Annual Report*, 2012)

The annual offer of sheep and goats is about 3 million lambs and kids. According to the statistics of the Ministry of Agriculture and Rural Development, there were, in Romania, at the end of 2011, 11,494,000 sheep compared to 9,800,000 in 2008 (*Figure 1*).

The commercial trade of sheep meat is, at present, about 950,000 t, i.e. 11% of the total sheep meat, of which 90% carcass due to the more attractive price and 10% live animals (*Table 2*).
The main importers of sheep meat are, generally, developed countries such as France, United Kingdom, Japan, USA, Canada and Italy, and such Arab countries as Jordan, Saudi Arabia, and the United Arab Emirates.
The greatest sheep exporters are Australia and New Zealand, which supply about 70% of the total sheep meat exported worldwide, particularly as carcass.
In this context, Romania has a great potential to produce sheep meat and meet on a regular basis, both domestic and foreign demands at standard levels.

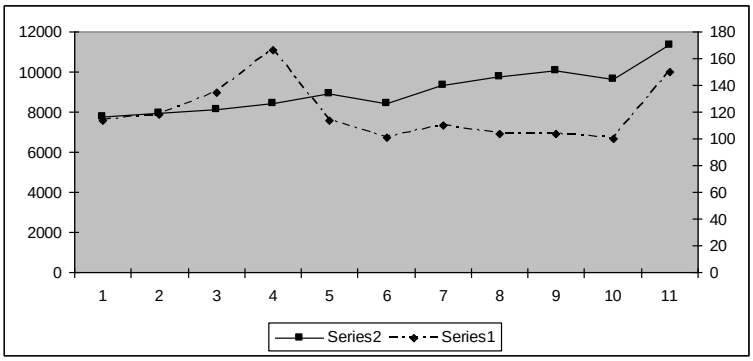


Figure 1. Evolution of sheep number and live meat production

In this context, lamb fattening after the most modern technologies (intensive and semi-intensive) becomes a first rank necessity in Romania. It is extremely important to correlate improvement measures through selection of domestic breeds and types for meat production and crossing and development of hybrids with the most suitable meat sheep breeds.
Sheep meat produced in Romania according to European quality standards is an asset of Romanian sheep raisers.

Table 2. Mean weight of sheep upon slaughter between 2001 and 2011

	UM	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Mean weight upon slaughter	kg/head	23	27	23	28	19	18	18	17	17	16	21

In Romania, lamb is the most consumed sheep meat: Romanians slaughter lambs in March, April, or May, before Easter, which makes lamb consumption a seasonal, ritual consumption. Lamb consumption is estimated at about 2.1 kg/inhabitant/year.

Table 3. Number and weight of sheep and goat upon slaughter during the period 2009-2011

	Number of animals (thousands of heads)			Weight of carcasses (tonnes)		
	2009**	2010**	2011*	2009**	2010**	2011*
Total sheep and goats slaughtered	6,122	6,150	7,247	50,975	47,157	69,503
Of which in specialised industrial units	120	377	357	1,349	4,432	4,131

*Provisional data: data concerning the specialised industrial units were collected through exhaustive statistics research, and data concerning individual farms were obtained from the Ministry of Agriculture and Rural Development
**Real data

In 2010, the number of sheep and goats slaughtered in specialised industrial units increased in a spectacular way compared to 2009 – 213.4%, and sheep and goat meat production also increased with about 228.5% (*Table 3*).

According to the National Institute of Statistics (in Business Resource Guide in Meat Industry, Annual Report, Romania 2012), in 2011, compared to 2010, the total number of sheep and goats slaughtered and the weight of sheep and goat carcasses increased with 17.8% and 47.3%, respectively.

Slaughters in specialised industrial units decreased from the point of view of the number of animals (with 5.3%) and from the point of view of the carcass weight (with 6.8%).

The number of sheep and goats increased year after year: at the end of February 2012, there were already 15.4 million heads, of which 13.7 million sheep. The number of reproduction female sheep and goats reached, in March 2012, 8.12 million heads. In January 2012, the total number of sheep and goats slaughtered decreased, compared to December 2011, with 60.6%, and the carcass weight decreased, compared to December 2011, with 59.8%.

Slaughters in specialised industrial units, which represented 4.37% of the total sheep and goat slaughters during the period 2009-2011, decreased in 2012 with 76.5% in number and with 73.7% in carcass weight.

In January 2012, compared to January 2011, the total number of sheep and goats slaughtered decreased with 15% and the carcass weight decreased with 16%. Meanwhile, slaughters in specialised industrial units and carcass weight increased in January 2012 compared to January 2011 with 33.3%, and with 37.0%, respectively.

CONCLUSIONS

The diversity of production in sheep, the low energy consumption and the nature of fodder sheep consume make sheep breeding a basic, sustainable and prospective occupation. There are, in Romania, in the near future, favourable conditions for larger amounts of sheep meat to be exported, which will allow large and small sheep raisers incomes to increase. As for the sales on the international market of fresh or refrigerated lamb, Jordan, Italy and Croatia are the main countries that have purchased it from the Romanian market, with a total of 15.5 million Euros in 2001, for 3.171, 5 to.

REFERENCES

AVRAMESCU, D., PETROMAN, I., AVRAM, E., PETROMAN, C., BALAN, I., IOSIM, I., ORBOI, D., MARIN, D. (2013): Quality of raw milk different dairy farms, Journal of Food, Agriculture and Environment, 11 (2): 267-269.

AVRAMESCU, D., PETROMAN, I., PĂDEANU, I., PETROMAN, C., PEŢ I., MARIN, D. (2011): Research concerning the body weight of hybrid Charollais X Merinos de Transilvania lambs and young rams from simple lambing. In proc.: International Scientific Symposium "Sustainable Rural Development", Faculty of Agricultural Management, USAMVB Timişoara, XIII (2), seria I, 167-172; 20 May 2011

ELOSEN, I.(1999): Selection des ovin viand developpment recent et perpectives. INRA, France

HARESING, W. (1988): Sheep Production, Ed. Butterworths, Londra

MOVILEANU, G. (2008): Clasificarea şi inspecţia carcaselor de porcine, bovine şi ovine conform normelor UE, Editura Ceres, Bucureşti

PADEANU, I. (2002): Producţiile ovinelor şi caprinelor, Editura Mirton, Timişoara

PAUNCHICI, I. (2004): Health-food references in foodstuff advertising. In proc.:3. Simpozion Internaţional USAMV Cluj-Napoca, „Perspective ale Agriculturii Mileniului III", Seria Agricultura, 60, 18-23 octombrie 2004, Editura AcademicPress, 315 – 320.

PETROMAN, C. (2007): Procesarea produselor agroalimentare, Editura Eurostampa, Timişoara

PETROMAN, C. (1999): Procesarea produselor agricole, Editura Mirton Timişoara

PETROMAN, C., BĂLAN, I., PETROMAN, I., ORBOI, M.D., BĂNEŞ, A., TRIFU C., MARIN, D. (2009): National grading of quality of beef and veal carcasses in Romania according to "EUROP" system. Food Journal of Agriculture &Enviroment Scince and Technology, 7, 3-4, July-October 2009, 173-174.

PETROMAN, C., PETROMAN, I., SARANDAN, H., STANA, L. (2007): On the Effect of Thermal Environment on Meat and Carcass Quality in Swine Raised on Privately-Owned Pig Farms. In proc.: Clima 2007 WellBeing Indoors, I, Helsinki, Finland, 105-109.

PETROMAN, I. (2007): Managementul sistemelor de creştere şi exploatare a animalelor, Editura Eurostampa, Timişoara

PETROMAN, I. (2000): Sisteme de creştere şi exploatare a animalelor, Editura Mirton, Timişoara

PETROMAN, I., CULEA, C. (1998): Sisteme de creştere şi exploatare a animalelor, Editura Mirton, Timişoara

Review on Agriculture and Rural Development 2014. vol. 3 (1) ISSN 2063-4803

STUDIES ON THE EFFECT OF THE NUMBER OF FARROWED SOWS IN HEAT PER BOX

CORNELIA PETROMAN, IONELA BIDIREAC, IOAN PETROMAN, C. BEJAN, B. BOGOSEL, DIANA MARIN, ANA LOZICI, COSMINA CHIRILA

Banat's University of Agricultural Sciences and Veterinary Medicine, Timisoara
Faculty of Agricultural Management,
Calea Aradului no 119, 300645,
Timişoara, România
c_petroman@yahoo.com

ABSTRACT
This scientific paper has as main objective the way how the type of box influences the number of farrowed sow. The number of sows of the Landrace breed that are in heat after weaning the piglets, tidmatter the duration of lactation or the number of boxes they are located in, is considerably larger than that of oestrus sows during lactation. Animal density in the box obviously influenced the appearance of heat, the largest share being in sows located by seven, i.e. 96.25%, and the lowest one, 59.68%, was in the sows located in larger boxes (32 capita). Achieving high performances of production and reproduction in raising swine greatly depends on the way animals are taken care of and exploited, i.e. the shedding system, the exploitation technology, the building material of the sheds, inside equipment, and degree of mechanisation. In sows with a 35-day lactation, the share of post partum heat occurrence had close values (though somewhat smaller), oscillating between 19.52% and 23.33%.

Key words: Landrace sows, oestrus, box type, density per box

INTRODUCTION

In the conditions of intensifying swine breeding, animals are taken away from under the direct influence of environmental factors, but there can also occur other stress factors, the artificial environment ones in which they are forced to live. Thus, size and density of animal groups, quality of building material, and the functioning of different equipment can influence negatively production and reproduction parameters (BOGDAN, 1999; PETROMAN ET AL., 2002; PETROMAN, 1997; UNTARU ET AL., 2012).

Group and individual care of sows during pregnancy in covered sheds, in collective boxes of 8-12 capita or in individual ones where each animal enjoys a useful area of 3 m^2 did not influence the value of some reproduction indices (MARIN ET AL., 2013; PETROMAN ET AL., 2013; STOICA ET AL., 1998).

Heat and mating behaviour in sows in both care systems were normal, with no significant differences in fecundity percentage. As for the total and live number of piglets, differences were significant between the two care systems, the weight of a piglet upon birth being larger in sows taken care of in common boxes (PETROMAN ET AL., 2013; PETROMAN ET AL., 2013).

One of the main factors of exploitation conditions influencing production performances in sows is the flooring surface per animal, or "animal density". Another important role is that of the size of the animal group in the box (PETROMAN, 1998; PETROMAN ET AL., 2012).

MATERIAL AND METHOD

We observed the influence of the different box types, i.e. their holding capacity, on the appearance of heat, studying Landrace sows located in three different box types in intensive exploitation:

- large boxes - with 32 heads per box;
- medium size boxes - with 16 heads per box;
- small boxes - with 7 heads per box.

RESULTS AND DISCUSSION

In sows located in the three types of boxes we monitored the frequency of the appearance of heat after farrowing, both during lactation and after weaning the piglets. Results are shown in *Table 1*. Analysing the data in this table, focusing on the share of females that showed post-partum oestrus during lactation, we can see that it is between 3.17 and 5.55%, i.e. inversely proportional compared to box size.
The same applies for the lots of females with early oestrus (during the first 10 days after farrowing) and in females in which heat appeared later than 20 days post partum. In these situations, we can see that among the females located in large boxes after having lost their piglets or in cases of agalaxy, 2.06% were in heat in the first decade and 1.11% three weeks after farrowing. In sows located in boxes of 16 heads this frequency increased to 2.78% and 1.74% respectively, and in females located in boxes of 8 heads it reached 3.74% and 2.08% respectively.

Table 1. Frequency of heat after farrowing depending on the number of animals per box

Holding capacity of the box (Nr)	Number of females having farrowed	Number of females in heat during lactation			
		Below 10 days		Over 20 days	
		Number	Births (%)	Number	Births (%)
32	680	13	2.0	7	1.1
16	288	8	2.7	5	1.7
8	144	5	3.4	3	2.0

Table 2. Frequency of heat after farrowing depending on the number of animals per box (after weaning piglets of different ages)

Box capacity (Nr)	Number of farrowing sows	Number of females in heat after having weaned their piglets					
		25 days		30 days		35 days	
		Number	Births (%)	Number	Births (%)	Number	Births (%)
32	630	118	18.73	135	21.43	123	19.52
16	288	73	25.35	101	35.07	90	31.25
8	144	41	28.47	50	34.72	48	33.33

The number of sows that, after weaning their piglets, showed heat (*Table 2*), no matter the duration of lactation - 25, 30, or 35 days - and the box type they were located in is

considerably larger than that of oestrus females during lactation. But we can also see that animal density in the box obviously influenced the appearance of heat. The largest share is that of sow lots located in boxes of 8 heads, i.e. 96.25%, and the lowest one, 59.68%, was in the sow lots located in boxes of 32 heads.
The frequency of the appearance of heat in sows with the shortest lactation increased from 18.73% to 28.47%; in sows with 30-day lactation, it reached the highest values, i.e. between 21.43% and 35.07%.

CONCLUSIONS

The frequency of heat in Landrace sows in post-partum oestrus was between 3.17% and 5.55%, with a share inversely proportional to box capacity. The number of sows in ostrus after weaning piglets no matter the duration of lactation and the type of box they were located in was considerably higher than that of oestrus sows during lactation.
Animal density per box obviously influenced the appearance of heat, the largest share being in sows located in 8 head boxes where oestrus represented 96.25% and the smaller one, 59.68% was in the sow lots located in 32 head boxes.

REFERENCES

BOGDAN A. T., (1999), Tratat de reproducţie şi însămânţări artificiale la suine, Editura Tehnică Bucureşti, pg. 134-136

MARIN D, PĂCALĂ NICOLAE, PETROMAN IOAN, PETROMAN CORNELIA, CIOLAC RAMONA, VĂDUVA LOREDANA, (2013) Values of Average Daily Gain of Swine Posted to Commercial Hybrids on Pork in Youth Phase depending on the Type and Size of Stalls, Lucrări Ştiinţifice Zootehnie şi Biotehnologii (Scientific Papers: Animal Science and Biotechnologies), ISSN 1221-5287, Editura Agroprint Timişoara, vol.46, pg. 30-32

PETROMAN I., NICOLAE M., CULEA C., PETROMAN CORNELIA, (2002), Creşterea porcinelor, Editura Mirton, Timişoara

PETROMAN I., CULEA C., (1998), Sisteme de creştere şi exploatare a animalelor, Editura Mirton Timişoara

PETROMAN I., UNTARU RAMONA CALIOPI, MARIN DIANA, (2013), Breeding season influence on sows gestation loss, Journal of Food, Agriculture & Environment Vol.11 (2): 305- 307, Helsinki, Finland

PETROMAN I., AVRAMESCU DANIELA, PETROMAN CORNELIA, MARTIN SIMONA, MARIN DIANA, CIOLAC RAMONA, TURC BOGDAN, LOZICI ANA, (2013), Habitat as environment in swine, Lucrări ştiinţifice Management Agricol, Seria 1, vol. XV (4) „Dezvoltarea rurală durabilă", Facultatea de Management Agricol, Timişoara, 20 mai, ISSN 1453-1410, pg. 30-32

PETROMAN I., Reproducţia suinelor, Editura Mirton, Timişoara, 1997, pg. 102-104

PETROMAN CORNELIA., PETROMAN I., PACALA N., UNTARU RAMONA., MARIN DIANA., FRAIU GIANINA, AVRAMESCU DANIELA, (2012) Management of sow replacement rate, Porcine Research, Volume 2(1) June, 30, Published by Bioflux, ISSN-L 2248-311X, pg. 16-18.

PETROMAN CORNELIA, MARIN DIANA, BELA ANGELA, (2013), Fecundity and sow gestation lost by pen type, Journal of Food, Agriculture & Environment Vol.11 (2): 305- 307.

STOICA ANGELA MARIA, PETROMAN CORNELIA, PETROMAN I., (1998), Rezultate practice privind valorile unor indici de reproducţie la scroafe, Editura Mirton, Timişoara, pg. 57-58

UNTARU RAMONA, PETROMAN I., PETROMAN CORNELIA, PĂCALĂ N., MARIN DIANA, FRAIU GIANINA, CIOLAC RAMONA, (2012) Research regarding the influence of housing sows in individual crates upon gestation losses in the first 2 parts of gestation, Porcine Research, Volume 2(2), December, 12, Published by Bioflux, ISSN-L 2248-311X, pg. 47-49

Review on Agriculture and Rural Development 2014. vol. 3 (1) ISSN 2063-4803

TAXONOMIC AND METABOLIC INVESTIGATION OF *BIPOLARIS* SPECIES

CSABA VÁGVÖLGYI, KRISZTINA KRIZSÁN, ANDRÁS SZEKERES, OTTÓ BENCSIK, DÓRA TÓTH, TAMÁS PAPP

University of Szeged, Faculty of Science and Informatics, Department of Microbiology, 6726 Szeged, Közép fasor 52., Hungary
csaba@bio.u-szeged.hu

The ascomycetous genus *Bipolaris* (Euascomycetes, Pleosporales, Pleosporaceae) contains melanin producing filamentous fungal species. Teleomorphic stages belong to the genus *Cochliobolus* together with the members of the other anamorphic genus, *Curvularia*; however, sexual reproduction has been rarely observed in nature. These fungi are frequently associated to graminaceous hosts and may infect corn, wheat, barley and rice causing devastating epidemics from time to time, primarily in tropical and subtropical regions. Climate change favours the spreading of these species in temperate regions, which underlines the importance of their study. The symptoms of *Bipolaris* infections begin with small necrotic lesions on leafs, which extends and cause notable yield losses. *Bipolaris* species produce a series of biological active secondary metabolites, which have or may have role in the pathogenesis. They produce various terpenoid compounds, such as sesquiterpenes, diterpenes and sesterterpenes. The sesterterpene-type ophiobolins constitute one of the most remarkable groups of these bioactive metabolites. Apart from their phytotoxic effects, several ophiobolin analogues have antimicrobial, antiviral, cytotoxic, anticancer, or nematocidal activity.

Besides plant pathogenicity, the genus is also known about their difficult species identification and confused taxonomy. Traditional morphology based methods are unsuitable for the precise species identification because of the similar characteristics, molecular identification based on the frequently used nuclear ribosomal ITS region is also problematic. In the present study, new markers potentially suitable for molecular identification were tested.

Our study demonstrated that the ITS region, the *calm*, *tub* and *tef* gene sequences, which are routinely used for identification, are unsuitable to discern *Bipolaris* species. Instead of them the use of the intergenic spacer region (IGS) of the nuclear ribosomal RNA gene cluster is suggested, in which species specific motifs were determined to distinguish the *Bipolaris* isolates. Furthermore, ability of *Bipolaris* and *Cochliobolus* isolates representing 23 different species to produce ophiobolin A, the best known phytotoxin of these fungi, was also investigated. Six of the tested isolates produced remarkable amounts of ophiobolin A (>1 mg/g [dry weight]). The secretion kinetics of the examined strains has been determined by HPLC technique during a 12 days long cultivation and found to be aggregated in four different groups according to the results.

This study forms part of the project TÁMOP-4.2.2.A-11/1/KONV-2012-0035, supported by the European Union, co-financed by the European Social Fund. For Cs.V: this research was realized in the frames of TÁMOP 4.2.4. A/2-11-1-2012-0001 „National Excellence Program – Elaborating and operating an inland student and researcher personal support system". The project was subsidized by the European Union and co-financed by the European Social Fund.

Review on Agriculture and Rural Development 2014. vol. 3 (1) ISSN 2063-4803

DEGRADATION OF PHENOL DERIVATIVES BY A *PHANEROCHAETE CHRYSOSPORIUM* STRAIN

CSABA VÁGVÖLGYI[1], MÓNIKA VÖRÖS[1], BETTINA BÓKA[1], MIRA PUCAREVIĆ[2], LJUBINKO JOVANOVIĆ[2], DEJANA PANKOVIĆ[2], LÁSZLÓ MANCZINGER[1]

[1]University of Szeged, Faculty of Science and Informatics, Department of Microbiology, 6726, Szeged, Közép fasor 52., Hungary
csaba@bio.u-szeged.hu
[2]University EDUCONS, Vojvode Putnika BB 21208 Sremska Kamenica, Serbia,
dejana.pankovic@educons.edu.rs

ABSTRACT
The white rot fungus *Phanerochaete chrysosporium* has significant pollutant-degrading capabilities with its oxidoreductases. The lignin-degrading enzyme system of this fungus also allows the breakdown of different organic pollutants (xenobiotics). The most significant enzymes in these processes are the lignin peroxidase and the manganese peroxidase. In this study, *Phanerochaete chrysosporium* strains were isolated from various Hungarian habitats. It was revealed, that one of these strains (Pha78) seems to be very promising for such remediation purposes. The degradation of different phenol derivatives by this isolate was investigated both in lignin peroxidase and manganese peroxidase inductive media. The starting concentrations of phenol derivative compounds were 20 mg l^{-1}. The amounts of the phenolic compounds in the media were measured by the colorimetric aminoantipyrine method. The tested *Phanerochaete* strain was able to degrade different phenol derivatives efficiently, especially in manganese peroxidase-inductive medium.

Keywords: bioremediation, phenol derivatives, *Phanerochaete chrysosporium*, pollution

INTRODUCTION

Agricultural and industrial activities release vast amount of different xenobiotics in the environment. Some of these compounds are classified as dangerous because they could be directly toxic to different organisms and/or they accumulate in the food chain. Beside the aniline and phenol derivatives, some filamentous fungi are capable for the degradation of various PAH (*Polycyclic Aromatic Hydrocarbon*) and POP (*Persistent Organic Pollutant*) compounds. *Phanerochaete chrysosporium*, a basidiomycetous filamentous fungus, is belonging to this group of microbes where this phenomenon is confirmed. *P. chrysosporium* is a white rot fungus which has a highly efficient lignin degrading enzyme system. With these enzyme systems the fungus can also break down different xenobiotic pollutants. In these types of degradation processes, the lignin peroxidase and the manganese peroxidase have great significance.
There are data in the literature, that when these enzymes are used alone or in combinations they target and could degrade pesticides, polycyclic aromatic compounds, chlorinated aromatic compounds, paints and many other xenobiotics (CAMERON ET AL., 2000). Based on this observation, the aim of our present study was to isolate strains of *P. chrysosporium* capable for efficient degradation of a variety of aromatic pollutants and pesticides.

MATERIAL AND METHOD

Isolation of strains

A new type of selective medium was used for the isolation of *Phanerochaete* strains. This contained peptone (0.5%), KH_2PO_4 (0.1%), glucose (1%), $MgSO_4$ (0.05%) and agar (2%) supplemented with 500 µl 5% rose bengal, 1 ml 0,2% dichloran, 100 mg streptomycin and 15 mg carbendazim after autoclaving. The isolates collected from this selective medium and one *P. chrysosporium* strain (DSM 9620) purchased from the *German Collection of Microorganisms and Cell Cultures* (DSMZ) were examined.

Molecular identification of strains

Molecular identification of the isolates was carried out with gene specific PCR and DNA sequencing. The presence of ligninase H8 gene was examined by specific PCR (JOHNSTON AND AUST, 1994) and the ITS regions of the isolates were amplified by ITS4 and ITS5 primers (WHITE ET AL., 1990) and sequenced.

Investigation of the *in vitro* xenobiotic-degrading abilities

The degradation of phenol derivatives were investigated in lignin peroxidase (JAGER ET AL., 1985) and manganese peroxidase inductive liquid media. The manganese peroxidase inductive nutrient solution contained 2 g glucose, 10 mM ammonium sulphate, 20 mM potassium sodium tartrate, 2 g KH_2PO_4, 0.5 g $MgSO_4$,10 mg thiamine, 30 mg $MnSO_4$, 1 mg $FeSO_4$, 1 mg $CuSO_4$, and 1 mg $ZnSO_4$ in one liter medium. The starting concentration of phenol derivatives was 20 mg l^{-1} in both media. Fifteen ml of both media were inoculated with 0.5 ml concentrated fungal spore-mycelium suspension of the *P. chrysosporium* Pha78 (= SZMC 20961) strain. The incubation was carried out without shaking at 25 ^{0}C for 7 days. The amounts of the phenolic compounds in the media were measured by the colorimetric aminoantipyrine method (DANNIS, 1951).

RESULTS

DIETRICH AND LAMAR (1990) reported the isolation of *P. chrysosporium* strains from soil by application of a selective media containing benomyl. Our efforts to isolate *P. chrysosporium* in this medium were unsuccessful. However, a new modified medium which contained dichloran, rose bengal and carbendazim was efficiently used for the isolation of *P. chrysosporium* from different Hungarian environmental samples.

Besides a micromorphological investigation, there is a possibility for rapid identification via the detection of the lignin peroxidase H8 gene of *P. chrysosporium* (JOHNSTON AND AUST, 1994). The special primer pair for this gene was used to identify our isolates. Fragments of the proper size (600 bp) were detected in 6 strains after the specific PCR reactions. Besides this sequencing of the ITS region were used for the exact identification of the strains. The sequences were analyzed with the NCBI BLAST service. These results proved that 5 of our strains were *P. chrysosporium* and one was *P. sordida*.

In a preliminary experiment, the degradation of xenobiotics was examined with 4 strains (DSM 9620, SZMC 20959, SZMC 20960 and Pha78) in soil microcosm experiments. The degradation of herbicides (chlortoluron, diuron, isoproturon and linuron) and parabens were measured. The rates of decomposition of inoculated samples were compared to the controls. The degradation of herbicides took place also in the non-sterile control samples, however, the inoculation of the degrading fungus highly improved this process in certain cases. The best degradation of herbicides and parabens was accomplished by the strain SZMC 20961 (*results*

are not shown). The results of the degradation of different phenol derivatives by the strain Pha78 in lignin peroxidase and manganese peroxidase inductive media are presented in *Figure 1* and *2*, respectively. The starting concentration of phenol derivatives was 20 mg l^{-1}. After one week incubation the tested *Phanerochaete* strain was able to degrade different phenol derivatives in the inductive media, first of all in the manganese peroxidase inductive medium (*Figure 2*). The most successful degradation values could be accomplished in the case of phenol, resorcinol, o-cresol and m-cresol.

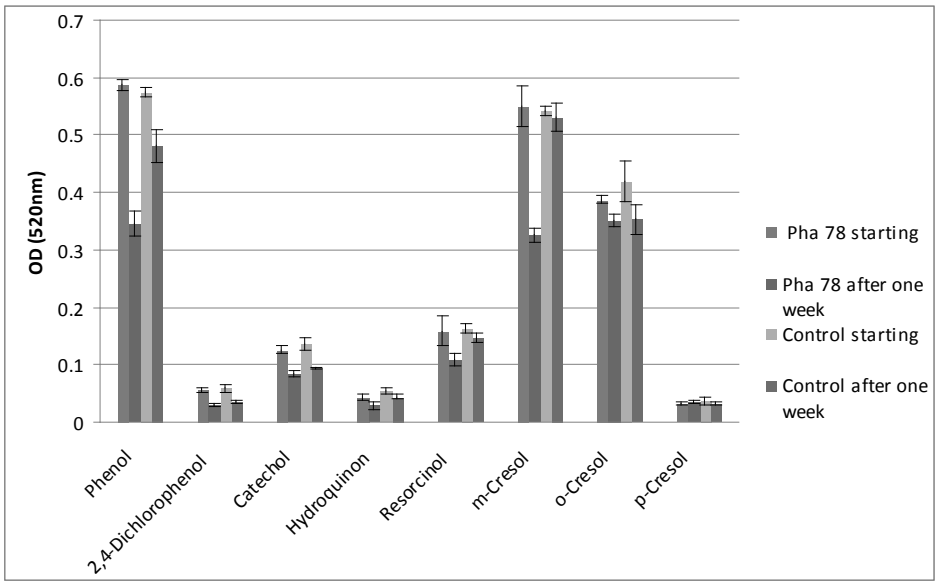


Figure 1. Degradation of distinct phenol derivatives by the *Phanerochaete chrysosporium* Pha78 strain in lignin peroxidase inductive medium

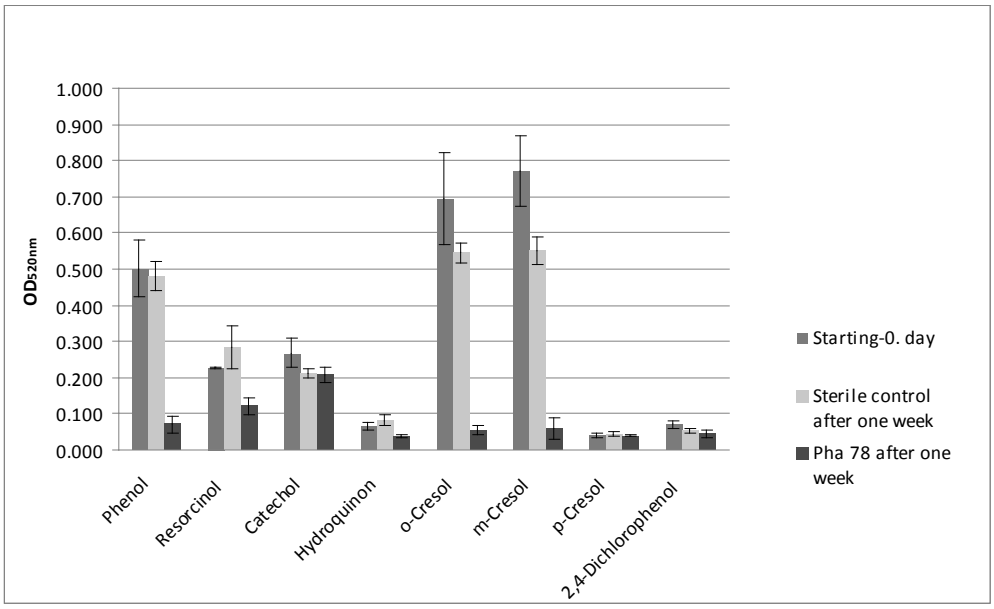


Figure 2. Degradation of distinct phenol derivatives by the *Phanerochaete crysosporium* Pha78 strain in manganese peroxidase inductive medium

CONCLUSIONS

The application of a new selective medium proved very useful to collect *P. chrysosporium* isolates from soil samples. The isolated *P. chrysosporium* strains efficiently degraded various xenobiotics in soil microcosm experiments. One of the isolated *P. chrysosporium* strains Pha78 was able for significant degradation activities even in sandy soil. This strain also degraded efficiently dangerous environment pollutant phenol derivatives.

ACKNOWLEDGEMENTS

This work was supported by the European Union through the Hungary-Serbia IPA Cross-border Co-operation Programme (PHANETRI, HUSRB/1002/214/068) and by the European Union co-funded by the European Social Fund (TÁMOP-4.2.2/B-10/1-2010-0012).

REFERENCES

CAMERON M.D., TIMOFEEVSKI S, AUST S.D., CAMERON, M.D., TIMOFEEVSKI, S., AUST, S.D. (2000): Enzymology of *Phanerochaete chrysosporium* with respect to the degradation of recalcitrant compounds and xenobiotics. Applied Microbiology and Biotechnology, Volume 54. pp. 751–758.

DANNIS M. (1951): Determination of phenols by the amino-antipyrine method. Sewage and Industrial Wastes, Volume 23, pp.1516-1522.

DIETRICH D.M., LAMAR, R.T. (1990): Selective medium for isolating *Phanerochaete chrysosporium* from soil. Applied and Environmental Microbiology, Volume 56. pp. 3088–3092.

JAGER, A.. CROAN C., KIRK, T.K. (1985): Production of ligninases and degradation of lignin in agitated submerged cultures of *Phanerochaete chrysosporium*. Applied and Environmental Microbiology 50, 1274–1278.

JOHNSON C. G., AUST S. D. (1994): Detection of *Phanerochaete chrysosporium* in soil by PCR and restriction enzyme analysis. Applied and Environmental Microbiology, Volume 60. pp. 2350–2354.

WHITE, T.J., BRUNS T., LEE S., TAYLER, J. (1990): Amplification and direct sequencing of fungal ribosomal RNA genes for phylogenetics. In PCR protocols: A guide to methods and applications, Innis M. A. – Gelfand D. H. – Sninsky J. J. – White T. J. (eds.) Academic Press, San Diego, California, pp. 315–322.

Review on Agriculture and Rural Development 2014. vol. 3 (1) ISSN 2063-4803

INFLUENCE OF THE TEXTURE ON THE EFFICIENCY OF THERMAL DESORPTION PROCESS OF SOILS CONTAMINATED WITH CRUDE OIL

DORINA POP, VALER MICLE

Technical University of Cluj – Napoca
Faculty of Materials and Environment Engineering
Bd. Muncii Nr. 103 – 105, Postcode 400641, Cluj –Napoca, Romania
dddorinaa@yahoo.com

ABSTRACT
The hereby paper presents the experimental research on the influence of three types of soil texture on the efficiency of decontamination performed using the technology of thermal desorption. The concentrations of crude oil of the soil samples, the initial ones as well as those following the depollution process were determined using the Soxhlet method. The decontamination process with thermal desorption on soil samples was performed using the electric oven with chamber, and with silicon carbide bars. Experimental researches were performed on the following types of soils: loamy sand, loam and loamy clay. The main parameters established for the process of thermal desorption were the temperature 350 °C and the amount of time for keeping the soil samples in the oven, of 5, 10 and 15 minutes. The results of the experiments indicated that the type of texture has influenced the efficiency of the thermal desorption, and the highest efficiency was obtained for the sample of loamy sand, treated for 15 minutes.

Keywords: crude oil, pollution, soil texture, technology, thermal desorption.

INTRODUCTION

The development of the oil industry, both the extractive one as well as the exploitation industry, including transport of crude oil and petroleum products is sometimes accompanied by accidental phenomena leading to environment contamination with crude oil, residues and petroleum products. The impact on ecosystems, due to pollution with crude oil residues and used waters exceeds the intensity of other anthropogenic actions (PÂRVAN, 2012).
Due to these phenomena, the implementation of certain remediation methodologies is absolutely necessary, considering that crude oil pollution affects even the capacity of soils to maintain life.
In the researches of ARARUNA, J.T. ET AL. (2004) experiments were performed in an ex situ small thermal desorption system. The system was used to evaluate two parameters: the temperature between 100 – 500 °C and the amount of exposure time, from two to eight hours. Tests were made for 50 g soil samples polluted with petroleum residues. The unit was set up inside a chamber with controlled temperature. Researches indicated that the highest efficiency of thermal desorption was obtained by exposing the samples to temperatures over 450 °C.
FALCIGLIA ET AL. (2011) have made research on the influence of temperature and soil texture in the kinetic elimination of contaminants using thermal desorption at low temperatures, for soil polluted with diesel. The experimental researches were performed on soil of five granulometric fractions: coarse sand (500 – 840 μm), medium sand (200 – 350 μm), fine sand (75 – 200 μm), silt (10 – 75 μm) and clay (> 4 μm), where they have been artificially contaminated with diesel and thermally treated using a machine inside the laboratory. The results have shown that the desorption efficiency was affected by the soil texture and that the temperature and the amount of time for treatment have been the key factors of the remediation process (FALCIGLIA ET AL. 2011).

After the treatment using thermal desorption, it is possible to reuse the soil, depending on the temperatures used and the concentration of contaminants (WOOD P., 2001).
The purpose of the hereby study is the lab research on the decontamination of various types of soil (loamy sand, loam and clay loam) polluted with crude oil, using the thermal desorption technology.

MATERIAL AND METHOD

In order to implement the experimental researches on the depollution of the three types of soil (loamy sand, loam and clay loam), contaminated with a quantity of 6,1 ml crude oil per 100 g of soil, we have prepared the scheme of the research plan, presented in *Figure 1*.

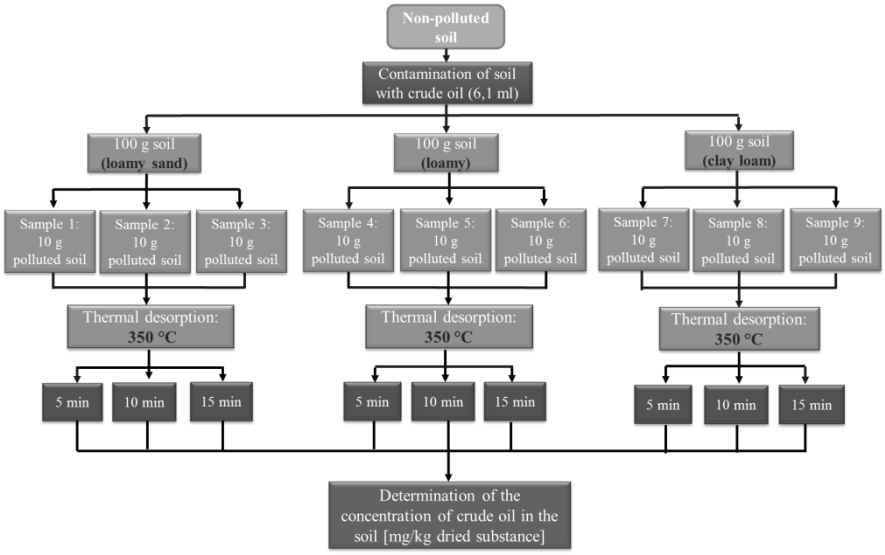


Figure 1. Scheme of the research plan

The soil samples were extracted in the area of Cluj County, Romania, at a depth of 0 – 20 cm according to STAS 7184/1-75 (state standards). The soil samples of loamy sand texture (P1) and loamy texture (P2) were extracted in the commune of Bonţida, and the third type of soil – clay loam (P3) in the Commune of Căianu.
The elaboration of experiments regarding the process of decontamination using thermal desorption was performed with the electric oven with chamber and silicon carbide bars, owned by the Technical University of Cluj – Napoca.

The main parameters established for thermal desorption were the temperature of 350 °C and three different treating amounts of time (5, 10 and 15 minutes), then we determined the quantity of crude oil in the soil in order to establish the efficiency of the decontamination. The content of crude oil from the soil samples, both the initial and the one remaining after decontamination, were determined according to STAS SR 13511/2007 (state standards) using the Soxhlet method (*Figure 2*).

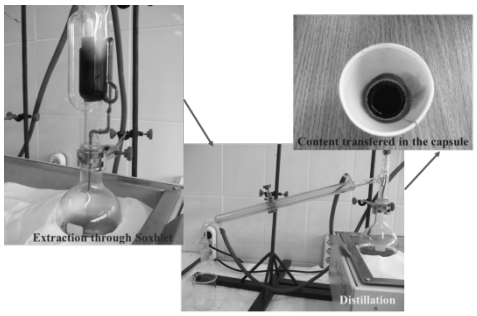


Figure 2. Extraction of crude oil using the

Soxhlet method The concentrations of crude oil in the samples tested in the lab were related to the values of the alert threshold and intervention threshold established by ORDER NO. 756 of 11/03/1997, (*Table 1*).

Table 1. Reference values for the total amount of hydrocarbons in the petroleum (mg/kg dried substance)

Traces of elements – Hydrocarbons in petroleum	Normal values	Alert threshold / Types of uses		Intervention threshold / Types of uses	
		sensible	less sensible	sensible	less sensible
Total Hydrocarbons in petroleum	< 100	200	**1000**	500	**2000**

RESULTS

The results obtained after having determined the initial content of crude oil in the control samples are shown in *Figure 3*.
By analyzing these results, it can be observed that the standardized values as per ORDER NO. 756 of 11/03/1997 are highly exceeded.

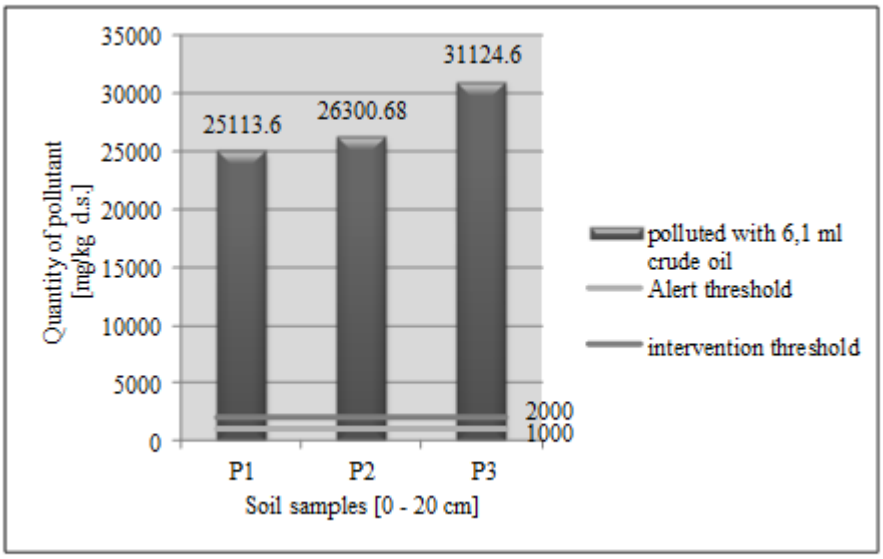


Figure 3. Initial content of crude oil in the soil samples

Variation of the quantity of crude oil in the soil following the thermal desorption

Following the experimental researches on the process of decontamination using thermal desorption, it can be observed that the amount of crude oil contained in the soil is under the alert threshold only for samples P1 treated for 10 and 15 minutes and for sample P2 exposed for 15 minutes at a temperature of 350 °C (*Figure 4*). In addition, it can be observed that the amount of pollutant after the treatment, for all soil types, decreased while the amount of time for exposure in the oven increases, and the highest value is obtained for the samples with clay loam texture.

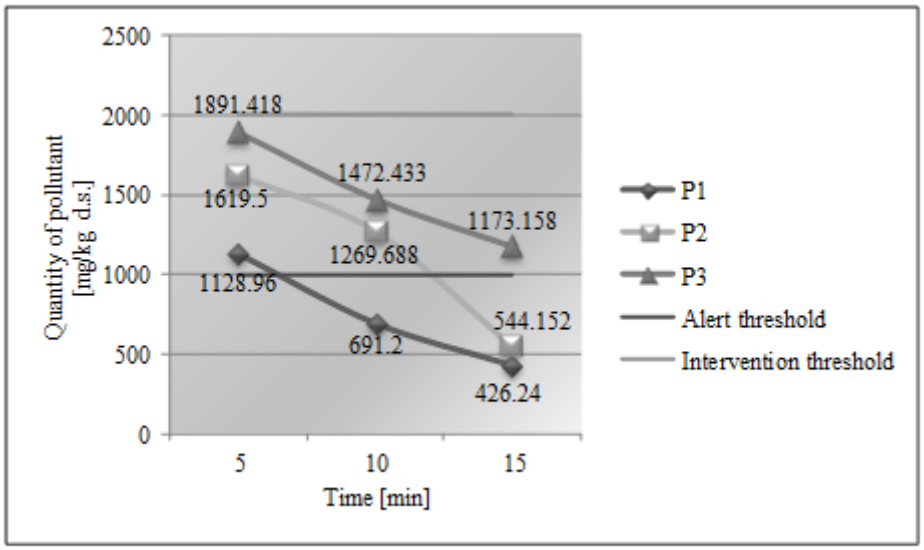


Figure 4. Variation of the quantity of crude oil in the soil samples after the thermal desorption at a temperature of 350 °C

Variation of the quantity of crude oil eliminated through thermal desorption

Looking at the variation of crude oil eliminated through thermal desorption (*Figure 5*), it can be observed that the value is increasing as the time for exposing the samples in the oven increases. The highest level of pollutant is for sample P3.

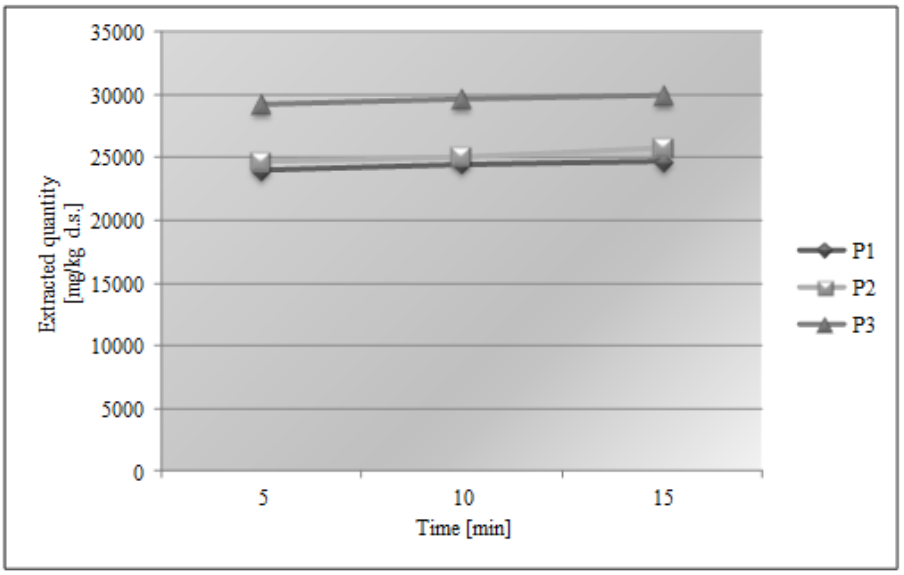


Figure 5. Variation of the quantity of crude oil eliminated through the thermal desorption technology

Efficiency of thermal desorption at 350 °C

The final step in the experimental researches was to calculate the efficiency of the desorption process of the crude oil from the soil, for the three types of soil, depending on the main parameters of the decontamination process. The values of the thermal desorption efficiency ranged between 93,84 – 98,30 % (*Figure 6*).

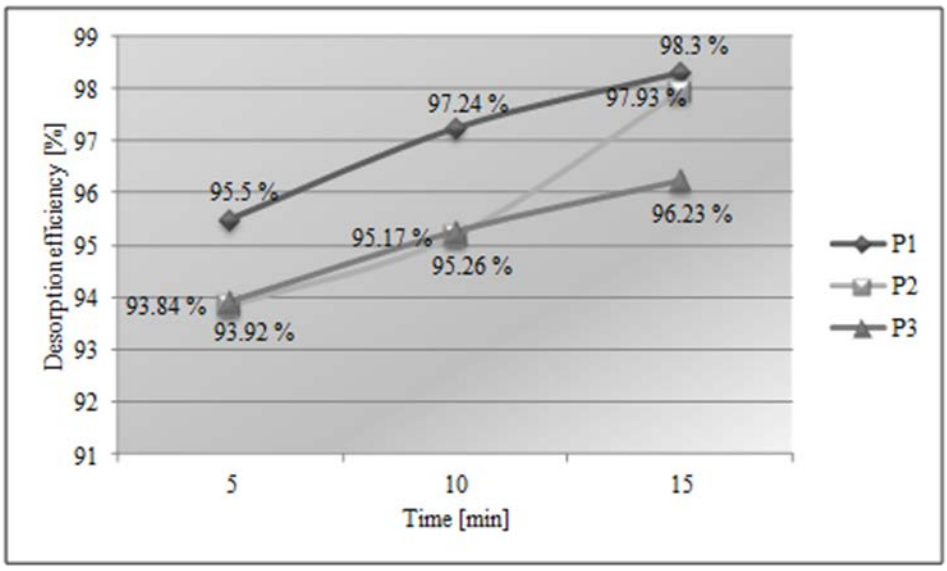


Figure 6. Variation of the efficiency values depending on the soil texture and the amount of time for exposure of samples in the oven, at 350 °C

By comparing the results obtained, it can be observed that the highest efficiency was reached for sample P1 (loamy sand texture) for an amount of exposure time of 15 minutes in the oven, while the lowest efficiency was obtained for sample P2 (loamy texture) for treated for 5 minutes.

CONCLUSIONS

After determining the pollutant concentration in the control samples, it can be observed that the alert threshold and the intervention threshold as per the standardized norms, are highly exceeded.

The results of the experiments performed indicate that the temperature, the exposure time in the thermal desorption unit and the soil texture are the main parameters influencing the process of eliminating pollutants through thermal desorption.

Efficiencies obtained during the experiments range between 93,84 – 98,30 %. By analyzing the efficiencies depending on the soil texture, it results that the highest efficiency of thermal desorption was obtained for the loamy sand for an exposure period of 15 minutes, and the lowest value was obtained for the loamy texture, for the soil treated for 5 minutes.

REFERENCES

ARARUNA, J.T., Jr., PORTES, V.L.O., SOARES, A.P.L., SILVA, M.G., STHEL, M.S., SCHRAMM, D.U., TIBANA, S., VARGAS, H., (2004): Oil spills debris clean up by thermal desorption, Journal of Hazardous Materials Volume110. pp. 161–171.

FALCIGLIA, P.P., GIUSTRA, M.G., VAGLIASINDI, F.G.A., (2011): Low-temperature thermal desorption of diesel polluted soil: Influence of temperature and soil texture on contaminant removal kinetics, Italy, Journal of Hazardous Materials Volume185. pp. 392–400.

ORDER no. 756 of 11/03/1997 approval of the Regulation on the evaluation of environment pollution, Official Gazette no. 303 of 11/06/1997.

PÂRVAN E. L, (2012): Doctoral thesis – Methods of bio-remediation of soils polluted with petroleum products, University of Agronomy and Veterinary Medicine of Bucharest, http://www.usamv.ro/fisiere/file/documentedeinvatamant/Parvan%20Lavinia/ REZUMAT %20romana.pdf

STAS 7184/1-75: (state standards) on extracting soil samples for pedological and agro-chemical studies.

SR 13511, (2007): Soil quality. Determining the total amount of hydrocarbons in the soil. The gravimetric method.

WOOD P., (2001): Remediation Methods for Contaminated Sites, Issues in Environmental Science and Technology, Number 16. Assessment and Reclamation of Contaminated Land, The Royal Society of Chemistry.

Review on Agriculture and Rural Development 2014. vol. 3 (1) ISSN 2063-4803

DILEMMAS OF AGRO-ENVIRONMENTAL MANAGEMENT FOR THE 2014-2020 PROGRAMMING PERIOD

EDIT HOYK[1], JENŐ ZSOLT FARKAS [2]

[1]College of Kecskemét, Faculty of Horticulture, 6000, Kecskemét, Erdei F. sq.1-3., Hungary
[2] Institute for Regional Studies of CERS HAS, 6000, Kecskemét, Rákóczi road 3., Hungary
hoyk.edit@kfk.kefo.hu

ABSTRACT
The environmental impact of agriculture is in the focus of public and scientific interest since the 1980's. After the economic transition, because of market loss and other reasons, Hungary was characterised by reduced negative environmental effects of agriculture. However, an OECD analysis prognosticated an again growing environmental impact of agriculture in Hungary. The connections between environment and agriculture form an important part of Hungarian Rural Development Programme for the 2014-2020 programming period. The aim of this paper is to provide an analysis of the selected indices of the Hungarian agricultural sector to decide whether to prognosis of the OECD was correct.
In accordance with these results, the authors also examine to what degree the Rural Development Program in preparation can contribute to the goals of agro-environmental management, sustainable agriculture and environment protection.

KEYWORDS: climate change, agriculture, agro-environmental programs, rural development

INTRODUCTION

Environmental policy is one of the EU's horizontal policies and has to be implemented in all sectoral policies of the Member States to ensure that environmental aspects are taken into account in every sector of the economy. This particularly applies to agriculture for which unpolluted environment, clean soils, water and air are essential. This is why the environmental impact of agricultural production during the post-productivist transition is in the focus of both public and scientific interest.
The study gives an overview of the environmental impact of the Hungarian agriculture and the related challenges of climate change. These topics form an important part of both the strategic documents of the EU for the programming period 2014-2020 and the related forthcoming Hungarian Rural Development Programme 2014-2020, which also underlines the relevance of this paper.
Besides the actuality of these problems, the authors' topic choice was also heavily influenced by an OECD analysis form 2008, which prognosticated the recurrent increase of the environmental impact of the Hungarian agriculture. According to the OECD analysis, the improving financial situation of the producers, the increasing farm concentration and the growing significance of the agricultural subsidies of the EU will be the main factors behind the anticipated environmental impact growth (OECD, 2008). This prognosis comes as no surprise, considering that after the economic transition, Hungary was characterised by reduced agricultural intensity due to the market problems and changes in land ownership and farm structure. A significant drop in the use of inorganic fertilizers and pesticides affected the environment positively, but some of the consequences like the reduction of yields and soil fertility were unfavourable for the producers and the agricultural sector.

The study mainly focuses on whether the Hungarian agricultural subsidies introduced in 1998 and the EU subsidies available from 2004 induced notable changes in the environmental impact of agriculture and to what degree have the agro-environmental measures implemented since 2003 been able to neutralize it.
The authors' hypothesis is that the agro-environmental subsidies fulfil their role only partially and induce similar processes to those took place in Western Europe in the 1990s. In order to maximise their subsidies, the farmers participate in the agro-environmental programmes, but with a smaller area than it was expected, while they intensify the production in the remainder of their lands (BOWLER-ILBERY, 1998). This process magnifies the negative impact on the environment and undermines the efficiency of the measures to mitigate the effects of climate change.

MATERIAL AND METHOD

The original sources of the agro-environmental and farm structure data used for the analysis are the Farm Structure Survey of 2003 and 2013, the Agro-environmental Report 2000-2010 and the Statistical Yearbook of Agriculture, 2012; collected and published by the Hungarian Central Statistical Office. Because of the limitations of this article, the authors deliberately focused on only a few of the available indices. The authors' opinion is that these chosen indices are the best to illustrate the changes in the environmental impact of agriculture.
Another important source document of the analysis was the draft version for public consultation of the Hungarian Rural Development Programme. This document will provide the framework for managing the funds of the next programming period. The fourth (restoring, preserving and enhancing ecosystems dependent on agriculture and forestry) and the fifth (promoting resource efficiency and supporting the shift towards a low-carbon and climate-resilient economy in the agriculture, food and forestry sectors) priorities are concerning with the relations between agriculture and environment-protection.

RESULTS

At first, the authors examined the factors identified by the OECD (farm concentration and growing income) and their environmental impact.
In Hungary, land concentration is, without doubt, an ongoing process, although its rate varies according to the different official statistics. In 2000, there were more than 966 thousand agricultural holdings in Hungary, while the Farm Structure Survey of 2013 only found 493 thousand farms, which indicates rapid concentration. The average size of the private farms increased from 2.51 hectares to 5.4 hectares between 2000 and 2013, thus confirming the land concentration. However, the average size of the agricultural enterprises decreased from 553.49 hectares to 308 hectares in the same period. The shrinkage can be explained by the growing number of agricultural enterprises (KSH, 2004; KSH, 2014).
The land concentration is more evidently visible in the area payment data. According to the available data for Bács-Kiskun County, the average size of subsidised land per claimer grew from 13.7 hectares to 18.21 hectares between 2003 and 2006. This suggests that the reinstatement of agricultural subsidies in 1998 and later the introduction of the European subvention system to Hungary led to a significant decrease of self-sustaining social farms and an increase of market-oriented agricultural holdings. More farmers aim cost-

effectiveness (e.g. optimal farm size) to maximise profit and tend to intensify their production. This process is indicated by the increased use of pesticides *(Fig. 1.)*

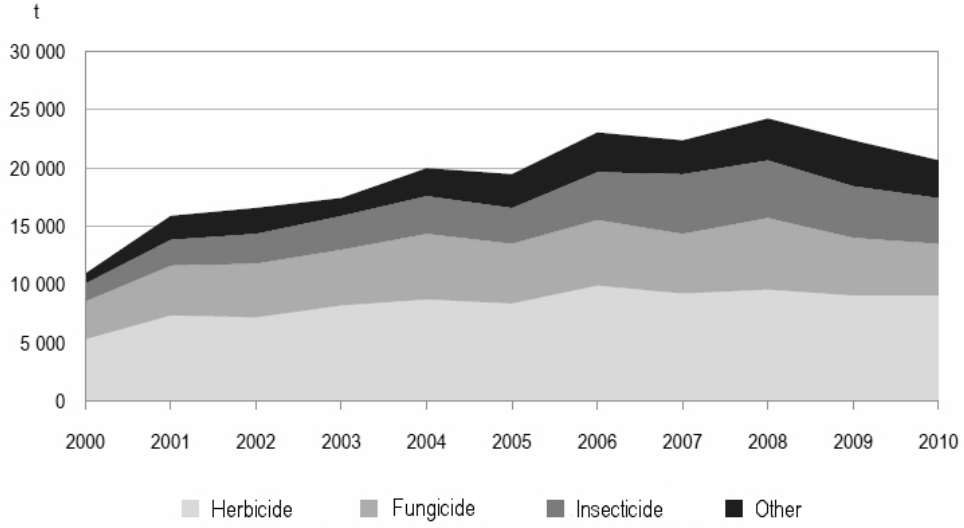


Figure 1. The amount of sold pesticides 2000-2010
(Source: Research Institute of Agriculural Economics, KSH, 2012)

While the increase in the use of inorganic fertilisers was less apparent, Hungary was characterised by a rapid growth in the use of pesticides in the period of 2000-2007. Only years with unfavourable weather condition did not follow this trend. After 2008 the pesticide usage was dropped in relation to the economic crisis. Data from 2012 suggests that the agricultural sector is getting over the crisis and the inorganic fertiliser and pesticide use have been slowly increasing again in the last three years (KSH, 2012; KSH, 2013).
One of the possible indicators of the negative environmental effects of the aforementioned processes is the population change of birds living in agricultural habitats. Between 1999 and 2012, the population of these species decreased by more the 30 percent, with a more rapid decline after 2009-2010 (KSH, 2013). This implies amplified disturbance and the shrinkage of favourable habitats. The increase in land area included in the High Nature Value Areas programme (HNVA) is definitely a success; however it cannot balance out the overall negative effects of the agro-environmental measures. Similar tendencies can be observed in relation to the environment-friendly organic and ecological farming; with stagnation in both the number of the participants, and the included land area in the last 7 years (KSH, 2013). This clearly indicates that farmers seek to achieve market competitiveness through intensive large-scale agricultural production, and the programmes created to counterbalance it are not appealing enough because of different economic and bureaucratic reasons. The authors' opinion is that these processes are similar to those took place in Western Europe in the 1990s, at the launch of agro-environmental programmes.
Another environmental problem area, the connection between climate change and agriculture, is also emphasised in the strategic documents of the European Union. These documents focus on turning the agricultural sector more climate-resilient, reducing greenhouse gas emission, increasing the energy efficiency in agriculture and promoting renewable energy sources. In the period of 2007-2011, the greenhouse gas emission of the Hungarian agricultural sector slightly reduced at first then stagnated, while its ammonia emission steadily declined (KSH, 2013). The energy consumption of the agricultural sector also reduced by 20 percent from 2007 to 2010, but the overall energy costs remained the same because of the rising energy prices (KSH, 2013). This reduce is due to the

replacement of agricultural machinery with more effective ones, while the agricultural buildings are outdated and not energy-efficient.

It is important to note that the drop in energy consumption did not followed by a similar reduce in the emission of greenhouse gases. This shows that climate change measures cannot be limited to the continuous decrease of fossil energy sources; possibilities for substitution, promotion of renewable energy sources should also be emphasised in order to reach the global and national climate change goals.

The fifth priority of the Rural Development Programme is an important step towards a more climate-resilient economy. Because of the aforementioned economical and other reasons the significance of high-intensity agriculture will not decrease in the close future, which makes the measures to mitigate the effects of climate change less effective. It is necessary to concentrate on technologies, agricultural production methods and energy sources which could contribute to reach the goals set up by the European Union for 2020.

The Programme identifies it as a weakness that the water management does not pay enough attention to water conservation. The acceptable state of the irrigation system would be essential for good water management, but it currently does not meet the requirements. With the water as a natural resource getting more valuable, the poor conditions could easily became hindering factor when the adaptation to aridification will require the use of the latest water-efficient irrigation technologies. The area of irrigable land permitted by the Hungarian water law, around 200 000 hectares, did not change significantly in the period of 2007-2012 (KSH 2013). However, the amount of irrigated water – in close connection with the weather conditions – slightly increased. Because of the limitations of further growth, the notions of the Rural Development Programme about water management and water conservation should be emphasised.

Proper soil management and other agricultural methods with a focus on water conservation form an important part of water-efficient methods, but do not get enough emphasis in the Rural Development Programme. *Figure 2.*, displaying the share of different types of winter soil cover, proves the relevance of the problem. More than half of the agricultural land do not have any kind of cover during the winter, which increases evaporation loss and aggravate the water condition of the soils. It would be expedient to provide funds for changing these methods through trainings and awareness-raising campaigns.

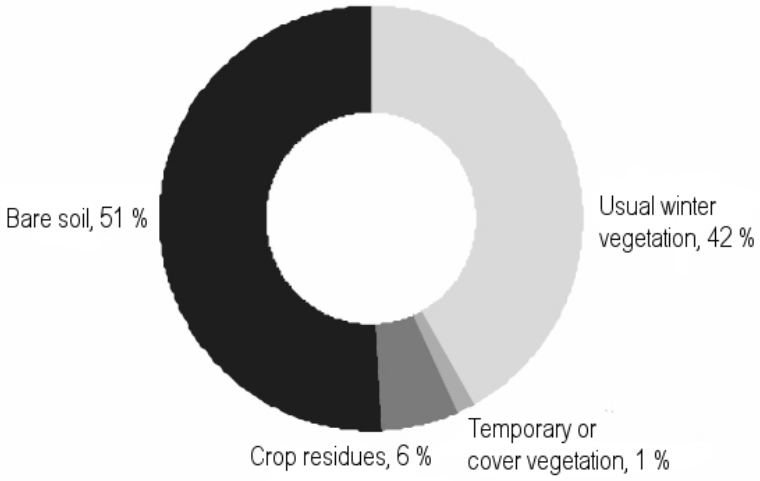


Figure 2. The share of different types of winter soil cover
(Source: KSH, 2012)

Amongst the measures to mitigate the effects of climate change, the promotion of renewable energy sources – not only in the agricultural sector – gets special attention. Hungary's most abundant renewable energy source is biomass, which is closely linked to agriculture and forestry. However, it has to be mentioned that energy production from biomass has an ambiguous reputation, thus differentiation between the biomass produced solely for energy production and the biomass composed of by-products and organic waste of agriculture and forestry would be preferable. Only the latter should be considered as a truly renewable energy source, and the distribution of subsidies should be modified accordingly.

The extensive use of biomass for energy production, especially the increased use of wood (and its planned support), does not constitute as an effective measure against climate change. The growing share of firewood from the energy sources indicates the possibility that the subsidies for energy production from biomass may divert sources from the spread of truly renewable energy production, thus not contribute to achieve the original goals.

DISCUSSION AND CONCLUSIONS

The analysis of the selected indices and processes in relation to the environmental impact of the Hungarian agriculture partially confirmed the OECD prognosis from 2008 about the growing negative environmental effects of the Hungarian agricultural sector. After the crisis of the early and middle 1990's, the intensity of Hungarian agricultural production started to increase again. This process influenced by numerous economic, social and regulatory factors. For the moment, these factors play a more important role in making rational production decisions than agro-environmental aspects. Hence the effects of the agro-environmental programmes lagged behind the original expectations, and characterized by constant reduce in both the number of participants and the included land area.

The authors' opinion is that the 2014-2020 programming period will have a crucial role in finding the balance between the market-oriented intensive farming and the ecological, economic and social functions of the Hungarian landscape. Because of the complexity of the agro-environmental system, finding the adequate measures won't be easy. One of the most important tasks is the renewal of the agro-environmental programmes in order to make them more attractive to the farmers and become a real alternative in the production decisions. Secondly, the promotion of intensive production methods and innovations (e. g. precision agriculture) which can reduce the environmental impact even in large-scale farms with intensive agriculture would also be preferable.

Regarding to climate change and renewable resources, multiple problems can be distinguished in Hungary. The most important is the problem of biomass, which should not be handled as one like the solar and wind energy. Biomass has many sources, including agricultural products, which take away land from food and fodder production. Moreover, this production technology is not sustainable in the long term (e. g. because its production requires fossil fuel). Priority should be given to biomass composed of by-products and organic waste of agriculture and forestry.

Moreover, using adequate production technologies and choosing plant species with a greater tolerate for aridity and extreme weather are the keys for climate change adaptation. With the most modern irrigation technologies, irrigation can be effective even with scarcer water sources.

In addition to this, we must not forget about people connected to agriculture and rural development. Even the most innovative methods and technologies are ineffective without people capable to use their potential.

REFERENCES

BOWLER, I.R., ILBERY, B. W. (1998): From agricultural productivism to post-productivism. In: B. W. Ilbery (ed.): The Geography of RuralChange. Longman, Harlow, pp. 57-84.
OECD (2008): Az OECD mezőgazdaságának környezetvédelmi hatásai 1990 után: Magyarország. http://www.oecd.org/dataoecd/10/36/40801754.pdf
KSH (2004): Magyarország mezőgazdasága, 2003 (Gazdaságszerkezeti összeírás – előzetes adatok). http://www.ksh.hu/docs/hun/xftp/idoszaki/gszo/gszo03.pdf
KSH (2012): Agrárkörnyezeti adatok, 2000-2010.
http://www.ksh.hu/pls/ksh/docs/hun/xftp/idoszaki/pdf/agrarkornyezet2010.pdf
KSH (2013): Mezőgazdasági statisztikai évkönyv 2012
KSH (2014): Magyarország mezőgazdaság, 2013 (Gazdaságszerkezeti összeírás – előzetes adatok). http://www.ksh.hu/docs/hun/xftp/idoszaki/gszo/gszo_elozetes_2013.pdf
VIDÉKFEJLESZTÉSI PROGRAM 2014-2020 (a társadalmi egyeztetésre került 3. verzió),http://palyazat.gov.hu/download/49630/Vid%C3%A9kfejleszt%C3%A9si%20Program.pdf

Review on Agriculture and Rural Development 2014. vol. 3 (1) ISSN 2063-4803

THOUGHTS ON THE RUSSIAN DEMON

EDIT ILONA MÁRI

University of Szeged, Faculty of Agriculture,
Institute of Economy and Rural Development
6800 Hódmezővásárhely, Andrássy út 15., Hungary
mari@mgk.u-szeged.hu

ABSTRACT
The representation of the Demon is not exclusively connected to the Russian literature, art or way of thinking. Moreover, it is not just the specificity of the European Christian culture and religion. In my presentation my aim is to introduce how demon is represented in some examples of the Russian literature.
We can find plenteous adaptations of this subject within the religious-theological literature or in the history of the philosophical thinking. This topic can also be found in the holy books of other religions and cultures. Therefore, it takes an outstanding place in the teachings and contemplations of other different cultures. Such folkloric demonology, which was relying on biblical-religious sources, was not typical of the medieval art and literature but its origins were found in pre-Christian eras as well.
In the 19th century Russian poetry the representation of the tragic experience of the encounter with the Demon first appeared in Pushkin's poems. In the Russian literature after Pushkin, we can find numerous instances for the representation of Demon (Devil, Satan etc.): "Devils" by Dostoevsky, the devil hallucination of Ivan Karamazov in his work of "Karamazov brothers"; Fyodor Sologub's short story "The Petty Demon" "The Little Demon"; Vasily Shukshin's narrative "Until the Cock Crows Thrice"; Woland, the representation of the Satan in "Master and Margaret" by Bulgakov.

Keywords: Russian literature, Goethe, Faust, Demon, Bulgakov

INTRODUCTION

First of all, I would like to note, that the representation of the Demon and treating with the Demon and its' "synonyms", -such as the Satan, the Devil, the Antichrist- is not exclusively connected to the Russian literature, art or way of thinking. Moreover, it is not just the specificity of the European Christian culture and religion. In my presentation my aim is to introduce how demon is represented in some examples of the Russian literature. Dealing with this subject does not exclude but rather presupposes the connections with the universal European thinking and art.
It is obvious, that owing to the biblical origin of the Demon, Satan, Devil, we can find plenteous adaptations of this subject within the religious-theological literature or in the history of the philosophical thinking. I would like to emphasize that this topic can also be found in the holy books of other religions and cultures. Therefore, it takes an outstanding place in the teachings and contemplations of other different cultures.
It is also noted, that such folkloric demonology, which was relying on biblical-religious sources, was not typical of the medieval art and literature but its origins were found in pre-Christian eras as well.

THE RUSSIAN DEMON

In the 19th centurial Russian poetry the representation of the tragic experience of the encounter with the Demon, was first appeared in Pushkin's poems like "Demon" written in 1823. Pushkin himself connected this poem, in one of his short comments written in 1823,

to the figure of Mephisto of Goethe's Faust. As it is known, the hero of Goethe's dramatic poem, in his debate with the Lord in the Prologue in Heaven, is not willing to acknowledge the creation of the Lord referring to men's suffers.

The hero of Pushkin's lyrical poem experiences the romantic disillusionment, the Byronic world-pain, by meeting with the spirit of doubt and denial. But typically this negative experience will never become dominant or irresolvable in Pushkin's biography. Pushkin represents the phenomenon of disillusionment in his other works written in different genres. These are the following poems entitled "Angel" (1827) and "At the beginning of my life I remember a school" (1830).

Pushkin's contemporary Gogol in his novels gives a sometimes comic representation of the caricature of the world that becomes demonic.

Another contemporary and follower of Pushkin is Lermontov whose life-work is determined by the Demon-experience. It is well-characterizing that during his 27 years of his life he wrote eight variants of his poem "Demon". But most of his poems, dramas and prose are profound, diverse and powerful compositions of this experience. Plenty of Lermontov's lyrical poems were set to music by his contemporary-, and other later composers. Based on Lermontov's narrative poem entitled "Demon" Vrubel painted a series of pictures, and it also had a significant effect on Rubinstein's music as well.

Figure 1. Tamara and Demon by Mikhail Vrubel

While in the narratives of Gogol the lack of spirit is dominated, that is the overmastered world of the Devil is the comical source of the tragic laughter. In contrast, the lyrical poems, and perhaps the entire oeuvre of Lermontov are based on Goethe's Mephisto's denial and the rejection of the world comparable to skepticism and denial.

However, as it can be read in his poem written at the age of 15 "My Demon" (1829), Lermontov's Demon is always different. Though, it essentially differs from Mephisto or from Pushkin's hero in the sense that not just the immanent, empirical world is unacceptable, but he collects all of its disappointingly disgusting facts. His lyrical hero experiences that he will never be released from his Demon and from himself, he will never find relief and therefore he will be condemned to an irresolvable solitude to such an extreme level, that he connects the realia of the empirical, immanent world with the demonic transcendent world; with the completeness of its spiritual experience, a beautiful, brilliant and seductive world; a world that can never be achieved.

Lermontov's Demon does not make any compromise: it does not replace the unachievable

but clearly sparkling ideals with the livable world. Life means completeness, the truth; therefore, his heroes are not capable and not willing to live in the real world. Their souls are disrupted by the extreme metaphysical ambiguity of the desire for life (Demon, Pecrorin) and of the unachievable, perfect idealistic world.

In the Russian literature after Pushkin, we can find numerous instances for the representation of Demon (Devil, Satan etc.). Such works are as follows: a novel entitled "Devils" by Dostoevsky, the devil hallucination of Ivan Karamazov in his work of "Karamazov brothers"; Fyodor Sologub's short story "The Petty Demon" " The Little Demon"; Vasily Shukshin's narrative "Until the Cock Crows Thrice"; Woland, the representation of the Satan in "Master and Margareta" by Bulgakov.

Figure 2. The Master and Margareta (Illustration)

The 20th centurial Hungarian philosopher Bela Hamvas writes in his study entitled "Henoch" about the previously mentioned unachievable ideal and the metaphysical ambiguity of the transcendent and immanent being. He writes about the "irreversibly lost Paradise", "high existence", " the salvation", " the Paradise and the kingdom of God", "the beginning and the end", "the Fall", "the expulsion", "rebellious angels" and of the Antichrist. He contrasts the personal existence with the impersonal, where personal means the real "godlike existence", and impersonal equals with sin, the unreal, the inexistent, the "destruction". Previously he writes about the Antichrist – which I consider as the equivalent to the Demon-, as the "impersonal", the "non-existent, not human, the nothing, the in vain, …the empty, the nothing that can be experienced when you face with the damned and silly pressure, the impersonal violence, or with the fact where there is no man behind just the impersonal itself." Sin is impersonal, but the personalization of the impersonal, that is the not-being of the existent, the commanded human action: the commanded murder of another person.

Before turning to Tolstoy's representation of the hegemony of the Antichrist, and its impersonality, I find it necessary to discuss another philosopher of the 20th century. The French Simone Weil (1909-1943) who immigrated to London from the Nazi occupation and because of her compassion for his compatriots she died of voluntary starvation. Her main works were written during her exile in London, of which I refer to the following work: "The Personal and the Sacred" (its French title is *Le Personne et le Sacré*). Simone Weil unlike Bela Hamvas neither deals with the contrast of the personal and impersonal, nor with the opposition of the person and the individual (as Nikolay Berdyaev a Russian philosopher of religion, lived in exile in Paris). But like the previously mentioned philosophers, she discusses the fundamental questions of human existence, the renewal of

the human spirit and the possibility of spiritual rebirth and sanctification. As a Jewish female writer she has had a remarkable impact on the universal Christian thinking. The main idea of her study on the personal and the sacred is about the opposition of the natural and supernatural, in other words of the immanence and the transcendence. “Something that is essential for goodness is impossible in a natural way, but it is always possible in a supernatural way (…). The supernaturally good is not just some completion of the naturally good (…). Each important question of human existence is solely a choice between the supernatural and the bad.” She classifies democracy, law and person to the immanent fair valued world, “from which nothing good can come from, but it can inevitably causes a lot of trouble” for the people, as Simone Weil notes “for the unfortunates”. “Solely the light, that constantly falls down from the sky can give rain to the trees (…). Only those things that come from Heaven can leave a real mark on the ground.”

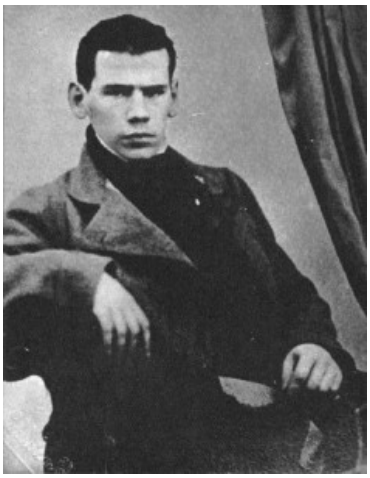
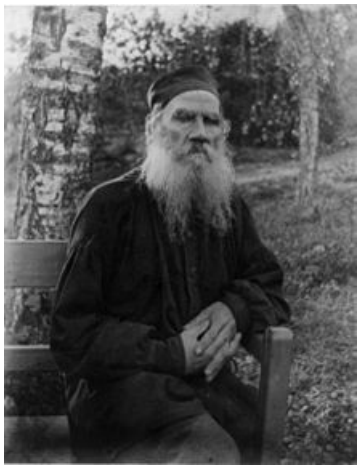



Figure 3. Lev Nikolayevich Tolstoy

In the novel of Tolstoy’s “War and Peace” in volume four, part one, chapter eleven, we can read about executions carried out by French soldiers because of some presupposed fire-raisings. In the narration – according to Tolstoy’s well-known psychological representation – the internal, mental processes are illustrated by the description of external visible features of the characters. Pierre Bezukov, the hero who observes the happenings as a spectator while he is waiting for his own execution, refers to the impersonal, the Antichrist, the nonsense state in the same way as the above mentioned Bela Hamvas. On the soldiers’ faces, who carry out the commanded executions, inconceivability and the horror of impersonality are reflected: “He swayed like a young soldier, his face deadly pale, his shako pushed back, and his musket resting on the ground, still stood near the pit at the spot from which he had fired. He swayed like a drunken man, taking some steps forward and back to save himself from falling.”

Pierre’s shaken sense of ontological certainty is restored again later, still in captivity, after a strange dream, when he identifies the love of live with God’s love: “From the moment Pierre had witnessed those terrible murders committed by men who did not wish to commit them, it was as if the mainspring of his life, on which everything depended and which made everything appear alive, had suddenly been wrenched out and everything had collapsed into a heap of meaningless rubbish. (…) his faith in the right ordering of the universe, in humanity, in his own soul, and in God, had been destroyed.”

It is possible that Pierre’s dream with his experience of God and of human sense can serve as an answer for the agonizing search for God by Bela Hamvas and by Simone Weil. Pierre

continues his dream and sees a moving, continually transforming ball that consists of drops. “This is life.”- said his humble Swiss teacher in his dream. This thought continues in his dream: “Life is everything. Life is God. (…) To love life is to love God. Harder and more blessed than all else is to love this life in one’s sufferings, in innocent sufferings.” (…) “That is life,” said the old teacher. (…) “God is in the midst, and each drop tries to expand so as to reflect Him to the greatest extent. And it grows, merges, disappears from the surface, sinks to the depths, and again emerges“.
In Pierre’s restored experience of human sense life (the immanence, the projection of the natural) gets its meaning as it is a changing eternity pervaded by the transcendence, the experience of God.

CONCLUSIONS

In this analysis, I have examined how demonism, which can be found in many cultures and mythology all around the world, is represented in some works of the German and Russian literature. Besides the above mentioned connections, we can also demonstrate further relationships between the two cultures and their literature. Namely, the well-known German philosopher of the early 20th century, Oswald Spengler in his work “The Decline of the West” mentions four Russian philosophers including Berdyaev and Frank, which is why the Bolshevik dictatorship sent them along with other 12 persons to exile in 1922. Spengler wrote his work “The Decline of the West” because of his disappointment and shock caused by World War I. The work has a rather pessimistic tone in which he focuses on the decline of the Christian culture. He finds that the only possible way of saving humanity is by the Russian culture, and by Russia itself. Furthermore, the “dialogue” between two other authors, Thomas Mann and Merezhkovsky, a Russian philosopher of the early 20th century, should also be studied. In Thomas Mann’s study of Tolstoy’s novel “Anna Karenina” he writes about the justification of Levin, the Russian author experiences faith as something that transcends and overwrites the civilization. Analyzing the final part of Goethe’s Faust Merezhkovsky contrasts the Levin-like human sense experience with its rejection of civilization and rationalism with Faust’s western idea of “Whosoever unceasingly strives upward... him can we save”. Taking into consideration today’s constant challenges, I believe that not only Europe, but also our accelerated world needs all the well-thought and suffered verities of the great European ancestors regarding the perspectives of the creative human activity.

REFERENCES

HAMVAS, B. (1987): Henoch. In: Silentium. Titkos jegyzőkönyv. Unicornis. Vigilia, Budapest. Henoch: pp 24-25.
HAMVAS, B. (1987): Henoch. In: Silentium. Titkos jegyzőkönyv. Unicornis. Vigilia, Budapest. Henoch: p.14.
WEIL, S. (1983): Ami személyes, és ami szent. Vigilia, Budapest.
WEIL, S. (1983): Ami személyes, és ami szent. Vigilia, Budapest. p. 87.
TOLSZTOJ, L.: Háború és Béke
UNKNOWN AUTHOR, wrnpc11.txt (Tolstoy quotations in English)
Figure 1 source: http://www.wikipaintings.org/en/mikhail-vrubel/tamara-and-demon-1891
Figure 2 source: http://azothgallery.com/yorksq/marina_korenfeld.html
Figure 3 source: http://www.albertsuckow.com/simplest-thing-made-clear/leo-tolstoy/

Review on Agriculture and Rural Development 2014. vol. 3 (1) ISSN 2063-4803

RELATIONSHIP BETWEEN THE BODY CONDITION AND THE MAIN JUDGEMENT CHARACTERISTICS OF HOLSTEIN-FRIESIAN COWS

EDIT MIKÓ, ÁKOS SZABÓ, MYRTILL GRÁFF

University of Szeged, Faculty of Agriculture
H-6800 Hódmezővásárhely, Andrássy u. 15., Hungary
mikone@mgk.u-szeged.hu

ABSTRACT
The objectives of this study were to estimate correlation between body condition score (BCS) and 5 main conformation parameters in Holstein cattle. The dataset consisted of 861 first-, 964 second-, and 634 third lactation cows. During the analysis of final class the details of the cows were grouped according to the BCS at classification (2-3 point, 4 point, 5 point, 6-8 point). The results of these groups were compared to the results within the number of lactations. The correlation examinations were also analysed within the lactation groups. The data were analyzed by the method of variance. The relationship between variables was examined with correlation analysis tests (Pearson's correlation coefficient).
The values of the body score changed between 77.58 and 84.23., correlation ranged from 0.06 (third lactation) to 0.20 (first lactation). The correlation analysis confirmed a positive, medium tightness in the relationship between the body condition and the legs, (between r=0.19 and r=0.31) within the lactation groups. When investigating the relationship between the body condition and the dairy strength. We found a negative correlation between these two characteristics. The correlation analysis confirmed only a loose correlation (r=0.03 and r=0.13 between the udder score and the body condition. When examining the final class it was again the scores of the cows with the weakest condition that were the lowest.
These results show that classification should be made later, probably in the 5th or 6th month of the lactation.

Keywords: body condition scoring system, conformation traits, type-classification, energy reserve, nutritional management, reproduction management

INTRODUCTION

Body condition score is a management tool used routinely to assess the body fat reserves and energy status in cattle (EDMONSON ET AL., 1989). Body traits in dairy cattle can be of interest as indicators of growth, maturity, and functionality. Conformation traits are recorded in many dairy cattle breeds.
Many countries have been recording BCS as part of a linear-type classification scheme for several years, and genetic parameters have been estimated (DOMECQ ET AL., 1997; VEERKAMP AND BROTHERSTONE, 1997). In Hungary the body condition scoring became part of the classification system in 2007, in accordance with recommendations by ICAR.
Some studies (DECHOW ET AL, 2003; BATTAGIN ET AL, 2012) have reported correlation between the body condition score and the main conformation traits.
In KADARMIDEEN AND WEGMANN (2003) study body condition score was favourably genetically related to some conformation traits, such as body capacity (0.19), stature (0.28), heart girth (0.21), strength (0.17), and overall scores for feet and legs (0.15) and final class (0.13). DECHOW ET AL. (2003) analysed a −0.73 genetic correlation between BCS and dairy form, whereas the genetic correlation between BCS and strength was 0.72. The genetic correlation between body condition score and the final score was rather low (0.08). The correlation between sharpness and body condition was -0.40 given by PRYCE ET AL. (2000). BASTIN ET AL. (2007) also reported a negative relationship between sharpness and body condition (r = -0.35 r = -0.73.) The contrast between the two parameters can be the result of the improved condition masked the sharpness.

KADARMIDEEN AND WEGMANN (2003) searched for significant association between the linear type traits, the main judgement characteristics and the body condition. They analysed the correlation between the body condition and chest width (r=0.17) and between BCS and body capacity (0.19) Body condition score had a negative correlation with dairy strength (-0.35) and udder quality (-0.42). Estimates of correlations between the BCS and final class (0.13) were not significant.

MATERIAL AND METHOD

During the analysis of estimated body condition scores at type-classification we tried to find the correlation between the BCS and the most important conformation characteristics.
During the analysis of final class the details of the cows were grouped according to the BCS at classification (2-3 point, 4 point, 5 point, 6-8 point). The results of these groups were compared to the results within the number of lactations. The correlation examinations were also analysed within the lactation groups. The data were analyzed by the method of variance. The relationship between variables was examined with correlation analysis tests (Pearson's correlation coefficient).

RESULTS

The relationship between the body condition and the main judgement characteristics (with regard to this examination) was illustrated in Figure 1-5.
The values of the body score (*Figure 1*) change between 77.58 and 84.23. It can be observed that the increasing number of lactation as well as the improving body condition has a positive effect on the body score.

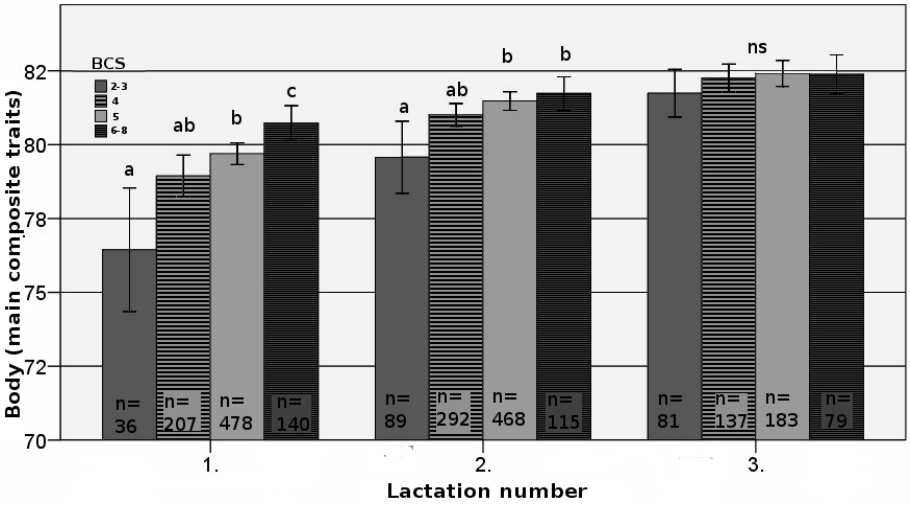


Figure 1. Body score of cows with different BCS in each lactation

In the figure it is visible that the strongest correlation is between the body condition and the body score of the first lactation cows. Significant difference was found in case of the second-lactation cows. There is a loose correlation between the body condition and body score in the first (r=0.20) and in the second (r=0.14) lactation. In the third lactation there is no correlation (r=0.06) between the two characteristics.
When analysing the relationship between the legs (*Figure 2*) and the body condition we

also concluded that the improving body condition has a positive effect on the legs. The legs of the cows with 2-3 BCS significantly (P <5%) falls behind the groups with a higher body condition. With the changes in the number of lactations no considerable difference can be detected in the legs. The correlation analysis confirms a positive, medium tightness in the relationship between the body condition and the legs, (between r=0.19 and r=0.31) within the lactation groups. The results suggest that the food uptake of the cows with better-structured, normal feet is higher than that of the animals with a worse foot-structure.

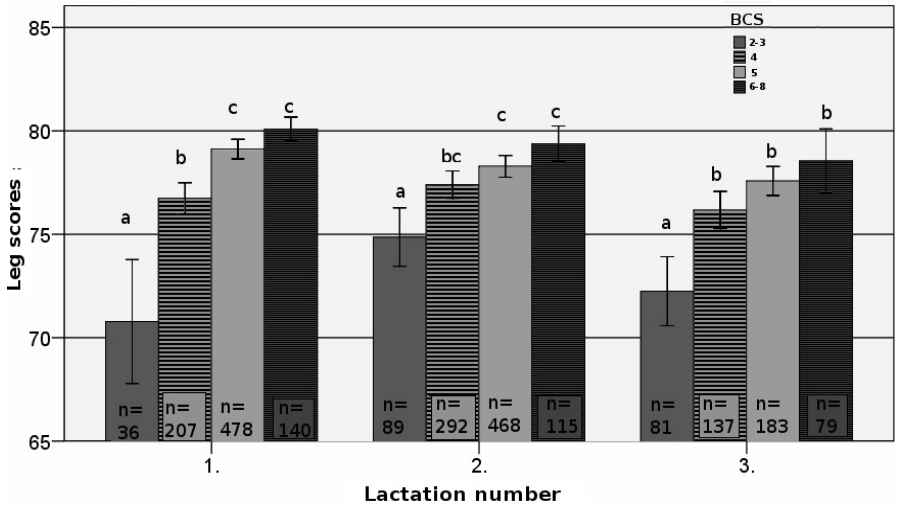


Figure 2. Leg score of cows with different BCS in each lactation

When investigating the relationship between the body condition and the dairy strength. We found a negative correlation between these two characteristics (*Figure 3*).

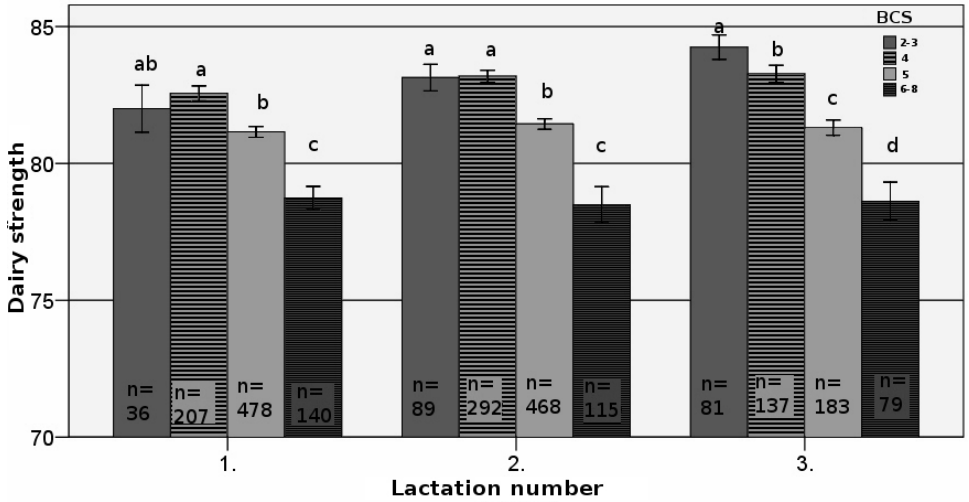


Figure 3. Dairy strength values of cows with different BCS in each lactation

The results of *Figure 3* demonstrate the unselfish character of the animal. The most scores for dairy strength were given to the cows that obtained only two, three or perhaps four linear score at the body condition scoring. Concerning the tightness of the relationships there are medium correlations in each lactation; a negative correlation (with extremes of r=-0.51 and r=-0.57) was confirmed between the dairy strength and the body condition. The strongest relationship is in the third lactation (r=-0.57). These results are identical to

those of DECHOW ET AL. (2003)(r= -0,73) and KADARMIDEEN AND WEGMANN (2003) (r=-0,35).

Considering the udder scores (*Figure 4*) there is no significant difference between the results of the first and second lactation cows. Following the third lactation the udder scores are significantly behind that of the previous lactations. Even the highest value is below the value of the 'good' class that is below 75 scores. When comparing the udder scores of the cows from BCS point of view there is a tendency of the low body condition associated with a low udder score. The correlation analysis confirmed only a loose correlation (r=0.03 and r=0.13 between the udder score and the body condition.

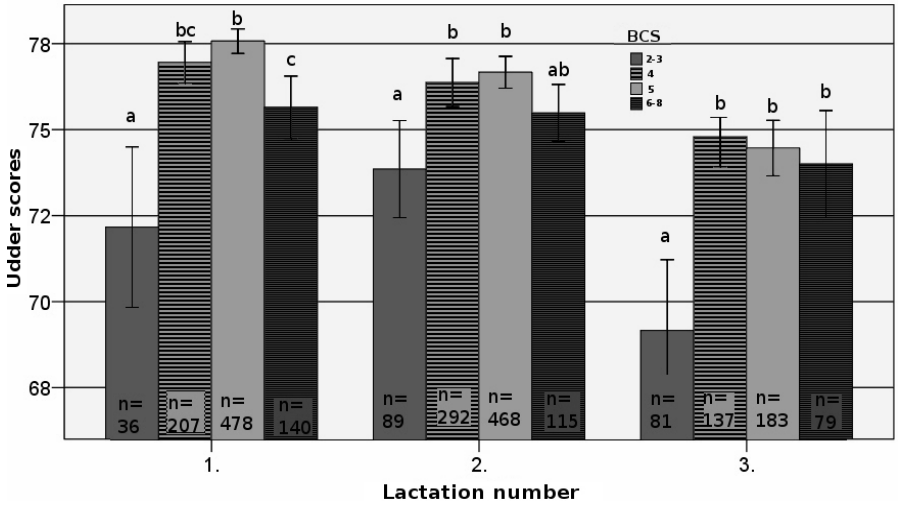


Figure 4. Udder score of cows with different BCS in each lactation

When examining the final class (*Figure 5*) it was again the scores of the cows with the weakest condition that were the lowest. It is especially true for the first lactation cows. In the first lactation the most scores were given to the group with the ideal (5) body condition. The variance analysis confirmed a significant (P <5%) difference between the groups.

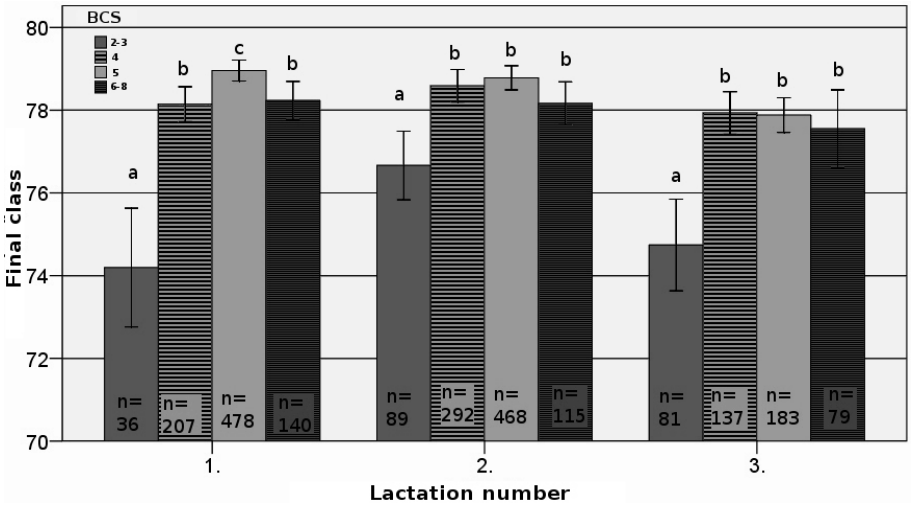


Figure 5. Final class of the cows with different BCS in each lactation

No significant difference was confirmed between the second-lactation groups made according to the body condition. Exceptions are the cows with 2-3 BCS, since their final classes are different from that of the other groups and this difference is statistically

confirmed. The Final class of the third-lactation cows follows a similar tendency as the second-lactations ones. When examining the tightness of the correlations we can claim that regardless of the number of lactation there is a weak positive (r=0.09 and r=0.16) correlation between the linear BCS and the final class. Also loose or very loose relationship has been reported between the condition and the final score in the work of DECHOW ET AL. (2003) (r = 0.08), KADARMIDEEN AND WEGMANN (2003) (r = 0.13), and VEERKAMP AND BROTHERSTONE (1997)(r =- 0.07).

CONCLUSIONS

The results of our study show that the increase in the number of lactations as well as the improving body condition had a positive effect on the body score. When investigating the relationship between the body condition and the dairy strength a negative correlation was found between these two attributes. Therefore we suggest that classification should be made later, probably in the 5^{th} or 6^{th} month of the lactation.

REFERENCES

BASTIN, C., LALOUX, L., GILLON, A., BERTOZZI, C., VANDERICK, S., GENGLER, N. (2007): First results of body condition score modeling for Walloon Holstein cows. http://www-interbull.slu.se /bulletins/bulletin37 /Bastin.pdf (2011.01.11.)

BATTAGIN, M., F. FORABOSCO, J.H. JAKOBSEN, M. PENASA, T.J. LAWLOR, M. CASSANDRO (2012): International genetic evaluation of Holstein bulls for overall type traits and body condition score, Journal of Dairy Science, 95, 8, 4721-4731,

DECHOW, C.D., ROGERS, G.W., KLEI, L., LAWLOR, T.J. (2003): Heritabilities and correlations among body condition score, dairy form and selected linear type traits. J. Dairy Sci. 86 6 2236-2242

DOMECQ, J.J., SKIDMORE, A.L., LLOYD, J.W., KANEENE, J.B. (1997): Relationship between body condition scores and milk yield in a large dairy herd of high yielding holstein cows. J. Dairy Sci. 80 1 101-112

EDMONSON, A.J., LEAN, I.J., WEAVER, L.D., FARVER, T., WEBSTER, G. (1989): A body condition scoring chart for holstein dairy cows. J. Dairy Sci. 72 1 68-78

KADARMIDEEN, H.N., WEGMANN, S. (2003): Genetic parameters for body condition score and its relationship with type and production traits in swiss holsteins. J. Dairy Sci. 86 11 3685-3693

PRYCE, J. E., COFFEY, M. P. BROTHERSTONE, S. (2000): The genetic relationship between calving interval, body condition score and linear type and management traits in registered holsteins. J. Dairy Sci. 83 11 2664-2671

VEERKAMP, R. F., BROTHERSTONE, S. (1997): Genetic correlations between linear type traits, food intake, live weight and condition score in Holstein Friesian dairy cattle. Animal Science. 64 03 385

Review on Agriculture and Rural Development 2014. vol. 3 (1) ISSN 2063-4803

A STUDY ON CONSUMERS' INTEREST IN PURCHASING BIOLOGICAL PRODUCE

ELENA PEȚ, IOAN PEȚ, LAURA MIHAELA GORUN, ADRIANA CARMEN CAZAN

University of Agricultural Sciences and Veterinary Medicine "King Mihai I of Romania" Timisoara
petz_elena@yahoo.com

ABSTRACT
At present, consumers are masters of their incomes. Social stratification differentiates incomes and determines significant variations of the consumption structure. Knowing the attitudinal structure of a consumer is a good opportunity to investigate the causes that determine acceptance or rejection of a produce. The most significant means is to study consumers' wishes. The demand for biological foodstuffs is increasing, and this increase is influenced by some changes in the consumer's behaviour and by the appearance and improvement of a legislative framework in the field. As for the biological produce, they have mainly the same features, the differences residing in type of production and certification type, marking, labelling, storage, advertising – elements that are more strictly stipulated by legal regulations than conventional foodstuffs. Organic farming should not be seen as the only viable solution for the rehabilitation of the entire Romanian agricultural sector but as a niche market with untapped potential in its capacity to be realized. Romanian consumer does not have an accurate perception of what it really a organic product although it claims to be the actual consumer of organic product.

Keywords: biological produce, market, health, taste

INTRODUCTION

Biological produce start to replace part of the conventional produce in the diet of more and more people with the increase of the population's interest in both a healthy lifestyle and awareness of the importance of healthy nutrition.
Biological nutrition refers to the consumption of diversified, healthy, residue free produce with a balanced content of high-quality bioactive and mineral substances that contribute to a rational physiological nutrition of the human body.

MATERIAL AND METHOD

The present study aims at studying the consumers' interest in purchasing biological produce. The first stage of the study, a quantitative one, consisted in applying a questionnaire to 125 respondents.

RESULTS

The results of this preliminary study allowed the identification of socio-demographic features of potential consumers of biological produce. The analysis of demographics of the respondents points out a series of conclusions relevant for the market study. Thus, of the total people questioned, 82% are from the urban area and 18% come from the rural area. As for gender, 38% of the respondents were males and 62% were females. As far as their marital status is concerned, 74% of the respondents were not married and 26% of them

were married. Likewise, 51% of the respondents have a medium level of education and 49% have an academic degree.

1st Question: ***Do you know anything about biological produce?***
Figure 1 shows that 94% of the respondents have knowledge about this type of produce.

Figure 1. Level of knowledge about biological produce

2nd Question: ***Do you read the information on the biological foodstuff labels?***
The importance of the information provided by the biological foodstuff labels are defining in making a purchase decision: most respondents declared they read in most cases the information on the biological produce label (*Figure 2*).

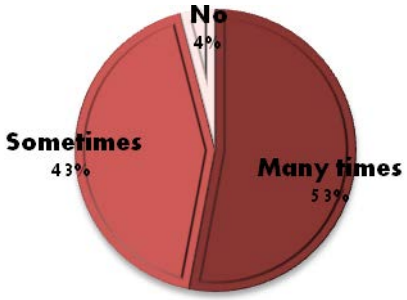


Figure 2. Frequency of checking the information on the biological produce label

It is remarkable that over 50% of the respondents read the information on the biological produce label in most cases.

3rd Question: ***Which of the information on the biological produce label are important to you?***
It is of utmost importance that biological produce labels contain as many information as possible: they should also be useful, as detailed as possible, and easy to identify.

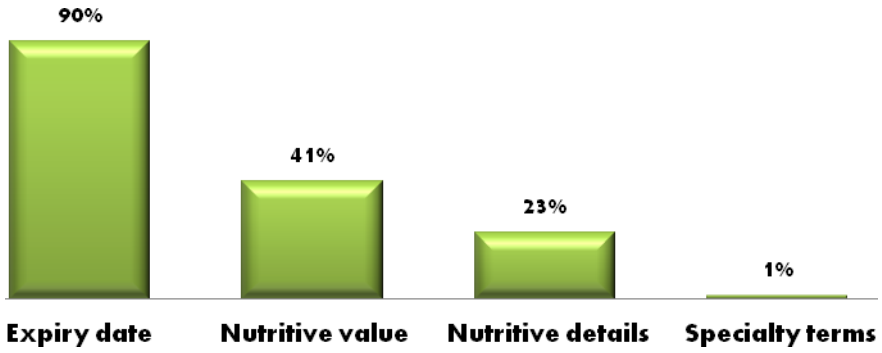


Figure 3. Hierarchy of information on biological produce labels

The most important information for the consumers of biological produce at the time of purchasing is the expiry date (*Figure 3*).

4th Question: ***Which foods do you think are biological?***
Though consumers are not enough informed about biological produce (to be more precise, about biological agriculture), most of them know how to pick the right answer to this question.
Knowing the fact that biological produce are those foods that are inspected and certified as products of biological agriculture is a positive aspect in the development of this sector on the domestic market.

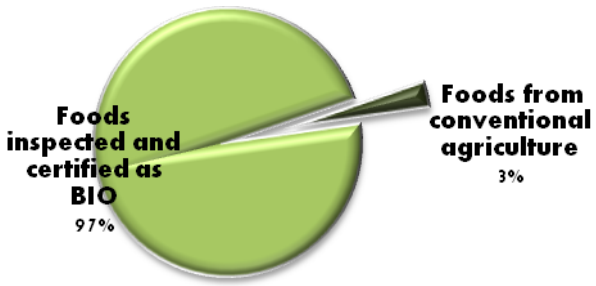


Figure 4. Degree of knowledge of consumers about biological foods

Responses to this question show that over 95% of the respondents consider that biological produce are inspected and certified as such, according to specific rules and standards (*Figure 4*).

5th Question: ***Do you think that biological produce are healthier and tastier than conventional produce?***
Most consumers believe that biological produce are healthier and tastier than conventional ones.

Figure 5. Opinion on biological and conventional produce quality

As shown in *Figure 5*, a significant number of people (87% of the respondents) consider that biological produce are healthier and tastier than conventional ones.

6th Question: ***Where did you get most information about biological produce?***

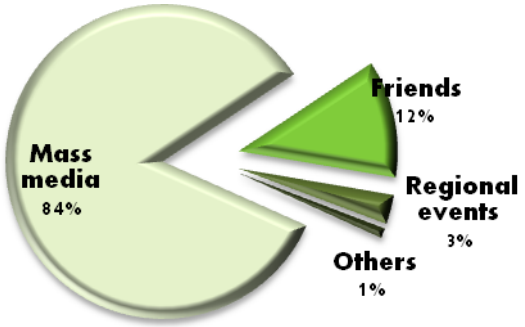


Figure 6. Sources of information about biological produce

Most information about biological produce comes from the mass media (TV, radio, Internet, newspapers, etc.) (*Figure 6*).

7th Question: ***Why would you purchase biological produce?***

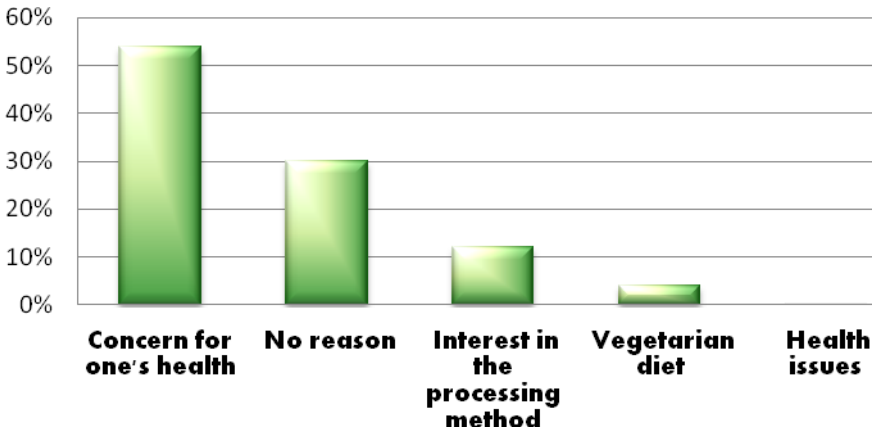


Figure 7. Reasons for purchasing biological produce

Taking into account the five variants of answers and the responses to the questionnaire, we can see that the main reason why people choose to purchase biological produce is the

concern for the family health state, while health issues already diagnosed as such were not taken into account at all (*Figure 7*).

8th Question: ***Which biological produce would you purchase?***

According to the information from our respondents, the most purchased biological foods are fresh vegetables and fruits (60% of the total respondents) followed closely by cereal produce, while the least purchased are potatoes (only 10% of the respondents) (*Figure 8*).

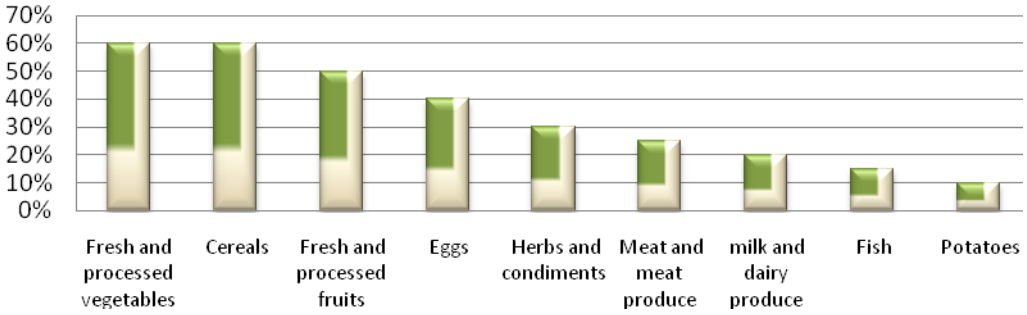


Figure 8. Most purchased biological produce

9th Question: Where would you purchase biological produce***?***

Knowing the point of purchase most frequented by the consumers of biological produce contributes positively to the identification of the opportunities for development of the produce range and sale market taking into account the most visited sales point.

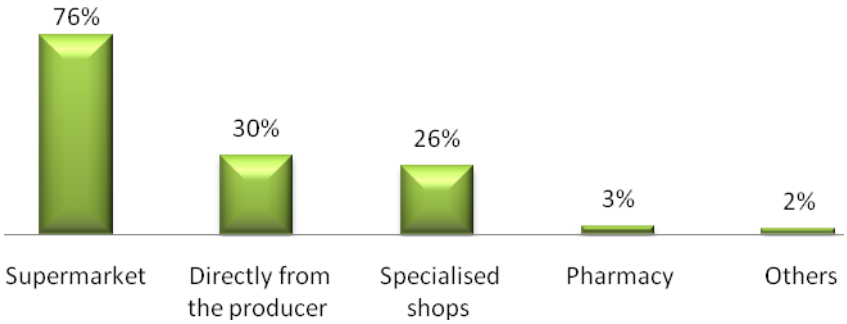


Figure 9. Purchase points for biological produce

Of the total respondents, 76% pointed to the supermarkets as their main point of purchase of biological produce; 30% acknowledged they purchase their biological produce directly from the producers; 26% pointed to the shops specialised in the sale of biological produce; pharmacies are preferred by only 3% of the respondents and 2% pointed to other sources (medicinal plant shops, fairs, exhibitions, etc.) (*Figure 9*).

10th Question: ***How much would you agree to spend on a monthly basis on biological produce?***

Because the price of these produce is 20 to 50% higher than that of conventional produce, the monthly budget destined to the purchase of these produce is rather low, hence the low level of biological produce consumption.

Low purchase power reflects directly in the consumption decision and Romania is among the countries with a low purchase power.

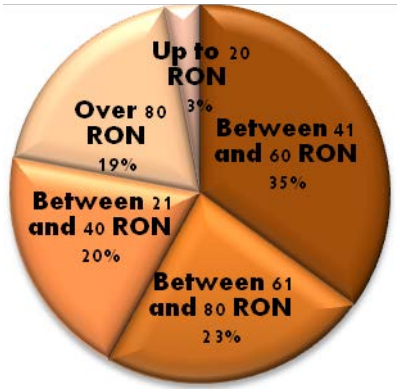


Figure 10. Financial availability for the purchase of biological produce on a monthly basis

Though this sector has started to increase on the domestic market and to be of interest for consumers, from the point of view of financial availability we can see the following: 35% of the respondents would spend up to 60 RON monthly on biological produce; 23% would spend between 61 and 80 RON per month on such foods; 20% would spend only up to 40 RON/month; 19% would spend over 80 RON on biological produce; and only 3% would spend only maximum 20 RON on biological produce (*Figure 10*).

CONCLUSIONS

Taking into account all these elements, we can say that the biological produce sector is of potential interest; getting aware of the benefits of consuming such produce is increasing among consumers; what we need in purchase decision-making is more advertising and, above all, a stronger purchase power (CONSTANTIN, 2009; POP, 2009; GÎNDU ET AL., 2013).
This sector of produce is accessible only to people with a monthly income above the average while in Romania people earn minimum wages on economy, which is not enough for a regular consumption of biological produce.
Biological produce are the result of biological agriculture, a farming system that observes the general principles of environmental protection and of human safety.
To conclude, we would say that "BIOLOGICAL CONSUMPTION IS A NECESSITY, NOT A TREND" – meaning it is not just a matter of price.

REFERENCES

CONSTANTIN, M. (2009): Marketingul producţiei agroalimentare. Editura AgroTehnica, Bucureşti. 786 p.
GÎNDU, E., CHIRAN, A., JITĂREANU, A.F. (2013): Marketing în alimentaţie publică şi agroturism. Editura PIM, Iaşi.
POP, D. (2009): Ecomarketing. Editura Universităţii din Oradea.

Review on Agriculture and Rural Development 2014. vol. 3 (1) ISSN 2063-4803

LICHENS AS POTENTIAL INDICATORS OF ENVIRONMENTAL HARM

ENDRE PÖLÖS, ATTILA HÜVELY, JUDIT PETŐ, FERENC BAGLYAS

Kecskemét College
Faculty of Horticulture
Department of Horticulture
polos.endre@kfk.kefo.hu; huvely.attila@kfk.kefo.hu; borsne.judit@kfk.kefo.hu;
baglyas.ferenc@kfk.kefo.hu

ABSTRACT
Environmental protection is one of the most important issues of our time; thereby there is an increasing awareness to regulate activities that degrade the environment pollution. Physical and chemical instrumentations provide accurate quantitative data to the various substances that are polluting but do not give a true picture of the extent of contamination that has impact on living organisms. The environmental impact on organisms and its effects on habitat can be detected by bioindicator plants. We chose Cladonia lichen as a biological indicator. We measured the photosynthetic activity of the algae cells and applied chlorophyll fluorescence induction method for the detection of environmental impacts. The most harmful toxic elements are Cd, Cr, Cu, Ni, Zn, Pb and toxic gases are NO_2, SO_2. We measured the accumulation of toxic elements in Cladonia lichen populations.
Today, the pollution of our environment is mostly caused by cars. A significant amount of Pb in the air comes from the exhaust gases of motor vehicles and contaminant are deposited along the roads. The measurement results confirm that lead contamination have been multiplied by six in the Buda crossing due to the heavy traffic. Transplanted lichen colonies show that the Cd contamination is more than thirty-fold at busy roads than in the National Park. The Cr value also increased by more than double, so it can be stated that mostly roads are blamed for the raise of the level of such toxic elements.

Keywords: Cladonia lichen biological indicator, toxic gases, toxic elements

INTRODUCTION

For a long time certain lichen species were considered suitable to use as indicator species of ecological continuity. Such indicator species are difficult to conquer new habitats. Therefore, it is important for them to have a continued existence, and corresponding micro-climatic factors of the habitats, usually huge old trees are also essential. The slowly decaying, very hard wood or deep bark grooves are essential to their survival. In addition there is secondary importance of having a closed canopy or prevailing humid environment inside the rain forests. Plasmatic resistance, ecological water demand, the relative air humidity and contamination play role in the indications. The toxic effect of sulphur dioxide on lichen depends on the pH of the soil. The lichens live in different substrates. Mainly epiphytic lichens are taken into account as biological indicators. Sulphur dioxide destroys unsaturated fatty acids in lichen plantations. This explains the different sensitivity of the lichen. The sensitivity of lichens against a variety of air pollutants is due to morphological, physiological differences:
Due to the lower chlorophyll content its growth is slow and thus regeneration capability is limited. The water balance of lichens almost entirely depends on the air humidity and rainfall, thereby the regeneration time of assimilation is short. The autotrophic algae cells are capable of photosynthesis, hyphae can take up organic matter. Lichens are sensitive indicators of changes in environment so they can be used in indirect biologic monitoring. Lichen species are formed from the symbiosis of unicellular or filamentous green or blue- algae and ascomycetes (KOVÁCS EL AL., 1986; FARKAS, 2007).

MATERIAL AND METHOD

In the study Cladonia lichen plantations were collected from the untouched territory of the Kiskunsági National Park. In order to stimulate different environmental contamination the colonies were exposed to different environmental stresses (toxic gases SO_2 and NO_2 and toxic heavy metals: Cd, Cr, Cu, Ni, Zn, Pb. The experiments were carried out in enclosed space (0.3 m^3 tank) with 0. 2, 4, 6, 8, and 10-hour duration of treatment (in 100 mg / l).
In order to follow the accumulation of toxic elements lichen colonies we placed in a major transportation hub of Kecskemét in a grassy field. The exposure time was 90 days. As a control, we used lichen colonies from Kiskunsági National Park. In both areas, four repetition were used. The toxic elements were as follows: As, Cd, Co, Cr, Mo, Ni, Pb and Se.

The measure of the photosynthesis of lichen colonies by fluorescence indication method
The principle underlying chlorophyll fluorescence analysis is relatively straightforward. Light energy absorbed by chlorophyll molecules in a leaf can undergo one of three fates: it can be used to drive photosynthesis (photochemistry), excess energy can be dissipated as heat or it can be re-emitted as light-chlorophyll fluorescence. These processes occur in competition, such that any increase in the efficiency of one will result in a decrease in the yield of the other two. Hence, by measuring the yield of chlorophyll fluorescence, information about changes in the efficiency of photochemistry and heat dissipation can be gained.
Although the total amount of chlorophyll fluorescence is very small (only 1 or 2% of total light absorbed), measurement is quite easy. The spectrum of fluorescence is different to that of absorbed light, with the peak of fluorescence emission being of longer wavelength than that of absorption. Therefore, fluorescence yield can be quantified by exposing a leaf to light of defined wavelength and measuring the amount of light re-emitted at longer wavelengths. It is important to note, however, that this measurement can only ever be relative, since light is inevitably lost. Hence, all analysis must include some form of normalisation, with a wide variety of different fluorescence parameters being calculated.
One modification to basic measuring devices, that has been instrumental in revolutionizing the application of chlorophyll fluorescence, has been the use of a 'modulated' measuring system. In such systems, the light source used to measure fluorescence is modulated (switched on and off at high frequency) and the detector is tuned to detect only fluorescence excited by the measuring light. Therefore, the relative yield of fluorescence can now be measured in the presence of background illumination, and, most significantly, in the presence of full sunlight in the field. Most modern fluorometers use such modulated measuring systems and anyone considering investing in a fluorescence system is strongly advised to select a modulated fluorometer (GOVINDJEE, 1995).

The toxic element content tests were performed in the Laboratory of Kecskemét College Faculty of Horticulture College according to accredited soil and plant testing standards. The lichen samples were washed thoroughly and dried at 70 °C in a drier. Then, the air-dried leaf samples were homogenized by grinding. Fort the elemental analysis the powdered samples were exposed to microwave disruptors in the presence of nitric acid and hydrogen peroxide (Milestone Ethos Plus). The examination of the most important types of toxic elements was carried out by Ultima 2 inductive plasma atomic emission spectrometer (ICP-AES device).

RESULTS

We assessed the effectiveness of photosynthesis of lichen colonies based on chlorophyll fluorescence measurement. The results of the measurements are shown in the *Table 1* and are illustrated in *Figure 1*.

Table 1. The influence of SO_2 és NO_2 on the effectiveness of (PSII) yield (Fv/Fm)

Hours after treatment	Fv/Fm		
	control	SO_2	NO_2
2	0,63	0,50	0,58
4	0,64	0,32	0,56
6	0,62	0,25	0,50
8	0,61	0,20	0,48
10	0,63	0,18	0,45

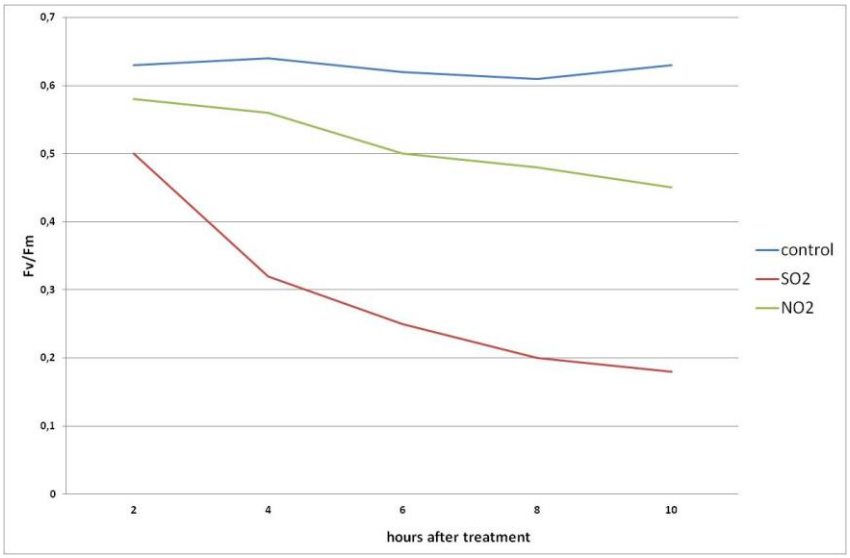


Figure 1. Photosynthetic activity induced by toxic gases

Table 2. The effect of toxic elements on the chlorophyll fluorescence of lichen colony (in 100 ppm concentration)

Hours after treatment	Fv/Fm						
	Cd	Cr	Cu	Ni	Pb	Zn	control
2	0,60	0,58	0,57	0,55	0,58	0,54	0,63
4	0,58	0,52	0,50	0,48	0,50	0,50	0,62
6	0,50	0,50	0,45	0,40	0,48	0,41	0,61
8	0,45	0,47	0,40	0,35	0,40	0,30	0,64
10	0,40	0,41	0,32	0,35	0,30	0,19	0,60

The accumulation of toxic elements in lichen colonies placed in public areas is presented in *Table 3*. Cadmium accumulation was extremely high lead, chromium and arsenic content also increased significant. The cobalt, selenium, nickel and molybdenum content remained practically unchanged.

Table 3. The accumulation of toxic elements in lichen colonies (mg/kg total elements expressed in dried solids (LOQ (Limit of Quantification): 0,500 mg/kg dry solids)

	As	Cd	Co	Cr	Mo	Ni	Pb	Se
K-1	**0,637**	**18,4**	**0,544**	**26,3**	**<0,500**	**11,8**	**38,2**	**<0,500**
K-2	**0,751**	**19,8**	**0,558**	**28,0**	**<0,500**	**8,74**	**41,4**	**<0,500**
K-3	**0,706**	**14,1**	**<0,500**	**21,5**	**<0,500**	**7,49**	**31,5**	**<0,500**
K-4	**<0,500**	**18,5**	**<0,500**	**21,7**	**<0,500**	**5,99**	**37,5**	**<0,500**
N-1	**<0,500**	**<0,500**	**<0,500**	**9,89**	**<0,500**	**7,70**	**6,53**	**<0,500**
N-2	**0,532**	**<0,500**	**<0,500**	**11,5**	**<0,500**	**9,58**	**5,09**	**<0,500**
N-3	**<0,500**	**<0,500**	**<0,500**	**10,8**	**<0,500**	**9,74**	**5,44**	**<0,500**
N-4	**<0,500**	**<0,500**	**<0,500**	**10,2**	**<0,500**	**9,44**	**4,84**	**<0,500**

K-1 – K-4: samples placed in public area; N-1 - N-4: Cladonia samples in the National Park

Lichen colonies were collected from the Kiskunsági National Park (*Figure 2*) and were placed in Kecskemét Budakapu Crossing (*Figure 3*). This later placed is heavy polluted because of the traffic.

Figure 2. *Cladonia magyarica* lichen colonies on sand dunes (photo Pölös)

Figure 3. Kecskemét Buda Kapu Crossing (a contaminated place by toxic elements) (photo Pölös)

CONCLUSIONS

The following conclusions can be drawn from the results:

- the effects of toxic elements caused by gases of vehicles are well detectable by Fv / Fm fluorescence parameter of photosynthesis.
- lichen colonies are primarily sensitive to sulphur dioxide gas and toxic elements from the copper, zinc and lead.
- we studied the enrichment of toxic elements in Cladonia lichen colony in urban areas / K-labelled samples / Kiskunsági National Park and / N-labelled samples /samples from Fülöpházi sandy dunes Kecskemét.
- in contaminated urban environment sites lead, chromium, cadmium and arsenic toxic elements were accumulated in lichen. These values were in substantially lower, minimal concentrations or absent in the lichen samples the National Park were.

REFERENCES

KOVÁCS M., PODANI J., TUBA Z., TURCSÁNYI G. (1986): A környezetszennyezést jelző és mérő élőlények. Mezőgazdasági Kiadó, Budapest , 191 p.

FARKAS E. (2007): Lichenológia: a zuzmók tudománya. MTA Ökológiai és Botanikai Kutatóintézete kiadványa, Vácrátót, 193 p.

GOVINDJEE (1995): Sixty-three years since Kautsky: clorophyll a fluorescence. Aust. J. Plant Physiol. 22. 131-160.

Review on Agriculture and Rural Development 2014. vol. 3 (1) ISSN 2063-4803

COMPARISON OF CHANGES IN THE BONE MINERAL CONTENT AND EGG SHELL WEIGHT AND EGG SHELL RATIO IN BROWN AND WHITE EGG LAYERS DURING THE FIRST EGG LAYING PERIOD

ESZTER SZENTIRMAI[1], GÁBOR MILISITS[1], TAMÁS DONKÓ[1], GYÖRGY KOVÁCS[3], ZOLTÁN BUDAI[2], JOLÁN UJVÁRI[1], IMRE REPA[1], ZOLTÁN SÜTŐ[1]

[1]Kaposvár University
Faculty of Agricultural and Environmental Sciences
H-7400 Kaposvár, Guba Sándor u. 40., Hungary
[2]Bábolna Tetra Ltd.
H-9651 Uraiújfalu, Petőfi Sándor u. 18., Hungary
[3]University of Debrecen, Faculty of Informatics
H-4028 Debrecen, Kassai út 26., Hungary
milisits.gabor@ke.hu

ABSTRACT
In this experiment computer tomography (CT) was used to follow the changes in the bone mineral content of laying hens and to examine its correlation with egg shell quality in brown and white egg layers during the first egg laying period. The experiment was carried out with 45 TETRA SL (brown egg layer) and 45 TETRA BLANCA (white egg layer) hens, which were scanned four-weekly by a Siemens Somatom Emotion 6 multislice CT scanner between 20 and 72 weeks of age. The CT measurements consisted of overlapping 10 mm thick slices covering the whole body of the hens. The estimation of the bone mineral content (BMC) was perfomed by scanning phantoms with hydroxyapatite densities equal to 0 and 200 mg/cm^3 and Hounsfield units of the bones (101-550) were linearly converted into hydroxyapatite densities. Based on the results it was established that changes in the bone mineral content of the laying hens showed an increasing tendency during the experimental period in both examined genotypes. Changes were parallel in both of the examined genotypes, but the measured values were mostly higher in the TETRA BLANCA hens than in the TETRA SL layers. Similar tendency was observed also in the changes of the egg shell weight in both genotypes. However, despite of the similar changes in bone mineral content and egg shell weight, only very low correlation was found between these traits in both examined genotypes (r=0.118 in the TETRA SL and r=0.173 in the TETRA BLANCA hens, respectively). Based on the results it was concluded that computer tomography seems to be useful tool for the *in vivo* examination of changes in the bone mineral content of laying hens. However, the low correlation coefficients between the bone mineral content and egg shell weight in this study indicate that instead of the whole bone structure of the hens only the examination of those bones seems to be needed, which are in close connection with the egg shell formation.

Keywords: hen, bone, egg shell, computer tomography

INTRODUCTION

In former studies it was already established that the bone and eggshell quality of laying hens is significantly affected by the keeping and nutritional conditions (LEYENDECKER ET AL., 2002; SILVERSIDES ET AL., 2012; JIANG ET AL., 2013). Because the close correlation between bone and eggshell quality was also pointed out in former experiments (KIM ET AL., 2012), bone quality was studied by different methods (chemical, biomechanical and computer tomography) in some former experiments (RICZU ET AL., 2004; STREUBEL ET AL., 2005; MARTINEZ-CUMMER ET AL., 2006; TOSSENBERGER ET AL., 2011).
However, this examinations were mainly done at given ages of the hens and, therefore, only less informations are available about the changes of bone quality during the egg laying period. Because in some former experiments computer tomography was established as a new useful tool for evaluating bone density in laying hens, this *in vivo* technique was

used in this experiment to follow the changes in the bone mineral content of laying hens and to examine its correlation with egg shell quality during the first egg laying period.

MATERIAL AND METHOD

The experiment was carried out with 45 TETRA SL (brown egg layer) and 45 TETRA BLANCA (white egg layer) hens, which were kept in cages (1,800 cm² basic area), in a closed building at the Poultry Test Station of the Kaposvár University, Faculty of Agricultural and Environmental Sciences, in Hungary. In order to the correct identification, of which egg was produced by which hen, hens were assigned individually with wing tags and two hens (one TETRA SL and one TETRA BLANCA) were placed into one cage. The hens were fed *ad libitum* with commercial diets during the whole experimental period (*Table 1.*). Drinking water was also continuously available from self-drinkers.

Table 1. Composition of the diets used in the experiment

Component	Content
Dry matter (g/kg)	903.4
ME Poultry (MJ)	11.56
Crude protein (g/kg)	177.8
Crude fat (g/kg)	43.0
Crude fibre (g/kg)	43.1
Crude ash (g/kg)	47.6
Nitrogen-free extractives (g/kg)	591.9
Sodium (g/kg)	1.7
Lysine (g/kg)	8.7
Methionine (g/kg)	3.9
Methionine + cystine (g/kg)	7.0
Calcium (g/kg)	37.6
Phosphorous (g/kg)	7.0

Changes in the hens' bone mineral content and egg shell weight and egg shell ratio were monitored four-weekly, between 20 and 72 weeks of age. The bone mineral content of the birds was always determined *in vivo* by means of computer tomography (CT) at the Institute of Diagnostic Imaging and Radiation Oncology of the Kaposvár University.

During the CT scanning procedures birds were fixed with belts in a special plexi-glass container, without using any anaesthetics. Three animals were scanned simultaneously. Due to the special arrangement of the hens, they were separable on the CT images, therefore their bone mineral content was determined individually.

The CT measurements consisted of overlapping 10 mm thick slices covering the whole body using a Siemens Somatom Emotion 6 multislice CT scanner. Following scanning parameters were set in: 130 kV – 80 mAs, spiral data collection (pitch 1), FoV 500 mm. The images obtained were evaluated by means of OpenIP software package (KOVÁCS *et al.*, 2010). The estimation of the bone mineral content (BMC) was perfomed by scanning phantoms with hydroxyapatite densities equal to 0 and 200 mg/cm^3 and Hounsfield units of the bones (101-550) were linearly converted into hydroxyapatite densities.

After the CT measurements, all of the eggs, which were produced by these birds on the CT examination days, were weighed and broken. After breaking the eggs the weight of the shell was measured and its ratio to the whole egg weight was calculated.

For the statistical evaluation of the differences in the bone mineral content, egg shell weight and egg shell ratio between the examined genotypes, the Independent Samples t-test was used. For testing the correlation between the bone mineral content of the hens and the egg shell weight, Pearson correlation coefficients were calculated. Both statistical analyses were carried out by the SPSS statistical software package, version 10.0 (SPSS for Windows, 1999).

RESULTS AND DISCUSSION

Examining changes in the bone mineral content of the laying hens it was established that it showed an increasing tendency during the experimental period in both examined genotypes (*Figure 1.*).

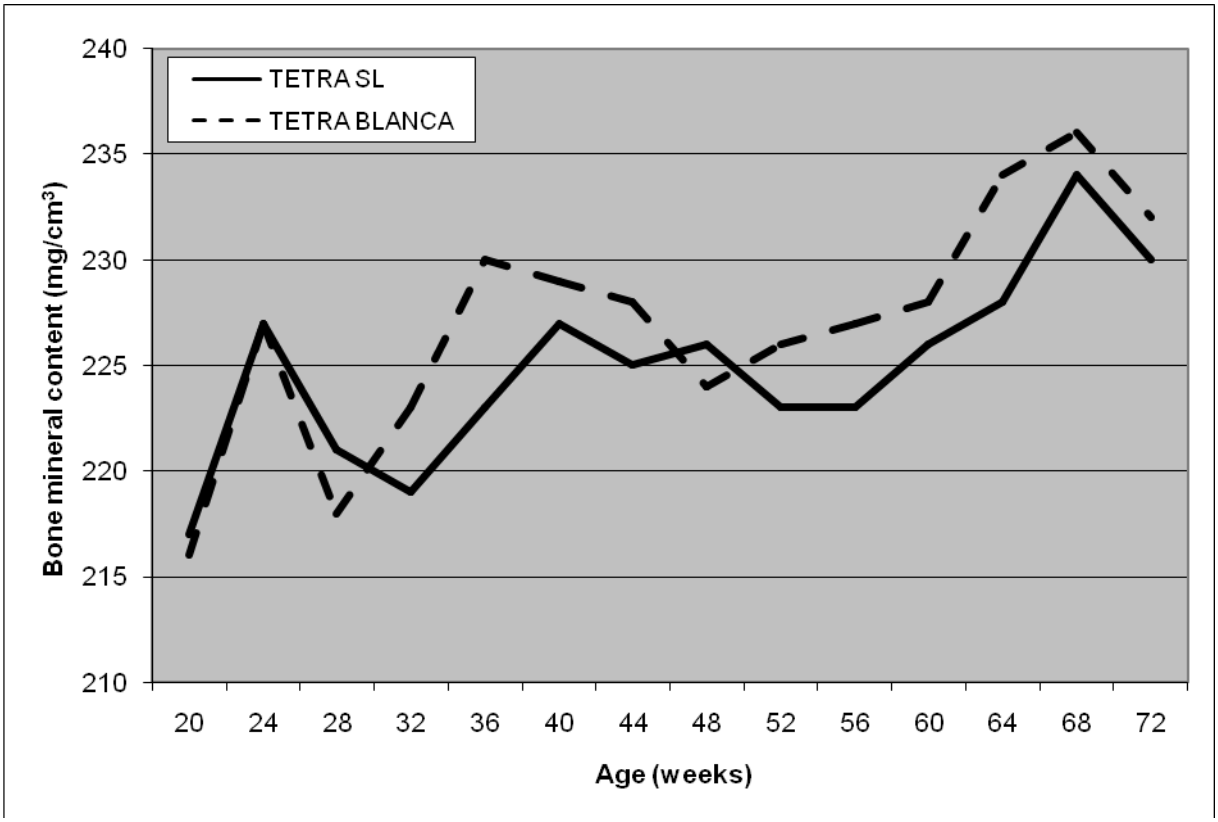


Figure 1. Changes in the bone mineral content of TETRA SL and TETRA BLANCA laying hens during the first egg laying period

The bone mineral content increased from 217 to 230 mg/cm^3 in the TETRA SL hens and from 216 to 232 mg/cm^{3}in the TETRA BLANCA hens between 20 and 72 weeks of age. Changes were parallel in both of the examined genotypes, but the measured values were mostly higher in the TETRA BLANCA hens than in the TETRA SL layers. However, significant differences were found only at 32, 36 and 64 weeks of ages ($P<0.05$).
Similar tendency was observed also in the changes of the egg shell weight in both genotypes (*Figure 2.*).

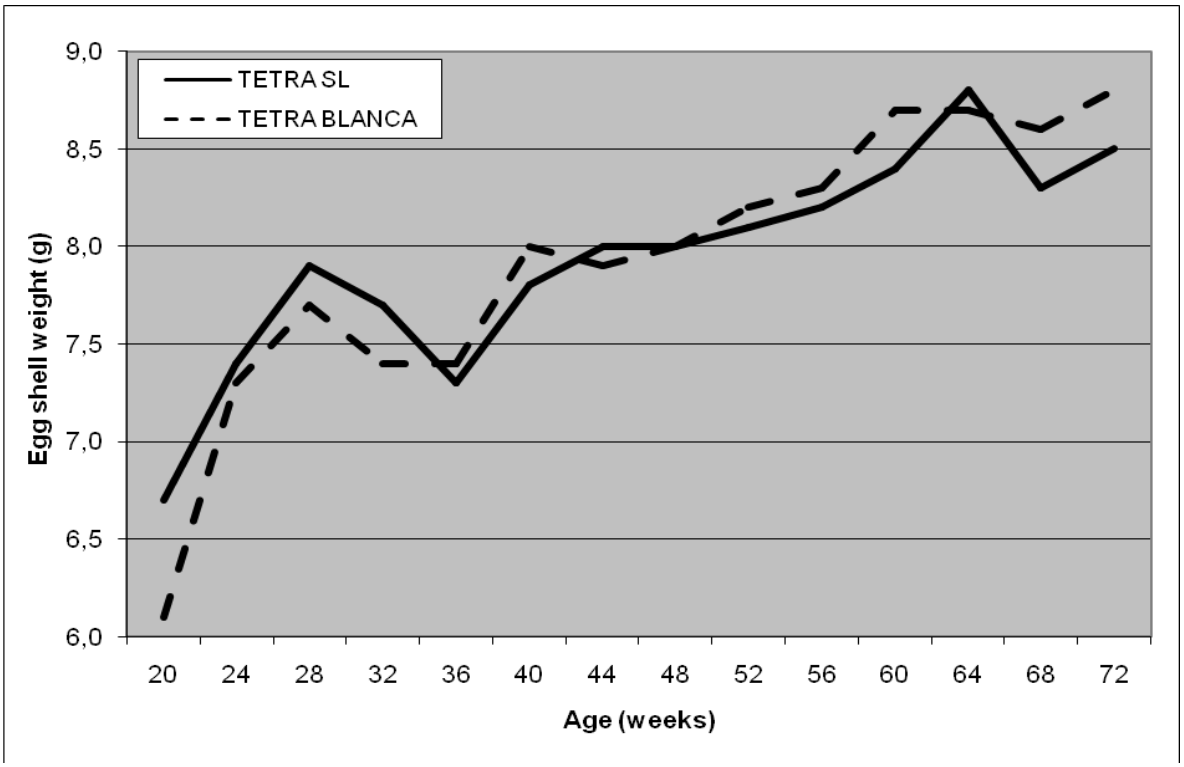


Figure 2. Changes in the egg shell weight of TETRA SL and TETRA BLANCA laying hens during the first egg laying period

The egg shell weight increased from 6.7 to 8.5g in the TETRA SL hens and from 6.1 to 8.8g in the TETRA BLANCA hens during the examined period. Similarly to the changes in the bone mineral content, the higher increase was observed in the TETRA BLANCA hens also in this case. While the egg shell weight increased by 44.3% in TETRA BLANCA hens, it's increase was only 26.9% in the TETRA SL hens between 20 and 72 weeks of age. Significant differences were not observed between the genotypes in this case.

Because of the similar changes in bone mineral content and egg shell weight, the correlation between these traits was tested as next step of the data evaluation. By calculating the Pearson correlation coefficients it was established that only a very low – but highly significant ($P<0.001$) – correlation exists between these two traits in both genotypes ($r=0.118$ in the TETRA SL and $r=0.173$ in the TETRA BLANCA hens, respectively).

When the ratio of egg shell weight to the whole egg weight was calculated, a decreasing tendency was observed in both genotypes between 20 and 36 weeks of age (*Figure 3.*). The egg shell ratio decreased from 14.0 to 12.0% in the TETRA SL hens and from 14.6 to 13.1% in the TETRA BLANCA hens during this period. This ratio remained almost the same in the case of TETRA BLANCA hens, while it increased slightly in the case of TETRA SL hens between 36 and 72 weeks of age. The higher values were observed in the eggs of TETRA BLANCA hens during the whole experimental period. Significant differences between the examined genotypes were pointed out from 24 to 40 weeks of age ($P<0.001$).

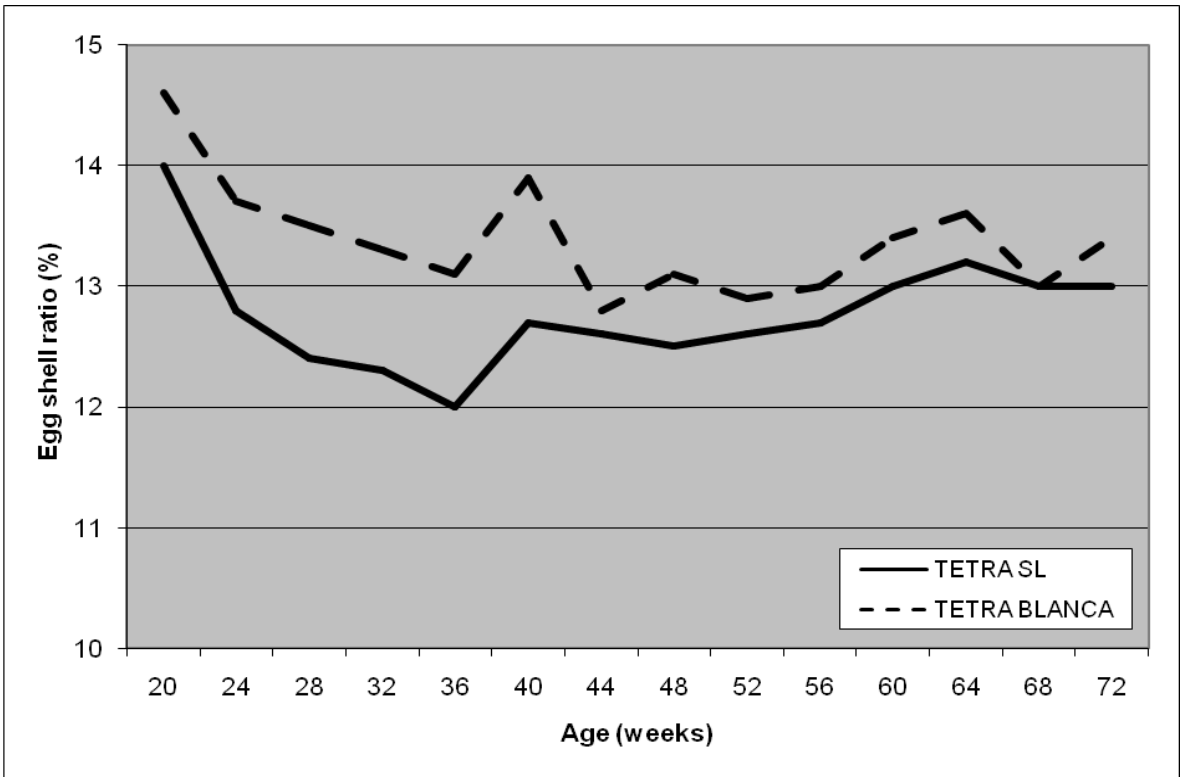


Figure 3. Changes in the egg shell ratio of TETRA SL and TETRA BLANCA laying hens during the first egg laying period

CONCLUSIONS

Based on the results it was concluded that computer tomography seems to be useful tool for the *in vivo* examination of changes in the bone mineral content of laying hens. However, the low correlation coefficients between the bone mineral content and egg shell weight in this study indicate that instead of the whole bone structure of the hens only the examination of those bones seems to be needed, which are in close connection with the egg shell formation. The development of the suitable method for this examination could be the main goal of the further experiments.

ACKNOWLEDGEMENTS

This research project was supported by the National Office for Research and Technology (TETRAKAP-TECH_08_A3/2-2008-0394).

REFERENCES

JIANG, S., CUI, L., SHI, C., KE, X., LUO, J., HOU, J. (2013): Effects of dietary energy and calcium levels on performance, egg shell quality and bone metabolism in hens. Veterinary Journal, Volume 198. Number 1. pp. 252-258.

KIM, W.K., BLOOMFIELD, S.A., SUGIYAMA, T., RICKE, S.C. (2012): Concepts and methods for understanding bone metabolism in laying hens. World's Poultry Science Journal, Volume 68. Number 1. pp. 71-82.

KOVÁCS, GY., IVAN, J. I., PANYIK, A., FAZEKAS, A. (2010): The openIP open source image processing library. Proc. of ACM Multimedia 2010 International Conference, pp. 1489-1492. (ISBN: 978-1-60558-933-6), Firenze (Italy), October 25-29. 2010

LEYENDECKER, M., HAMANN, H., HARTUNG, J., GLUNDER, G., NOGOSSEK, N., NEUMANN, U., KAMPHUES, J., DISH, O. (2002): Analysis of the egg shell stability and the bone strength of laying hens in three different hen housing systems. Züchtungskunde, Volume 74. Number 2. pp. 144-155.

MARTINEZ-CUMMER, M.A., HECK, R., LEESON, S. (2006): Use of axial X-ray microcomputed tomography to assess three-dimensional trabecular microarchitecture and bone mineral density in single comb white leghorn hens. Poultry Science, Volume 85. Number 4. pp. 706-711.

RICZU, C.M. SAUNDERS-BLADES, J.L., YNGVESSON, A.K., ROBINSON, F.E., KORVER, D.R. (2004): End-of-cycle bone quality in white- and brown-egg laying hens. Poultry Science, Volume:83, Number 3. pp. 375-383.

SILVERSIDES, F.G., SINGH, R., CHENG, K.M., KORVER, D.R. (2012): Comparison of bones of 4 strains of laying hens kept in conventional cages and floor pens. Poultry Science, Volume 91. Paper 1. pp. 1-7.

STREUBEL, R., BARTELS, T., KRAUTWALD-JUNGHANNS, M.E. (2005): Computed tomography assisted, chemical and biomechanical studies on bone density and breaking strength in laying hens. Archiv für Geflügelkunde, Volume 69. Number 5. pp. 206-212.

TOSSENBERGER, J., TENKE, J., DONKÓ, T., REPA, I., HORÁK, A., TISCHLER, A., KÜHN, I. (2011): The effect of phytase and phosphorus supply on different bone parameters estimated by computer tomography in broilers. European Symposium on Poultry Nutrition, Izmir (Turkey), 31 October – 4 November 2011.

Review on Agriculture and Rural Development 2014. vol. 3 (1) ISSN 2063-4803

COPPER FLUORESCENCE BASED COPPER TOXICITY ASSESSMENT OF TWO GRAPE VARIETIES

FERENC BAGLYAS, ENDRE PÖLÖS

Kecskemét College, Faculty of Horticulture, Department of Horticulture, Hungary
baglyas.ferenc@kfk.kefo.hu; polos.endre@kfk.kefo.hu

ABSTRACT
Chlorophyll fluorescence analysis has become one of the most powerful and widely used techniques available to plant physiologists and ecophysiologists. This review aims to provide an introduction for the novice into the methodology and applications of chlorophyll fluorescence. After a brief introduction into the theoretical background of the technique, the methodology and some of the technical pitfalls that can be encountered are explained. A selection of examples is then used to illustrate the types of information that fluorescence can provide. In recent years, the technique of chlorophyll fluorescence has become ubiquitous in plant ecophysiology studies. This study evaluates the difference in leaf sensitivity of two grapevine varieties, *Pannon frankos* and *Narancsízű*, to copper. The photosynthetic efficiency of the varieties was measured as the ratio of variable to maximal chlorophyll fluorescence (Fv/Fm). Young and older leaves of these varieties were exposed to four different pesticides with copper active ingredients in the recommended dosage: Bordói por (copper sulphate), Champion 50 WP (copper hydroxide), Rézoxiklorid 50 WP (copper-oxychloride) and Ridomil Gold Plus 42,5 WP (mefenoxam+copper-oxychlorid) and their physiology were studied 4 times, on the 2nd, 4th, 8th and 12th days after treatments. These pesticides caused proportional decrease in the photosynthetic efficiency.

Keywords: chlorophyll fluorescence, copper toxicity, variety sensitivity

INTRODUCTION

Copper is considered as a toxic heavy metal ion to plants and is a potent inhibitor of photosynthesis. In grapevine, copper is essential for metabolic processes like electron transport in photosynthesis and in various enzyme systems (e.g. amine oxidase, cytochrome c oxidase). However, excess copper results in toxic responses, including subtle changes in enzymatic activity to gross changes in cell structure and function and inhibits photosynthesis. The type and extent of the responses of grapevine to copper vary according to the varieties under consideration.

MATERIAL AND METHOD

Material

Four different kinds of pesticides were used *(Table 1)* and two grape varieties were sprayed in the recommended dosage *(Figure 1)*.

Table 1. The pesticides used in the experiment

Name of product	Active ingredient	Dosage
Bordói por WP	20 % copper equivalent réz /II/-calcium-double-salt	4-6 kg/ha
Champion 50 WP	77% copper-hydroxide	2-3 kg/ha
Rézoxiklorid 50 WP	50% Rézoxiklorid	2-3 kg/ha
Ridomil Gold Plus 42,5 WP	2,5% mefenoxam + 40% Rézoxiklorid	3.5–4.0 kg/ha

the vineyard Narancsízű Pannon frankos

Figure 1. Kecskemét-Máriahegy vineyard and the varieties

Methods

The pulsed amplitude modulation (PAM) fluorometer *(Figure 2)* is one of the instruments available for use in measuring chlorophyll fluorescence as an indicator of primary productivity. The PAM fluorometer uses the saturation pulse method, in which dark adapted leaf is subjected to a short beam of light that saturates the PS II reaction centers of the active chlorophyll molecules (see Schreiber, 1986 for a detailed discussion). This process suppresses photochemical quenching, which might otherwise reduce the maximum fluorescence yield (SCHREIBER ET AL, 1994) (Figure 3). A computer subsequently records fluorescence yield measurements. A ratio of variable to maximal fluorescence (Fv/Fm) can then be calculated which approximates the potential quantum yield of PS II (BILGER ET AL, 1995).

Statistical analysis was carried out with the SPSS statistical computer package (SPSS for Windows, Version Release 11,5). Statistically differences in F_o/F_m were analyzed by GLM procedure and factor level was established according to factor significance and interactions. Studies of instantaneous comparisons were carried out by analysis of variance (ANOVA). Significant effect of means was identified with Tukey-test at 0.05 probabilities.

Figure 2. MINI-PAM fluorometer

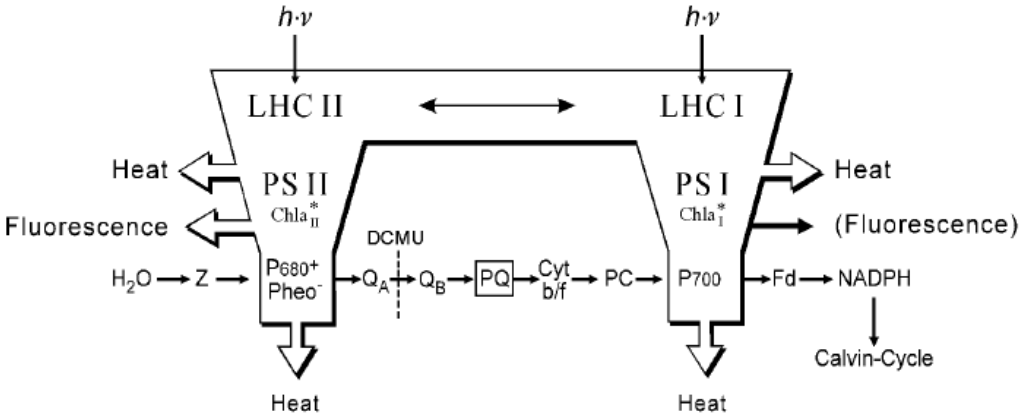


Figure 3. Schematic view of primary energy conversion and primary electron transport in photosynthesis

LHC, light harvesting pigment-protein complex; P680 and P700, energy converting special chlorophyll molecules in the reaction centers of photosystem II (PSII) and photosystem I (PSI), respectively; Pheo, pheophytin; DCMU, PSII inhibitor (diuron); PQ, plastoquinone; PC, plastocyanin; Fd, ferredoxin (http://www.walz.com/downloads/manuals/mini-pam/MINIP_1EB.pdf)

RESULTS

Pannon frankos and Narancsízű young leaf copper toxicity by Rézoxiklorid 50 WP (copper-oxychloride) measured in four days after spraying

As significance coefficient, $p>0.05$ there is no significant differences varieties, day of measurement and their combination. It means that Copper-oxychorid, which is known to be the most toxic of all cupriferous pesticides are not toxic on young leaves if it is sprayed in the recommended dosage.

Table 2. ANOVA table of Rézoxiklorid 50 WP treatment

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	0.107(a)	7	0.015	0.898	0.531
Intercept	1.324	1	1.324	77.829	0.000
VARIETY	0.016	1	0.016	0.957	0.342
DAY OF MEAS.	0.085	3	0.028	1.667	0.214
VARIETY * DAY OF MEAS.	0.006	3	0.002	0.109	0.953
Error	0.272	16	0.017		
Total	1.703	24			
Corrected Total	0.379	23			

Pannon frankos and Narancsízű older leaf copper toxicity by Champion 50 WP (copper-hydroxide)

As *Table 2* indicates $p<0.05$ so we can say that there is a statistical difference between the days of measurement.

Table 3. ANOVA table of Champion 50 WP treatment

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	0.379(a)	7	0.054	3.821	0.013
Intercept	2.549	1	2.549	180.102	0.000
VARIETY	0.066	1	0.066	4.649	0.047
DAY OF MEAS.	0.312	3	0.104	7.339	0.003
VARIETY * DAY OF MEAS.	0.001	3	*0.000*	0.027	0.994
Error	0.226	16	0.014		
Total	3.154	24			
Corrected Total	0.605	23			

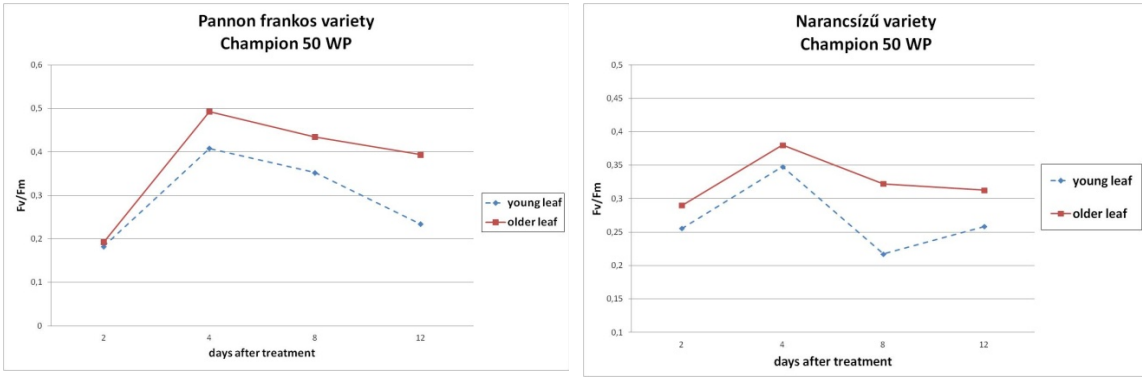


Figure 4. The effect of Champion 50 WP pesticide on the Y(II) of older leaves of Pannon frankos and Narancsízű varieties

Table 4. Multiple Comparisons of measurement day

(I) DAY	(J) DAY	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
1.00	2.00	-0.3009(*)	0.06868	*0.002*	-0.4974	-0.1044
	3.00	-0.2427(*)	0.06868	*0.013*	-0.4392	-0.0462
	4.00	-0.2176(*)	0.06868	*0.028*	-0.4141	-0.0210
2.00	1.00	0.3009(*)	0.06868	0.002	0.1044	0.4974
	3.00	0.0582	0.06868	0.831	-0.1383	0.2547
	4.00	0.0833	0.06868	0.628	-0.1132	0.2798
3.00	1.00	0.2427(*)	0.06868	0.013	0.0462	0.4392
	2.00	-0.0582	0.06868	0.831	-0.2547	0.1383
	4.00	0,0251	0.06868	0.983	-0.1714	0.2216
4.00	1.00	0.2176(*)	0.06868	0.028	0.0210	0.4141
	2.00	-0.0833	0.06868	0.628	-0.2798	0.1132
	3.00	-0.0251	0.06868	0.983	-0.2216	0.1714

Based on observed means.
* The mean difference is significant at the ,05 level.

Table 4 and *Table 5* indicate that there is a significant difference between each measuring days.

When we look at the F_V/F_m lines it is seen that in Pannon frankos Y(II) values were always higher than the control while in case of Narancsízű there was an inhibiting effect 2 days after the treatment *(Figure 4)*. In both varieties Champion 50 WP had a positive effect on photosynthesis.

A question arises whether the results are influenced by the change of Y(II) of the control leaves. We investigated it by running a two-way ANOVA between variety and control's older leaves. *Table 3* of ANOVA shows that there is no statistical difference in the measuring days so the Champion 50 WP results are only explained by the effect of the pesticide.

Table 5. ANOVA table of control

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	0.238(a)	7	0.034	1.720	0.174
Intercept	2.599	1	2.599	131.655	0.000
VARIETY	0.005	1	0.005	0.255	0.621
DAY OF MEAS.	0.071	3	0.024	1.201	0.341
VARIETY * DAY OF MEAS.	0.162	3	0.054	2.729	0.078
Error	0.316	16	0.020		
Total	3.152	24			
Corrected Total	0.554	23			

CONCLUSIONS

Based on our research we can conclude the followings:

- in therapy dosage copper is not toxic to varieties, however the date of recovery is significantly different
- control Y(II) did not change in the measurement period
- according to the ANOVA calculations, it is possible that copper-hydroxide has a positive effect on enzymatic activities
- the hypothesis that young leaves can be burnt by copper did not prove to be true
- difference between variety's copper sensitivity was not observed
- temperature and sunshine largely influenced the data obtained

REFERENCES

BILGER, W., SCHREIBER, U., BOCK, M., (1995): Determination of the quantum efficiency of photosystem II and of nonphotochemical quenching of chlorophyll fluorescence in the field. Oecologia. 1995;102:425–432.

SCHREIBER, U., SCHLIWA, W., U. BILGER (1986): Continuous recording of photochemical and non-photochemical chlorophyll fluorescence quenching with a new type of modulation fluorimeter. Photosynthesis Research, 10, 51-62.

SCHREIBER, U., BILGER, W., NEUBAUER (1995), C. Chlorophyll fluorescence as a nonintrusive indicator for rapid assessment of in vivo photosynthesis.

SCHULZE, E.D., CALDWELL, M.M. (eds). Ecophysiology of photosynthesis. Springer Berlin Heidelberg, 1994. V.100, p.49-70.

http://www.walz.com/downloads/manuals/mini-pam/MINIP_1EB.pdf

Review on Agriculture and Rural Development 2014. vol. 3 (1) ISSN 2063-4803

THE VARIATION OF SOME VEGETATION INDICES OF MAIZE UNDER THE INFLUENCE OF MINERAL FERTILIZATION

FLORIN SALA[1*], **DACIAN LUCHIAN**[1], **MARIUS BOLDEA**[2]

[1]Soil Science and Plant Nutrition Department, Banat University of Agricultural Sciences and Veterinary Medicine, "Regele Mihai I al României" from Timişoara, Romania
[2]Mathematics and Statistics, Banat University of Agricultural Sciences and Veterinary Medicine, "Regele Mihai I al României", Timisoara, Romania
florin_sala@usab-tm.ro

ABSTRACT
The present research studied the variation of foliar area and chlorophyll in maize under the influence of mineral fertilization.
The fertilizers applied were nitrogen, in doses that varied from 0 to 200 kg a.s. ha^{-1}, and the PK complex in doses between 0 and 150 kg a.s. ha^{-1}. The vegetation indices were studied in the leaf opposite the ear, and the determinations were made during the silking stage. The foliar area varied between 513.88±16.47 cm^2 in the control variant and 724.32±13.61 cm^2 in the variant with $P_{150}K_{150}N_{200}$. Chlorophyll values ranged from 30.74±0.89 to 55.93±0.73 SPAD units in the same variants. The experimental results present high degree of statistical certainty ($p< 0.01$; $F >> F$ crit, for Alfa = 0.001). The interdependence identified between the vegetation indices and the fertilizer doses was revealed by statistical-mathematical analysis (correlations and regressions) as well as by graphical representation.

Keywords: maize, foliar area, chlorophyll, mineral fertilizers

INTRODUCTION

Maize is one of the most important crop plants, being widely cultivated due to its multiple uses as food for humans and as fodder (TAGNE ET AL. 2008, OECD-FAO, 2013).
A large number of studies have focusses on the influence of climate changes on the population, on the vegetal cover, on agricultural crops and food safety, (HARTKAMP ET AL. 2001, IPCC 2001, JONES and THORNTON 2003, LOBELL ET AL., 2008). The relation between maize and vegetation and technological factors, with fertilizers in particular, has also widely been studied, for the purpose of ensuring qualitative and quantitative stability of the yield, (SCHRÖDER ET AL., 1996, DOUGLAS ET AL., 1998, SCHRÖDER ET AL. 2000, ANDRASKI and BUNDY, 2003, VETSCH and RANDALL, 2004, TAJUL ET AL., 2013).
The way in which plants make use of the vegetation conditions and especially of nutriments provided through fertilization is reflected in certain vegetation indices, such as foliar area and chlorophyll content, (LING and SILBERBUSH 2002). Both indices are directly involved in photosynthesis and therefore they are determining factors for the yield. Their assessment in the vegetation period helps in establishing the nutrition status and in estimating the yield.
Our research was aimed at evaluating maize vegetation status based on foliar area and chlorophyll content, as well as at finding the interdependence degree between fertilization and the values of vegetation indices under analysis.

MATERIAL AND METHOD

The present research evaluated the variation of foliar area and of chlorophyll content in maize, in the leaf opposite the ear, under the influence of mineral fertilization.

The fertilizers involved in our study included complex mineral fertilizers of the type NPK (S) + Zn and ammonium nitrate (35:0:0) in various combinations, making up the following variants: $P_0K_0N_0$, $P_0K_0N_{100}$, $P_0K_0N_{200}$, $P_{50}K_{50}N_{50}$, $P_{50}K_{50}N_{100}$, $P_{50}K_{50}N_{200}$, $P_{100}K_{100}N_{100}$, $P_{100}K_{100}N_{150}$, $P_{100}K_{100}N_{200}$, $P_{150}K_{150}N_{150}$ and $P_{150}K_{150}N_{200}$.

The soil in the location of the experiment was slightly gleyed cambic chernozem with medium fertility: *p*H = 6.85, poor phosphorus supply (P = 25.2 ppm) and good potassium supply (K = 184.26 ppm), the humus content being 2.86%:

The climate conditions in the crop years period 2011 – 2013 were generally characterized by rainfall deficit as compared with the multiannual average, and by uneven distribution of rainfall throughout the year, with droughts and high temperatures especially in July and August. These climatic particularities of the crop years influenced the evolution of the maize crop especially during flowering and pollination, formation and development of kernels on the cob.

The tested maize hybrid was DKC5143, with good productivity, stability and yield quality. The experimental variants were set in randomized blocks, in three replicates. The area of a variant was 30 m^2. Complex fertilizers were applied in autumn, and nitrogen fertilizers were applied in spring. Both fertilizations were made manually, for better uniformity. The crop technology ensured uniform conditions for plant growth and development.

The vegetation indices under study – foliar area and chlorophyll content - were studied in the leaf opposite the ear, and the determinations were made during the silking stage.

The experimental data were processed statistically through variance analysis, correlations, regressions, multivariate analysis using the statistic module from EXCEL 2007 and the programme PAST.

RESULTS AND DISCUSSIONS

Fertilization generated different conditions for growth and development of the maize plants. Therefore, the two variation indices studied, i.e. foliar area and chlorophyll, displayed specific variations. *Table 1* presents the results.

Table 1. Values of productivity elements of, hybrid DKC 5143, depending on fertilization

Variant \ Parameter		Foliar area (cm^2)	Chlorophyll (SPAD units)
Fertilizer dose	Variant number		
$P_0K_0N_0$	V_1 (Mt)	513.88±16.47	30.74±0.89
$P_0K_0N_{100}$	V_2	687.05±11.29	51.72±0.45
$P_0K_0N_{200}$	V_3	707.26±9.46	54,73±0.64
$P_{50}K_{50}N_{50}$	V_4	662.97±4.98	48.12±1.31
$P_{50}K_{50}N_{100}$	V_5	683.46±8.91	52.44±1.22
$P_{50}K_{50}N_{200}$	V_6	727.26±8.42	55.76±0.65
$P_{100}K_{100}N_{100}$	V_7	671.36±8.71	51.63±1.04
$P_{100}K_{100}N_{150}$	V_8	689.59±10.80	53.68±0.71
$P_{100}K_{100}N_{200}$	V_9	729.26±12.93	55.14±1.19
$P_{150}K_{150}N_{150}$	V_{10}	698.60±9.38	53.15±0.99
$P_{150}K_{150}N_{200}$	V_{11}	724.32±13.61	55.93±0.73

The values of foliar area ranged from 662.97±4.98 cm^2 in variant $P_{50}K_{50}N_{50}$ to

724.32±13.61 cm^2 in variant $P_{150}K_{150}N_{200}$, while in the control variant $P_0K_0N_0$ foliar area was 513.88±16.47 cm^2. The foliar area increase caused by mineral fertilization, in the leaf opposite the ear, varied between 149.09 and 230.44 cm^2.
The values of chlorophyll ranged from 48.12±1.31 SPAD units in variant $P_{50}K_{50}N_{50}$ to 55.93±0.73 SPAD units in variant $P_{150}K_{150}N_{200}$. Under the same experimental conditions, the chlorophyll content in the control variant was 30.74±0.89 SPAD units. The foliar area increase caused by mineral fertilization ranged from 17.38 to 25.19 SPAD units.
ANOVA statistical analysis proves that the experimental results have statistical assurance with high confidence degree ($p< 0.001$; $F >> F$ crit, for Alfa = 0.001), *Table 2*.

Table 2. ANOVA: Single Factor

Source of Variation	SS	df	MS	F	P-value	F crit
Between Groups	2794634	3	931544.5	177.2477	3.92E-23	6.59454
Within Groups	210224.3	40	5255.608			
Total	3004858	43				

Alfa = 0.001

Relations of interdependence were identified between the vegetation indices studied and the doses of fertilizer applied; the correlation degree of the two vegetation indices was higher with nitrogen than with the PK complex.

Table 3. Correlation matrices

	N	PK	FS	Chl
N	1.000			
PK	0.423	1.000		
FS	0.**874**	0.486	1.000	
Chl	0.**842**	0.458	0.**985**	1.000

FS – foliar surface; Chl – Chlorophyll content

The relation between foliar area and fertilization can be described by relation (1), with high degree of confidence and high statistical assurance ($R^2 = 0.778$; $p<0.01$).

$$FS = 575.715 + 0.7344N + 0.0783PK \quad (1)$$

The relation of chlorophyll with fertilization is described by relation (2), also with high degree of confidence and statistical assurance ($R^2 = 0.723$; $p<0.01$). The values of the coefficients corresponding to the two categories of fertilizers N and PK in equations (1) and (2) also define the participation degree of the two types of fertilizers for the realization of each index taken separately, whence the justification of different correlation degrees. The differentiated participation of nitrogen and the PK complex in the values of foliar area and chlorophyll is emphasized also by tridimensional graphic representation, *Figures 1 and 2*.

$$Chl = 39.1705 + 0.0831N + 0.0079PK \quad (2)$$

Positive correlation was identified between the two vegetation parameters, with high degree of significance, ($R^2 = 0.989$), *Figure 3*.
Multivariate analysis of experimental data grouped the variants into three distinct clusters: one includes the control variant, with the smallest values of the indices under analysis. The

other two clusters include 5 variants each, depending on the results generated, their grouping being obviously influenced by the doses of fertilizer applied, *Figure 4*. The cophenetic coefficient is 0.774, which indicates high certainty in grouping the variants.

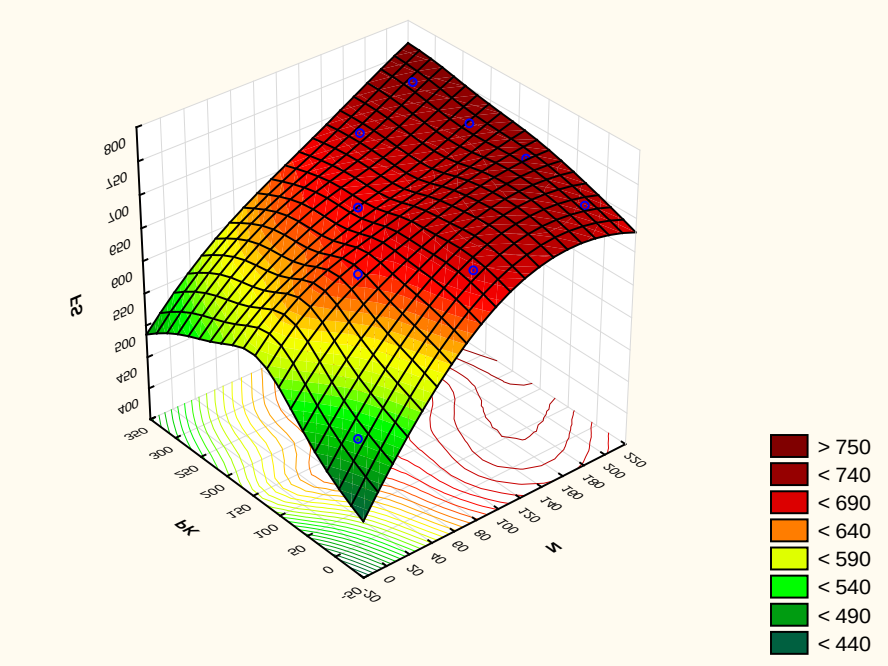


Figure 1. Tridimensional graphic representation of the foliar area distribution of maize, the leaf opposite the ear, under the influence of the two types of fertilizers (N and PK)

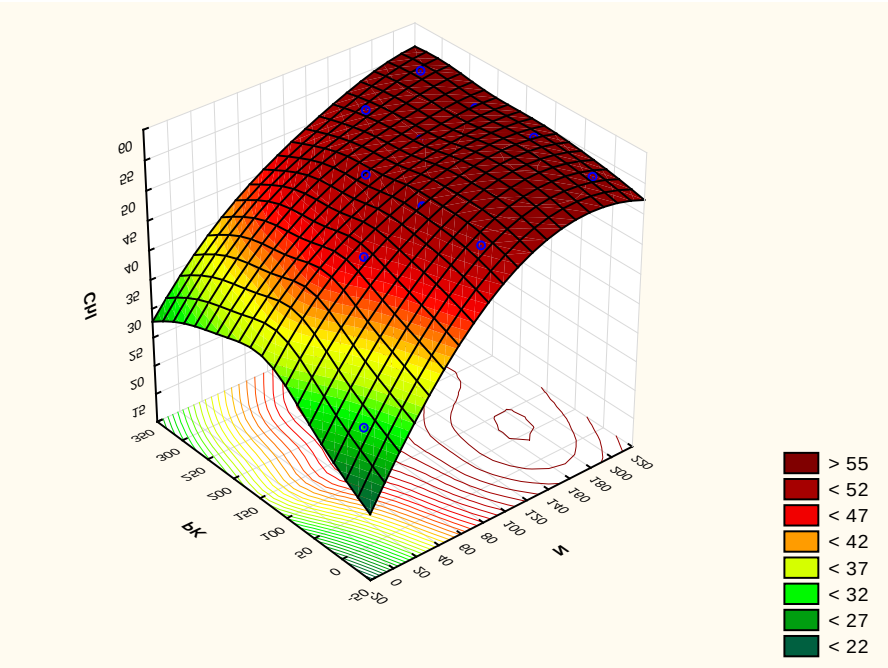


Figure 2. Tridimensional graphic representation of chlorophyll distribution in maize, the leaf opposite the ear, under the influence of the two types of fertilizers (N and PK)

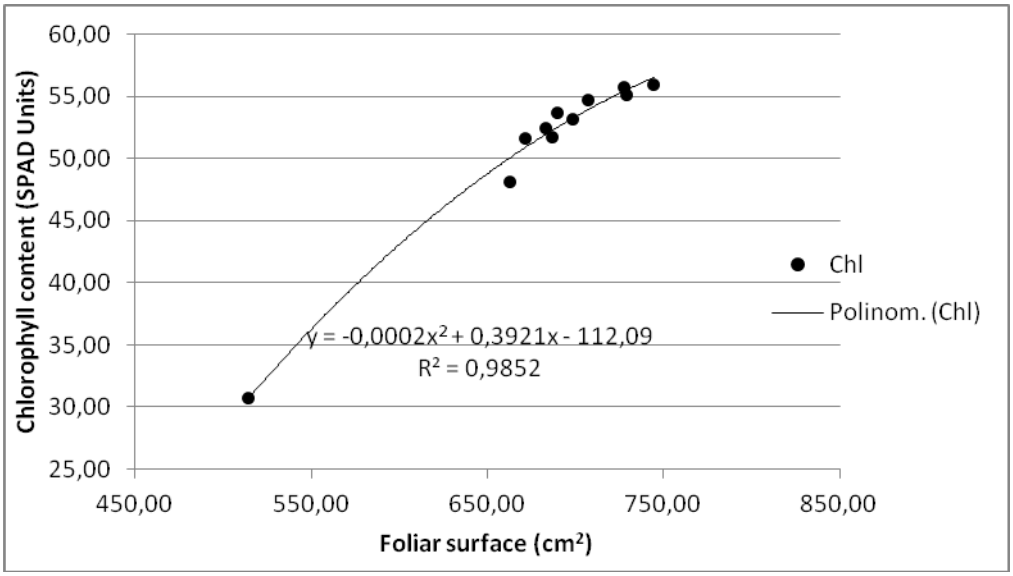


Figure 3. Graphic representation of the correlation between foliar area and chlorophyll content in maize, in the leaf opposite the ear, hybrid DKC5143

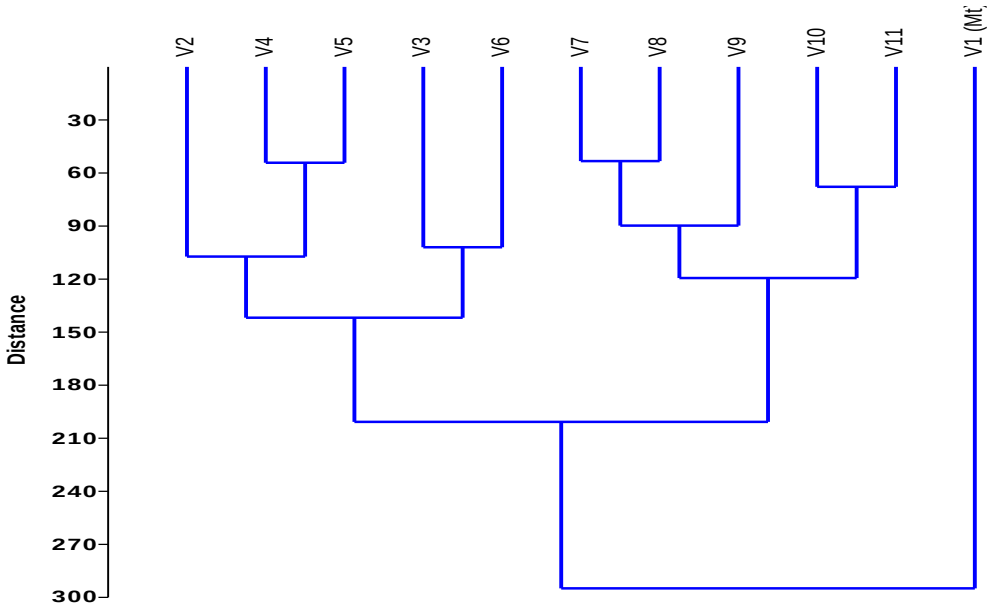


Figure 4. Cluster grouping of the variants based on the results generated

CONCLUSIONS

NPK mineral fertilization of maize determines different variation of the foliar area and chlorophyll in the leaf opposite the ear, in relation to the dose and combination of fertilizers. The contribution of nutrients in the fertilizers is different to the variation of the foliar area and chlorophyll as vegetation indices. Nitrogen has a greater contribution to the variation of the two indices (r = 0.874 for foliar surface; r = 0.842 for chlorophyll) than the PK complex, as revealed by statistical and mathematical methods (correlations and regressions) and by graphical methods, as well. Multivariate analysis allowed the grouping of variants based on similarity with high statistical assurance; cophenetic coefficient has the value 0.774.

ACKNOWLEDGEMENTS

The authors express their thanks to the staff of the Didactic and Experimental Station of the Banat University of Agricultural Sciences and Veterinary Medicine "Regele Mihai I al României" of Timișoara, Romania for facilitating the set-up of the experimental field for this research.

REFERENCES

ANDRASKI T. W., BUNDY L. G. (2003): Relationships between Phosphorus Levels in Soil and in Runoff from Corn Production Systems, Journal of Environmental Quality, Vol. 32, No. 1, p. 310-316.

DOUGLAS L. K., KRAMER L. A., LOGSDON S. D. (1998): Field-Scale Nitrogen Balances Associated with Long-Term Continuous Corn Production, Agronomy Journal, Vol. 90 No. 5, p. 644-650.

HARTKAMP A.D., WHITE J.W., RODRIGUEZ AGUILAR A., B. ANZIGER M., SRINIVASAN G., GRANADOS G., CROSSA J. (2001): Maize Production Environments Revisited. A GIS-Based Approach. International Maize and Wheat Improvement Centre, Mexico, DF. p. 1-33.

JONES P.G., THORNTON P.K. (2003): The potential impacts of climate change on maize production in Africa and Latin America in 2055, Global Environmental Change, Vol. 13 (1) 51-59.

LING F., SILBERBUSH M. (2002): Response of maize to foliar vs. soil application of nitrogen–phosphorus–potassium fertilizers, Journal of Plant Nutrition, Volume 25, Issue 11, p. 2333-2342.

LOBELL D.B., BURKEL M.B., MASTRANDREA M.D. CLAUDIA TEBALDI, FALCON W.D., NAYLOR R.L. (2008): Prioritizing Climate Change Adaptation Needs for Food Security in 2030, Science Vol. 319 no. 5863 pp. 607-610, DOI: 10.1126/science.1152339.

SCHRÖDER J.J., NEETESON J.J., OENEMA O., STRUIK P.C. (2000): Does the crop or the soil indicate how to save nitrogen in maize production?: Reviewing the state of the art, Field Crops Research, Volume 66, Issue 2, p. 151–164.

SCHRÖDER J.J., VAN DIJK W., DE GROOT W.J.M. (1996): Effects of cover crops on the nitrogen fluxes in a silage maize production system, Netherlands Journal of Agricultural Science 44, p. 293 – 315.

TAGNE A., FEUJIO T.P., SONNA C. (2008): Essential oil and plant extracts as potential substitutes to synthetic fungicides in the control of fungi, ENDURE International Conference Diversifying crop protection, La Grande-Motte, France.

TAJUL M. I., ALAM M. M., HOSSAIN S. M. M., NAHER K., RAFII M. Y., LATIF M. A. (2013): Hindawi Publishing Corporation, The Scientific World Journal Volume 2013, Article ID 193018, 9 pages http://dx.doi.org/10.1155/2013/193018.

VETSCH J. A. , RANDALL G. W. (2004): Corn Production as Affected by Nitrogen Application Timing and Tillage, Agronomy Journal, Vol. 96 No. *2*, p. 502-509.

*** Intergovernmental Panel on Climate Change (IPCC), (2001): Climate Change 2001: The Scientific Basis. Working Group 1 Contribution to the IPCC Third Assessment Report. Online at http://www.ipcc.ch, November 2001.

*** OECD-FAO Agricultural Outlok 2013 – 2022, (2013): http://www.oecd.org/site/oecd-faoagriculturaloutlook/highlights-2013-EN.pdf

Review on Agriculture and Rural Development 2014. vol. 3 (1) ISSN 2063-4803

THE RELATION BETWEEN PRODUCTIVITY ELEMENTS AND MINERAL FERTILIZATION IN WHEAT

FLORIN SALA[1*], **IOZSEF NEMET**[1], **MARIUS BOLDEA** [2]

[1]Soil Science and Plant Nutrition Department, Banat University of Agricultural Sciences and Veterinary Medicine, "Regele Mihai I al României" from Timişoara, Romania
[2]Mathematics and Statistics, Banat University of Agricultural Sciences and Veterinary Medicine, "Regele Mihai I al României", Timisoara, Romania
florin_sala@usab-tm.ro

ABSTRACT
The present research deals with the relation for determining productivity elements based on differentiated fertilization of wheat.
Ear length and spikelet number presented smaller variation amplitude, while grain number and the weight of the grains on the ear had greater variation under the influence of differentiated fertilization. The differences in the productivity elements under analysis have statistical assurance and high degree of certainty ($p<0.01$). Generally, nitrogen had a higher contribution to the formation of productivity elements ($R^2 = 0.853 – 0.946$) than phosphorus and potassium ($R^2 = 0.449 – 0.723$). Phosphorus and potassium played a more important part in the formation of the number of grains than in the other productivity elements. It is possible to predict with a high level of certainty ($p<0.01$) the productivity elements based on the doses of fertilizers applied. Nitrogen allows of better prediction than the PK complex.

Keywords: wheat, productivity elements, mineral fertilizers, prediction

INTRODUCTION

Wheat is one of the most important agricultural crops, and as such its biology and its relation with environmental factors have been the focus of a large number of studies, for the purpose of adapting agricultural technologies, (FISCHER 1985, SHEWRY 2009, DELCOUR ET AL. 2012).
Plant density, foliar area, nutrition state, ear length, spikelet number, number of grains, are individual morphological elements whose cumulated effect influences the formation of the agricultural crop, (HANSEN and SCHJOERRING 2003).
The productivity of wheat varieties is determined genetically, but at the same time it is influenced by soil and climate conditions, as well as by technological conditions, (STAPPER and HARRIS, 1989, AGGARWAL and KALRA 1994, ZHANG and OWEIS 1999).
Fertilization is one of the key factors that influence wheat productivity and yield, (JABLONSKYTĖ-RAŠČĖ ET AL. 2013). The differentiated state of nutrition given by fertilization ensures the different ways in which plants are formed and develop different values of productivity elements and finally different quality and quantity of the yield, (MULLA ET AL., 1992, TIMSINA and CONNOR 2001).
The present research deals with the relation between fertilization and productivity elements in wheat and also with the possibility to predict them based on the fertilizers applied.

MATERIAL AND METHOD

The research assessed the relations between mineral fertilization and productivity elements of winter wheat; ear length, spikelet number, number of grains and grain weight.

Fertilization was made with complex mineral fertilizers of the type NPK (S) + Zn and ammonium nitrate (35:0:0) in various combinations, which rendered the following variants: $P_0K_0N_0$, $P_0K_0N_{100}$, $P_0K_0N_{200}$, $P_{50}K_{50}N_{50}$, $P_{50}K_{50}N_{100}$, $P_{50}K_{50}N_{200}$, $P_{100}K_{100}N_{100}$, $P_{100}K_{100}N_{150}$, $P_{100}K_{100}N_{200}$, $P_{150}K_{150}N_{150}$ and $P_{150}K_{150}N_{200}$.

The research was set on slightly gleyed cambic chernozem with medium fertility: *p*H = 6.87, poor phosphorus supply (P = 24.3 ppm) and good potassium supply (K = 178.55 ppm), with a humus content of 2.87%:

The climate conditions in the crop years 2011 – 2013 were characterized by rainfall deficit as compared with the multiannual average, and by uneven distribution of rainfall throughout the year, with droughts and high temperatures especially in July and August. These climatic particularities of the experimental years did not have a significant influence over the wheat crop, as it was harvested at the beginning of July, and grain formation and maturation were finished in good conditions.

The biological material was represented by *Alex* cultivar, which has good productivity, stability and quality of the yield.

The experimental variants were set in randomized blocks, in three replicates. The area of a variant was 30 m^2. Complex fertilizers were applied in autumn, and nitrogen fertilizers were applied in spring. Both fertilizations were made manually, for better uniformity. General maintenance works were made uniformly within the general crop technology.

For determining the productivity elements, ear length, spikelet number, number of grains and the weight of grains on the ear, randomized plant samples were taken in each variant.

The experimental data were processed statistically through variance analysis, correlations, regressions, multivariate analysis using the statistic module from EXCEL 2007 and PAST software.

RESULTS AND DISCUSSIONS

The experimental variants obtained by fertilization caused different development of the wheat plants. For the same reason, specific variations were recorded in the productivity elements analysed, namely ear length, spikelet number, number of grains and the weight of the grains on the ear. These specific variations are presented in *Table 1*.

Table 1. Values of productivity elements of wheat, *Alex* cultivar, depending on fertilization

Parameter / Variant	Variant number	Ear length (cm)	Spikelet number	Grain number	Grain weight (g)
$P_0K_0N_0$	V_1 (Mt)	6.82±0.26	13.65±0.45	35.30±2.37	1.66±0.11
$P_0K_0N_{100}$	V_2	7.17±0.19	15.05±0.40	38.60±2.12	1.72±0.14
$P_0K_0N_{200}$	V_3	7.97±0.15	16.50±0.39	45.75±1.75	2.12±0.08
$P_{50}K_{50}N_{50}$	V_4	6.99±0.13	14.70±0.43	41.50±1.61	1.54±0.09
$P_{50}K_{50}N_{100}$	V_5	7.11±0.19	14.95±0.40	44.95±2.34	1.95±0.05
$P_{50}K_{50}N_{200}$	V_6	7.83±0.12	16.20±0.29	46.40±1.31	2.10±0.68
$P_{100}K_{100}N_{100}$	V_7	7.23±0.15	15.40±0.29	41.35±1.55	1.68±0.07
$P_{100}K_{100}N_{150}$	V_8	7.80±0.20	15.90±0.35	46.80±2.00	1.91±0.09
$P_{100}K_{100}N_{200}$	V_9	8.47±0.14	16.65±0.23	52.85±1.64	2.12±0.08
$P_{150}K_{150}N_{150}$	V_{10}	7.86±0.17	16.40±0.28	48.75±1.66	1.97±0.07
$P_{150}K_{150}N_{200}$	V_{11}	8.81±0.19	17.45±0.30	53.15±1.85	2.46±0.09

Ear length is the morphological and productivity element on which the other elements are

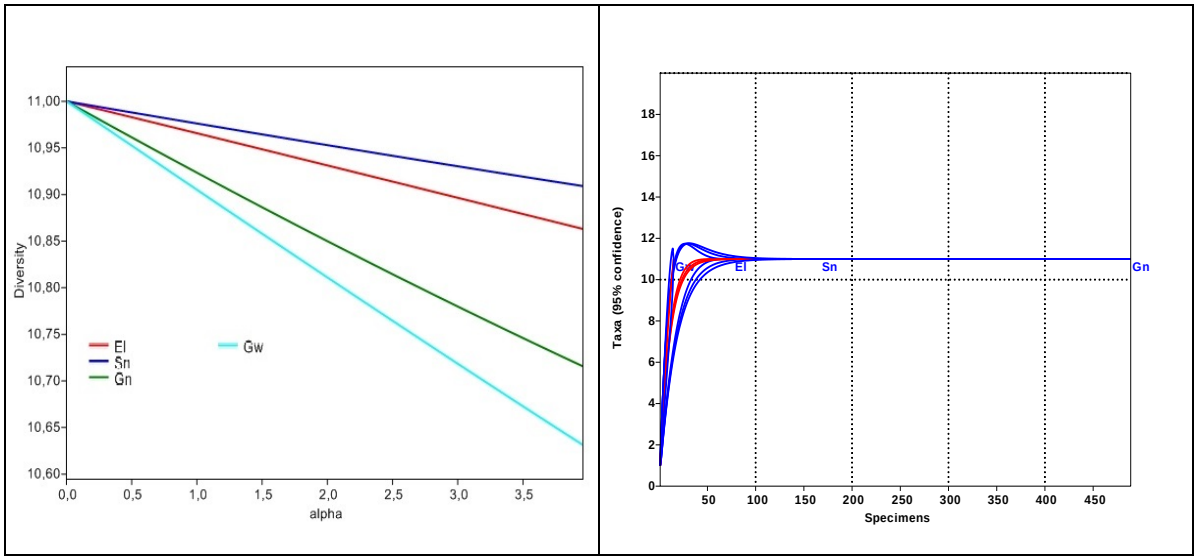
formed and develop: spikelet number, grain number and grain weight. As a result of differentiated fertilization, ear length varied between 6.99±0.13 cm in variant V_4 and 8.81±0.19 cm in variant V_{11}. In the control variant V_1, ear length was 6.82±0.26 cm. The values recorded for spikelet number ranged from 14.70±0.43 in variant V_4 to 17.45±0.30 in variant V_{11}, while the control variant gave 13.65±0.45 spikelets.
The number of grains on an ear had values between 38.60±2.12 in variant V_2 and 53.15±1.85 in variant V_{11}. In the same experimental conditions, the control variant V_1 gave 35.30±2.37 grains/ear. Grain weight on the ear gave values between 1.54±0.09 g in variant V_4 and 2.46±0.09 g in variant V_{11}. In the control variant, V_1 we recorded 1.66±0.11 g/ear grain weight.
The differences recorded about the productivity elements, generated by differentiated fertilization, are statistically assured, with a high confidence level ($p < 0.01$), *Table 2*.

Table 2. ANOVA: Single Factor

Source of Variation	SS	df	MS	F	P-value	F crit
Between Groups	12112.71	3	4037.571	497.0652	1.11E-31	6.59454
Within Groups	324.9128	40	8.12282			
Total	12437.63	43				

Alpha = 0.001

Of all productivity elements under analysis, the lowest variation amplitude generated by differentiated fertilization was recorded in spikelet number and ear length, and the highest was recorded in grain number and grain weight on an ear, as shown in *Figure 1*. This proves the greater dependence of grain formation (in terms of number and quality) on the nutrition state of plants than on the genetic factor.



a - Diversity profile b - Rarefaction curve

Figure 1. Variation amplitude of the productivity elements in relation with fertilizer doses (El – ear length; Sn – spikelet number; Gn – grain number; Gw – grain weight)

Between the two categories of variables analysed, i.e. fertilizers as an independent variable and productivity elements as dependent variables, we identified the relations of interdependence with different levels of significance, as shown in *Table 3*.
Under the climate and soil conditions specific for the research period, nitrogen had overall

a higher contribution to the formation of productivity elements than phosphorus and potassium. Analysis of the individual correlation values of the productivity elements with the fertilizer (*Table 3*) showed closer dependence of spikelet number and ear length to nitrogen. Phosphorus and potassium had a higher contribution to the formation of grain number than to any other productivity element.

Table 3. Correlation matrices (r) among the parameters determined

	N	PK	Length (cm)	Spikelet number	Grain number	Grain weight
N	1.000					
PK	0.423	1.000				
Length (cm)	0.888	0.607	1.000			
Spikelet number	**0.946**	0.628	**0.952**	1.000		
Grain number	0.853	**0.723**	**0.919**	**0.912**	1.000	
Grain weight	0.855	0.449	**0.906**	0.868	0.844	1.000

Based on the high values of the determined correlations, which express the interdependence between the two categories of variables, we studied the possibility to predict productivity elements by using the fertilizers applied. In the predictions presented below, the correlation given by R^2 was calculated on the predicted values.
Ear length prediction was possible with high certainty based on the two categories of nutrients, i.e. nitrogen and the phosphorus:potassium complex (R^2 = 0.854; r = 0.924; $p<0.01$), equation (1).

$$L_{ear} = 6.47384 + 0.00719N + 0.0016PK \quad (1)$$

Of the two categories of nutrients, nitrogen allows prediction with a higher certainty degree (R^2 = 0.930) *Figure 2*, than the PK complex, where potassium and phosphorus are considered together (R^2 = 0.432).
Spikelet number can be predicted with high certainty based on the fertilizer doses applied (R^2 = 0.957; r = 0.978; $p<0.01$), equation (2).

$$N_{spikelets} = 13.6176 + 0.01313N + 0.00268PK \quad (2)$$

Of the two categories of nutrients, nitrogen allows prediction with a higher certainty degree (R^2 = 0.939) *Figure 3*, than the potassium and phosphorus taken together (R^2 = 0.412).
Grain number can be predicted with high certainty based on the fertilizer doses applied (R^2 = 0.887; r = 0.942; $p<0.01$), equation (3).

$$N_{grains} = 34.8909 + 0.05431N + 0.0219PK \quad (3)$$

Of the two categories of nutrients, the prediction based on nitrogen is more certain (R^2 = 0.834) *Figure 4*, than the one made on phosphorus and potassium taken together (R^2 = 0.590). The PK complex ensures greater certainty for the prediction of this productivity parameter than for ear length and spikelet number.
Ear grain weight can also be predicted based on the fertilizer doses applied, but the certainty in this case is lower than for the other productivity elements under study (R^2 = 0.740; r = 0.860 ; $p<0.01$), equation (4).

$$G_{grains} = 1.4717 + 0.00319N + 0.00026PK \quad (4)$$

Analysis of the individual contribution of nutrients revealed that nitrogen gives a more certain prediction (R^2 = 0.988) *Figure 5*, than the phosphorus and potassium taken together (R^2 = 0.274).

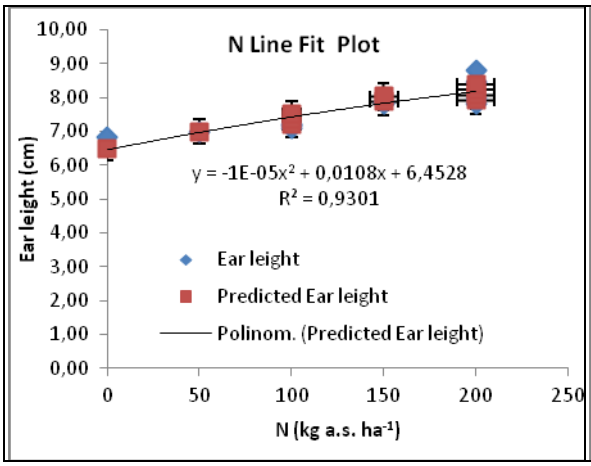


Figure 2. Prediction of ear length based on the nitrogen in the fertilizers

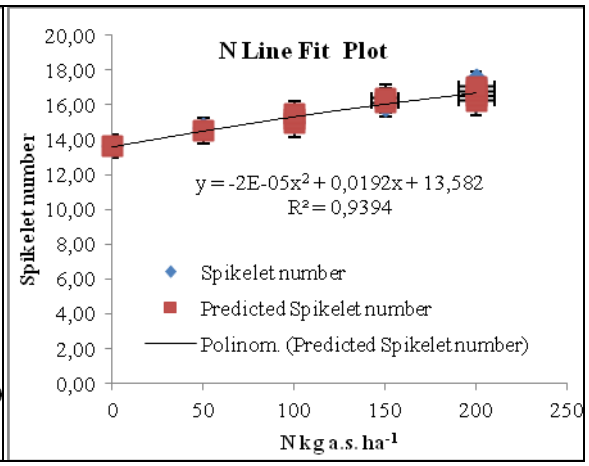


Figure 3. Prediction of spikelet number based on the nitrogen in the fertilizers

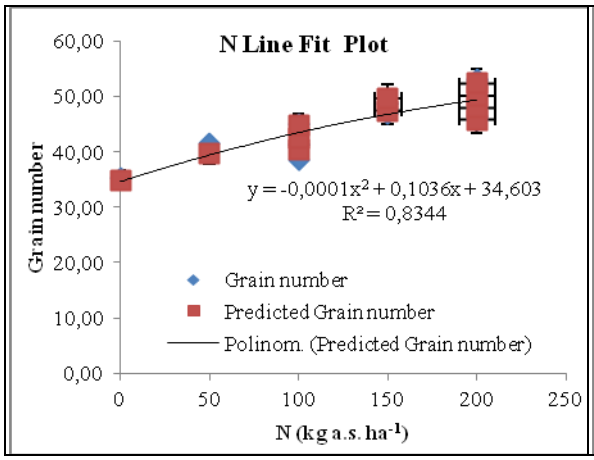


Figure 4. Prediction of grain number based on the nitrogen in fertilizers

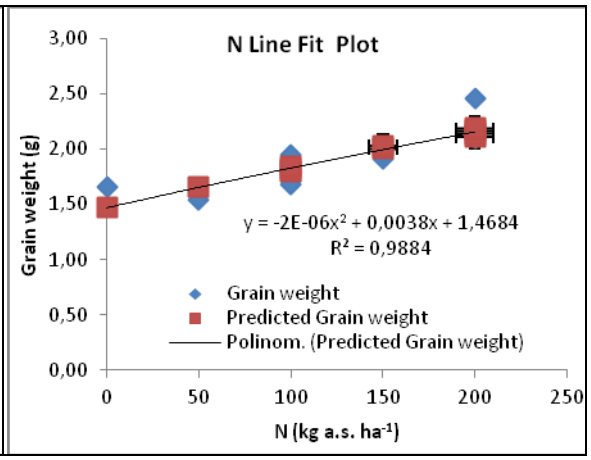


Figure 5. Prediction of ear grain weight based on the nitrogen in fertilizers

CONCLUSIONS

The productivity elements of wheat had specific variation induced by differentiated fertilization with nitrogen, phosphorus and potassium. The largest variation amplitude was recorded in grain number and grain weight, while the smallest variation appeared in ear length and number of spikelets.

Overall, nitrogen had a greater influence on the values and variation of productivity elements than phosphorus and potassium. The PK complex had a greater effect on the number of grains on an ear and a smaller effect on the other productivity elements.

Prediction of productivity elements based on the fertilizers applied is possible with higher certainty in the case of nitrogen.

ACKNOWLEDGEMENTS

The authors express thanks to the leaders and staff of the Didactic and Experimental Station of the Banat University of Agricultural Sciences and Veterinary Medicine "Regele Mihai I al României" of Timișoara, Romania for facilitating the set-up of the experimental field for this research. Biological material (wheat seed, Alex cultivar) was provided by the Agricultural Research and Development Station, Lovrin, Romania.

REFERENCES

AGGARWAL P.K., NAVEEN KALRA (1994): Analyzing the limitations set by climatic factors, genotype, and water and nitrogen availability on productivity of wheat II. Climatically potential yields and management strategies, Field Crops Research, Volume 38, Issue 2, p. 93–103.

DELCOUR J.A., JOYE I.J., PAREYT B., WILDERJANS E., BRIJS K., LAGRAIN B. (2012): Wheat gluten functionality as a quality determinant in cereal-based food products, Annu Rev Food Sci Techno. 3:469-92. doi: 10.1146/annurev-food-022811-101303.

FISCHER R.A. (1985): Number of kernels in wheat crops and the influence of solar radiation and temperature, The Journal of Agricultural Science, Volume 105 / Issue 02, p. 447 – 461, DOI: http://dx.doi.org/10.1017/S0021859600056495.

HANSEN P.M., SCHJOERRING J.K. (2003): Reflectance measurement of canopy biomass and nitrogen status in wheat crops using normalized difference vegetation indices and partial least squares regression, Remote Sensing of Environment, Volume 86, Issue 4, p. 542–553.

JABLONSKYTĖ-RAŠČĖ, D., STANISLAVA MAIKŠTĖNIENĖ, AUDRONĖ MANKEVIČIENĖ (2013): Evaluation of productivity and quality of common wheat (*Triticum aestivum* L.) and spelt (*Triticum spelta* L.) in relation to nutrition conditions, Zemdirbyste-Agriculture, vol. 100, No. 1, p. 45–56, UDK 633.111:631.47:631.8 / DOI 10.13080/z-a.2013.100.007.

MULLA D.J., BHATTI A.U., HAMMOND M.W., BENSON J.A. (1992): A comparison of winter wheat yield and quality under uniform versus spatially variable fertilizer management, Agriculture, Ecosystems & Environment, Volume 38, Issue 4, p. 301–311.

SHEWRY P.R. (2009): Wheat, Journal of Experimental Botany, Vol. 60, No. 6, p. 1537–1553, doi:10.1093/jxb/erp058.

STAPPER M., HARRIS H.C. (1989): Assessing the productivity of wheat genotypes in a Mediterranean climate, using a crop-simulation model, Field Crops Research, Volume 20, Issue 2, March 1989, p. 129–152.

TIMSINA J., CONNOR D.J., (2001): Productivity and management of rice–wheat cropping systems: issues and challenges, Field Crops Research, Volume 69, Issue 2, p. 93–132.

ZHANG H., OWEIS T. (1999): Water–yield relations and optimal irrigation scheduling of wheat in the Mediterranean region, Agricultural Water Management, Volume 38, (3), p. 195–211.

Review on Agriculture and Rural Development 2014. vol. 3 (1) ISSN 2063-4803

THE ENERGETIC UTILISATION OF CRYSTALLINE SOLAR CELL SYSTEMS, IN THE SIZE OF DOMESTIC SMALL POWER STATIONS IN 2014

HENRIK ZSIBORÁCS, BÉLA PÁLYI

University of Pannonia, Georgikon Faculty of Agriculture, Hungary-8360 16 Deák Ferenc Street Keszthely, Hungary
ifj.zsiboracs.henrik@gmail.com, palyi@georgikon.hu

ABSTRACT
Human life is based on energy consumption, and one of the biggest challenges is that the world's demand for energy continues to grow. The aim of present study is to review the world's energy demand and energy supply, the determination of the degradation of solar cells, the characteristics of the Hungarian energy supply, the introduction of renewable energy utilization and the economic determination of the return of crystalline solar systems in Hungary.
The main direction of my recent research is the utilization of photovoltaic solar energy. The studies were performed with crystalline solar systems. The research was carried out in solar-electric power plants extended from 2 kWp to 16.5 kWp.
The study included the investment of crystalline solar cell systems. The calculation of payback time was performed by static and dynamic indices.

Keywords: renewable energy, solar energy utilisation, crystalline solar systems, static and dynamic indices

INTRODUCTION

Sunshine is free and never gets used up. Also, there is a lot of it. The sunlight that hits the Earth in an hour has more energy than the people of the world use in a year. A little device called a solar cell can make electricity right from sunlight. A solar cell doesn't give off any gases. It doesn't even make any noise (HANTULA, 2010).
Energy generated by solar cells is free, which reduces the energy dependence on other countries. A system like this spares the supply of raw materials, affects the local economy advantageously and it is not necessary to transport energy on long distances. Unfortunately, solar energy can be planned ahead in a limited way, which is available in the largest quantities in summer. PV systems involve significant investment, but they do not contain moving parts (except for the inverter) and ideally it has to be maintained in every 10 or 15 years.

MATERIAL AND METHOD

The characteristics of the Hungarian energy supply

Hungary's energy consumption was 1162.4 PJ in 2011, 39.17% of which was domestic production and 60.83% of which was import. In our country, the oil and gas consumption is almost 65%. The nuclear energy use is significant and the use of coal shows a slight downward trend. The share of renewable energy in 2011 was more than 7.85% (VER, 2011).

Solar Cells

Solar Cells come in various sizes. Some are tinier than a stamp. Some are 12 centimeters across. The cells are made of a type of material known as a semiconductor. Often, they are

made of silicon. Semiconductors can conduct, or carry, electricity. They don't do this as well as metals, however. That is why they are called "semi." Because they only "semi" conduct electricity, they can be used to control electric current. On their top and bottom they typically have metal contacts through which current can flow. A typical simple cell has two layers of silicon. One is known as n-type. The other is p-type. The layers are different from each other. The process of making electricity begins when the silicon atoms absorb some light. The light's energy knocks some electrons out of the atoms. The electrons flow between the two layers. The flow makes an electric current. The current can leave the cell through the metal contacts and be used. When light hits a solar cell, much of its energy is wasted. Some light bounces off or passes through the cell. Some is turned into heat. Only light with the right wavelengths, or colors, is absorbed and then turned into electricity. A single simple solar cell makes only a little electricity. For most purposes more is needed. For this reason, cells are often linked together in groups known as solar modules. A solar module has a frame that holds the cells. Some modules are several feet long and wide. They usually can produce up to a few hundred watts of electricity. If more power is needed, modules can be joined together to form a large solar array (HANTULA, 2010).

Solar Cell degradation

Solar technology is adapting and getting better every day, the leading providers test the product in extreme conditions to ensure that they can provide solar panels that will provide us with the greatest capacity for the longest amount of time. Most warranty conditions declare that their panels are guaranteed to produce around 80% of maximum capacity after 20 years. This falls in line with the UK Government Feed in Tariff that currently are based on 20 years also. This suggests that the majority of solar panel manufacturers' believe that their panels will last a minimum of 20 to 25 years, but in a competitive market manufacturers are always competing to provide the most reliable and efficient product, we hope that this transfers to benefits for the consumer (www.theecoexperts.co.uk). In the research the degradation of solar cells was noted as 0.5% / year.

Static indicators

Their features is that they do not take the money value of time into account (NÁBRÁDI ET AL., 2008).

Average profitability of the investment

It expresses the efficiency of the investment and the relationship of expenditure and profit in its simplest form (NÁBRÁDI ET AL., 2008).

Br =(E /B)*100

Br the profitability of investment (%)
E the average annual return of investment (HUF)
B one-time investment cost (HUF)

Payback time

It expresses how many years it takes the investment to return from average surplus (NÁBRÁDI ET AL., 2008).

Bm = B/E

Bm the payback period of investment (years)
E the average annual return of investment (HUF)
B a one-time investment cost (HUF)

Dynamic indicators
Dynamic calculation methods take the time factor into account.

Net present value (NPV)
In finance, the Net Present Value (NPV) or Net Present Worth (NPW) of a time series of cash flows, both incoming and outgoing, is defined as the sum of the present values (PVs) of the individual cash flows of the same entity (Net Present Value).

$$\mathbf{NPV} = \sum_{i=1}^{n} \frac{Ri - Ii - Ci}{(1+r)^i}$$

NPV Net Present Value (HUF)
n time of use (years)
Ri receipts in i year (HUF)
Ii investment cost of the i year (HUF)
Ci operating costs in i year (HUF)
r discount rate (%/100)

Internal Rate of Return (IRR)
The internal rate of return on an investment or project is the "annualized effective compounded return rate" or "rate of return" that makes the net present value (NPV as NET*1/(1+IRR)^year) of all cash flows (both positive and negative) from a particular investment equal to zero. It can also be defined as the discount rate at which the present value of all future cash flow is equal to the initial investment or in other words the rate at which an investment breaks even (www.investopedia.com).

Benefit/Cost Ratio, BCR
BCR 1: It shows how many times the discounted sum of the one-time investment and ongoing costs of operation return from the discounted sums of incomes generated during the investment (NÁBRÁDI ET AL., 2008).
BCR 2: It shows how many times the discounted sum of the expenditures of one-time investment returns from the discounted sum of net profit generated during the investment (NÁBRÁDI ET AL., 2008).

$$\mathbf{BCR_1} = \frac{\sum PV(R)}{\sum PV(I) + \sum PV(C)} \qquad \mathbf{BCR_2} = \frac{\sum PV(R) - \sum PV(C)}{\sum PV(I)}$$

PV (R) Present Value of Output (HUF)
PV (I) Present Value of Investment (HUF)
PV (C) Present Value of Costs (HUF)

Profitability index (PI)
Profitability index (PI), also known as profit investment ratio (PIR) and value investment ratio (VIR), is the ratio of payoff to investment of a proposed project. It is a useful tool for ranking projects because it allows you to quantify the amount of value created per unit of investment (www.absoluteastronomy.com).
PI = PV(R)/PV(C)
If PI > 1 then accept the project
If PI < 1 then reject the project

Discounted payback period

It indicates how many years of discounted income is needed to return the sum of the initial investment (NÁBRÁDI ET AL., 2008).

RESULTS

Cost of solar PV systems built in Hungary in 2014

In Hungary it is not cheap to build solar PV systems, but in the last few years prices have fallen dramatically. Price changes in our country are slowly perceptible. The price/Watt relationship of 9 different solar systems of different performance was compared (types produced for network, fixed onto slanted roof, finished systems) (www.bacs-napkollektor.hu).

The type of solar panels is Jüllich and the brands of inverters are EHE and Fronius. The decline in the price of the finished system is not completely in accordance with capacity of the installed power. Upto 5 kWp decrease can be experienced, over 5 kWp there is a smaller price increase. The cheapest system regarding the watt / price connection is the 16,5 kW system (three-phases, one inverter) (*Figure 1*).

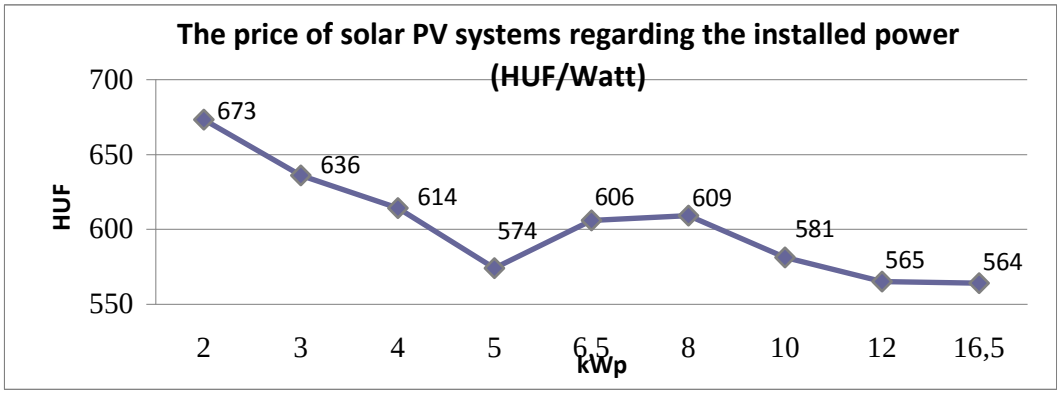


Figure 1. Gross cost of the finished solar PV systems in 2014, depending on the installed capacity (HUF) / Watt)

The examination of the theoretical payback time of crystalline PV systems, in domestic small power station sizes

The payback period was examined by static and dynamic indicators. Planning was helped by SolarGIS data, which provides high-resolution climate data, maps, software and services for on-line access to solar energy. 1200 kWh/m^2 –1360 kWh/m^2 power comes to Hungary every year. In theory a 1kW solar power plant can utilize this energy (20°-25°, including losses).

1 kWh of produced solar energy means a gross 37.47 HUF / kWh savings to private individuals in 2014. Energy measurement is carried out with a two-way measuring device. Excess energy can be sold at 15.44 HUF / kWh, so in the current situation solar power plants should be designed, that they do not produce more energy than we can use in a year (www.solargis.info/,www.eon.hu).

Analyzed systems were of 2 kWp, 5 kWp and 16.5 kWp solar PVs, assuming 100% own capital. These systems include 1 inverter. Characteristics of solar systems is, that they do not require any maintenance for 10-15 years if the instalment is professional. The energy that can be produced in one year: In the case of a 1 kWp nominal power solar system 1280 kWh were taken into account (the average of 1200 kWh and 1360 kWh). The annual

amortization is 0.5% / year, the returns were examined for 15 to 30 years *(*www.solargis.info/, www.bacs-napkollektor.hu*).*
The life expectancy of inverters is 10-15 years. The replacement is assumed in 15 years' time. Then we calculated operation, maintenance and replacement costs. The price of electricity has been considered with 4% annual price increase (Starting from 2014 / 37.47 HUF / kWh), assuming 100% consumption of energy. Different kinds of natural damage (lightning, hail) were not taken into account. A financial discount rate of 8% was calculated because this value is the applied in the financial sector. On the other hand 8% financial discount rate should be applied to the cash flows discounting (NFÜ, 2008) (*Table 2*).

Table 2. Savings in 1 year in the case of a 1kWh solar PV system in Hungary

1kW solar power plant energy produced, min/max (kWh)	1280
Electricity supply retail selling price of electricity in 2014 (HUF /kWh)	37.47
Overcapacity purchase price in 2014 (HUF/kWh)	15.44
Savings at 100% utilization (HUF)	**47961**
Savings at 80% utilization (HUF)	42321
Savings at 60% utilization (HUF)	36681
Savings at 0% utilization (HUF)	**19763**

The results of static and dynamic indicators

The results of static indicators
The data clearly show that the profitability of a 2 kWp system is 9.2% in the first 15 years, while a 16.5 kWp system is 10.9%, then 10.6 and 12.9%. It can be seen that the profitability of the smallest system is 1.7% lower in 15 years compared to 16.5 kWp system. During 30 years this value goes up to 2.3%. The payback period by solar power plants is can be made among 10 and 14 years (*Table 3*).

Table 3. Analysis of the profitability of investment and the investment payback

Years	**15**	**30**	**15**	**30**	**15**	**30**
The size of the system (kWp)	2		5		16.5	
E (HUF)	123 212	164 518	308 029	411 296	1 016 495	1 357 275
B (HUF)	1 346 200	1 546 200	2 870 200	3 258 820	9 311 640	10 488 930
Br=E/B*100 (%)	9.2	10.6	10.7	12.6	10.9	12.9
Bm=B/E (Years)	10.93	9.40	9.32	7.92	9.16	7.73

The results of dinamic indicators

NPV, PI, BCR1, BCR2: The examined plants are not recommended to be implemented in 15 years (*Table 4*).

IRR: The investment proposals will not be accepted.

Table 4. Dynamic indicators analysis in 15 years

Years	**15**		
System size (kWp)	**2**	**5**	**16.5**
Investment costs (HUF)	1 346 200	2 870 200	9 311 640
Maintenance costs (HUF)	0		
Electricity charge savings, at the same price (HUF)	1 848 173	4 620 433	15 247 431
r = interest (%)	**8**		
Present value savings (HUF)	1 004 623	2 511 558	8 288 144
NPV (HUF)	- 341 576	-358 641	-1 023 496
IRR (%)	**3.90**	**6.06**	**6.30**
BCR1	0.75	0.88	0.89
BCR2	0.75	0.88	0.89
PI	0.74	0.87	0.89
Discounted savings time (Year)	-	-	-

Table 5. Dynamic indicators analysis in 30 year

Years	**30**		
System size (kWp)	**2**	**5**	**16.5**
Investment costs (HUF)	1 546 200	3 258 820	10 488 930
Maintenance costs (HUF)	200 000	388 620	1 177 290
Saving Electricity charge, the same price (HUF)	4 935 546	12 338 865	40 718 256
r = interest (%)	**8**		
Present value savings (HUF)	1 533 669	3 834 173	12 652 772
NPV (HUF)	187 469	963 973	3 341 132
IRR (%)	**9.09**	**10.68**	**10.87**
BCR1	1.09	1.29	1.31
BCR2	1.09	1.30	1.32
PI	1.13	1.33	1.35
Discounted savings time (Year)	**26.33**	**22.45**	**22.08**

NPV, PI, BCR1, BCR2, IRR: The examined systems are recommended to be realized, but the payback period is very long, about 26 years (*Table 5*).

CONCLUSIONS

An average Hungarian family needs 2500-5000 kWh of electricity / year. This demand can be reduced significantly by the 2 kWp or the 5 kWp photovoltaic system. The cost of a 5 kWp system is slightly more expensive regarding watts / price (maintenance and replacement costs), than the 16.5 kWp solar power plant, but it is much cheaper. The

investment cost of the 2 kWp system was the worst regarding watts / price (also in payback time). In this case the cost of the inverter is the most expensive.
Licensing, design, construction costs are not negligible, which are also more expensive in the case of a low capacity system compared to the total costs. Unfortunately it is difficult to model the future. An unexpected factor is for example, the reduction of electricity prices introduced in 2014. Unfortunately, a solar system becomes recoverable later. In Hungary a solar power plant based on the applied models at 100% of personal funds returns in a long time. It would be appropriate to support not only companies in a project like this, but also individuals. It would be important to rationalize the transfer price of the extra energy. In households this amount is 15.44 HUF net. The price of the solar energy under 20 MW or in the case of smaller solar PV power plants is 32.49 HUF net in 2014 (www.eh.gov.hu).

ACKNOWLEDGEMENT

This work we would like to thank the Zsiborács family, without whom the research would not have been possible.

REFERENCES

A Magyar Villamos Energia-Rendszer (VER) 2011 Évi Statisztikai Adatai. Pdf. Magyar Energia Hivatal.
http://www.mavir.hu/documents/10258/154394509/statisztika_bel_2011_web_jav_1008.pdf/b0e712fc-2ded-46f5-a218-d89fa84bcb19
NÁBRÁDI A., PUPOS T., TAKÁCSNÉ GYÖRGY K. (2008): Üzemtan I. Szaktudás Kiadó Ház, Budapest. p. 193.
NET PRESENT VALUE (NPV). Calculating net present value a retailers perspective. Pdf. Zumo retail http://zumocalculators.com/retail/corporate_responsibility.php
NFÜ. Nemzeti Fejlesztési Ügynökség. Humán Erőforrás Programok Irányító Hatósága. Segédlet jövedelemtermelő projekt pénzügyi elemzéséhez. 2008. Pdf.
HANTULA, R. (2010): How Do Solar Panels Work (Science in the Real World). Pdf. Amazon Digital Services, Inc. p. 32.
http://www.absoluteastronomy.com/topics/Profitability_index
http://www.bacs-napkollektor.hu/napelem.html
http://www.eh.gov.hu/hatosagi-arak-2/villamos-energia/kotelezo-atvetel.html
http://www.eon.hu/Aram_informaciok_arak
http://www.eon.hu/eon.php?id=290
http://www.investopedia.com/terms/i/irr.asp
http://www.solargis.info/doc/_pics/freemaps/1000px/ghi/SolarGIS-Solar-map-Hungary-en.png
http://www.theecoexperts.co.uk/how-long-do-solar-panels-last

Review on Agriculture and Rural Development 2014. vol. 3 (1) ISSN 2063-4803

INFLUENCE OF SOME FOOD ADDITIVE CHEMICALS TO *PHOMOPSIS VITICOLA* SACC.

İSMET YILDIRIM

Çanakkale Onsekiz Mart University Agricultural Faculty, Department of Plan Protection
Çanakkale, Türkiye
yismet96@gmail.com

ABSTRACT
The effects of food additives potassium sorbate, sodium benzoate, sodium bicarbonate, and classical mancozeb on mycelial growth and the yield of pycnidium and pycnidiospore production of *Phomopsis viticola* were tested in vitro. Food additive chemicals were tested at five different dosages, 100; 300; 600; 1000 and 1600µg ml-1, mancozeb was tested only at recommended dose. Food additives showed inhibitory effect at different levels on mycelial growth of fungus isolates. According to the ED_{50} values at the 5th day, potassium sorbate (375 µg ml^{-1} for isolate İzmir 2 and 700 µg ml^{-1} for isolate Salihli 2) showed significant inhibition effect on the radial mycelial growth of fungal isolates. Similar efficacy for İzmir 2 and Salihli 2 was obtained at the highest doses (990 µg ml^{-1} for İzmir 2 and 1150 µg ml^{-1} for Salihli 2) from sodium bicarbonate and (1040 µg ml^{-1} for İzmir 2 and over 1600 µg ml^{-1} for Salihli 2) from sodium benzoate. MIC values of food additives on mycelial growth of *P. viticola* were found higher than 1600 µg ml^{-1}. The food additives at increasing doses were more successful on the pycnidia and pycnidiospores inhibition than on mycelial growth. The strongest inhibition among food additives on the pycnidia and pycnidiospores production was determined in potassium sorbate with dose between <100 µg ml^{1} and 620µg ml^{-1}. However, ED_{50} values of sodium benzoate were found lower than potassium and sodium bicarbonate had. While MIC of potassium sorbate was 1000µg ml^{-1} on pycnidium production; on pycnidiospore it was 600 µg ml^{-1}. Whereas MIC values of sodium benzoate and sodium bicarbonate were determined higher than potassium sorbate. Data obtained from the research demonstrated that food additives may be used against *P. viticola* in organic and traditional viticulture after field experiments.

Keywords: *Phomopsis viticola*, food additives.

INTRODUCTION

Phomopsis viticola is a well-known pathogen of *Vitis vinifera* cultivated in many of the vine-growing areas of the World (HEWITT AND PEARSON, 1998; PEARSON AND GOHEEN, 1994). Phomopsis causes important crop losses due to shoots breaking off near the basis where the lesion formed, reduced growth in vine shoots, loss of vigour, smaller bunches and sometimes as a result of fruit being infected (PINE, 1959; PSCHEIDT AND PEARSON, 1989). The fungus overwinters as mycelium and pycnidia in the bark, and also mycelium occurs in dormant buds. Both forms, especially pycnidia are significant for primer infection of *P. viticola*. Infection generally occurs in spring when shoots begin to grow, and mycelia and pycnidiospores, especially α-spores play important role for this infections. Spores are released in large quantities from the pycnidia on infected canes, spurs and bark, are splashed by rain onto newly developing shoots (HEWITT AND PEARSON, 1998). Infection occurs when free moisture remains on the unprotected green tissue for many hours, and symptoms become visible shortly afterwards. A synthetic fungicide may be used against to Phomopsis cane and leaf spot in the dormant period to help clean up overwintering inoculum and lessen the risk of new shoot infection. In severely affected vineyards, both dormant and spring treatments may be advisable (HEWITT AND PEARSON, 1998). Protective fungicides on new plant growth early in the growing season and eradicant fungicides could be applied during dormancy (CHAIRMAN ET AL., 1982). Some fungicides like captan, maneb, mancozeb, propineb, methiram complex and bordo mixture

have been registered against *P. viticola* in Turkey. Phomopsis cane and leaf spot may be controlled by synthetic fungicides; however, most of the fungicides embody the risk of leaving residue on products and have negative effects on human beings, animals and environment (WIGHTWICK AND ALLINSON, 2007; KOMAREK ET AL., 2010). In this context, recent studies have focused on alternative chemicals and biological agents in the control of pathogens (ARCHBOLD ET AL., 1997; SKIRDAL AND EKLUND, 1993; YILDIRIM AND YAPICI, 2007).

In this study the effect of food additives, potassium sorbate, sodium benzoate and sodium bicarbonate on the mycelial growth and yield of pycnidia and pycnidiospore of *P. viticola* were determined *in vitro*.

MATERIAL AND METHOD

Origin of *Phomopsis viticola* isolates

P. viticola isolates (İzmir 2 and Salihli 2) were obtained from infected cane (*Vitis vinifera* L. cv 'Sultana Seedless') obtained from vineyards in İzmir and Manisa, Türkiye. Cultures were grown on PDA in petri plates at 21 °C in the incubator, and then transferred into tubes including PDA medium for obtaining stock culture.

Natural Chemicals

To determination of inhibition effects of the food additives against *Ph. viticola*, potassium-sorbate, sodium benzoate, sodium bicarbonate, and a synthetic fungicide mancozeb were tested *in vitro* essays. The food additives were used in dose series as 0 (control); 100; 300; 600; 1000 and 1600 μg ml^{-1}. Mancozeb was used only in registered dosage (160 g a.i. 100 l^{-1} water). Some characteristics of the test chemicals are shown in *Table 1*.

Table 1. Some properties of the test chemicals

Commercial name	Formulation and ratio of a.i. (%)	Firm
Potasyum sorbate	$C_6H_7O_2K$, 150.22	Selen Kim. Tiç. Ltd.
Sodium benzoate	$C_7H_5NaO_2$, 144.11	Selen Kim. Tiç. Ltd.
Sodium bicarbonate	$NaHCO_3$ 99.00	Carlo Erba
Fumazin 80 WP	Mancozeb 80 WP	Hektaş AŞ.

Effects of Test Chemicals on Mycelial Growth

The stock isolates were grown on PDA medium for 5 days, and agar plugs (Ø4 mm) taken from fungal cultures by a sterile cork-borer were then placed onto surface of PDA medium with or without test chemical. The petri dishes sealed with plastic film after inoculation were incubated at 23 ºC in dark. Colony diameters at the widest point were measured at 24 hours intervals during 5 days. The inhibitory effects of chemicals were determined by comparing with colony diameters in the supplemented and un-supplemented medium. ED_{50} values of chemicals were found by semi-logarithmic graphics. The trials were arranged in a randomized complete block design with three replications.

Effects on Yield of Pycnidia and Pycnidiospores

After 20 days from inoculation, the numbers of Pycnidia were determined on the supplemented and un-supplemented media. Counted pycnidia were taken by means of

forceps, and were transferred into tubes including 10 ml sterile deionized water. Pycnidiospores were provided to pass into water by stirring for 10 min by means of vortex, which was then filtered through cheesecloth to remove the pycnidia and other debris. α-spores densities were determined with a haemocytometer (Precicolor HBG, Germany) by adding 20 ml sterile deionized water into the suspension.

The inhibitory effects of chemicals were determined by Abbot Formulation, and ED_{50} values (effective concentrations of the chemicals that reduced the pycnidia and Pycnidiospores numbers by 50%) were found by semi-logarithmic graphics.

RESULTS

The effects of the chemicals on colony growth of *Phomopsis viticola* (isolates: İzmir and Salihli 2) at 5th days after inoculation are presented in *Figure 1*.

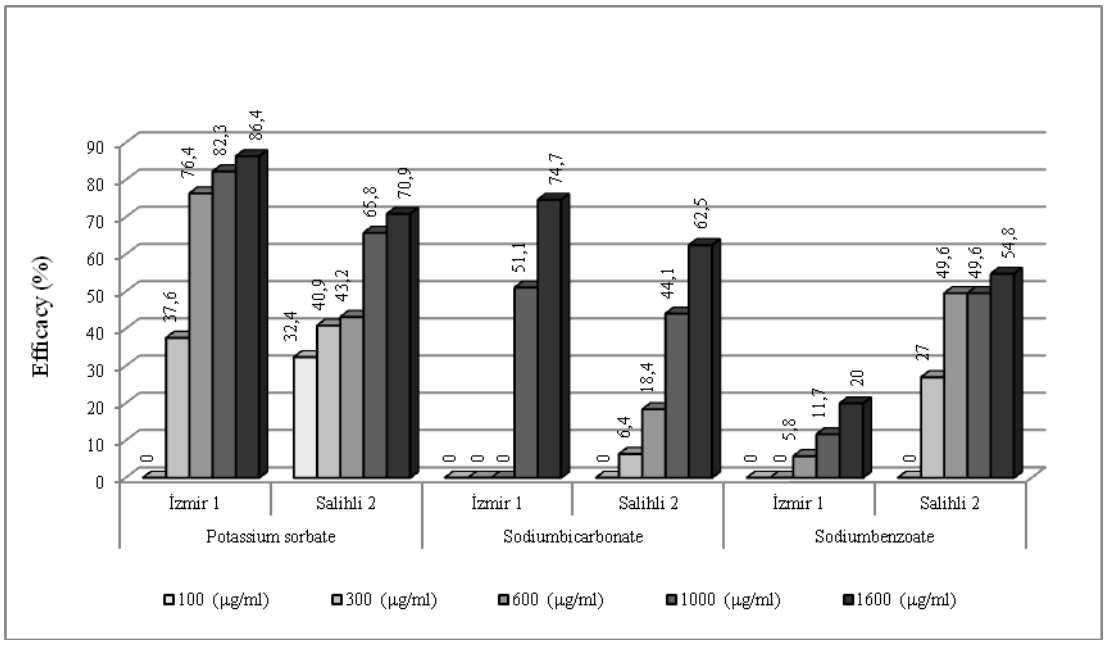


Figure 1. Efficacies of test chemicals on mycelial growth of *Phomopsis viticola* (isolates: İzmir 2 and Salihli 2) at 5th day

Test chemicals exhibited varying degrees of effect on mycelia growth of both isolates of *P. viticola* (*Figure 1*). Potassium sorbate at high dosages shown good antifungal activity on mycelium growth. While potassium sorbate at high dosages (600-1600 µg ml^{-1}) was the most effective against İzmir 2 isolate, it showed moderate effect to Salihli 2 isolate at all dosages. Sodium bicarbonate was found effective only at high dosages (1000-1600 µg ml^{-1}) to both isolates (İzmir 2 and Salihli 2). Sodium benzoate didn't have high inhibition effect to İzmir 1; but was moderately effective to Salihli 2. On the other hand, synthetic fungicide mancozeb at application dosage (%0.16) totally inhibited both isolates.

Minimum Inhibition concentration (MIC) and values of ED_{50} of the test chemicals on radial growth of the isolates of *P. viticola* are given in *Table 2*.

Test chemicals showed low activity with MIC values of >1600 µg ml^{-1}, but according to ED50 values, potassium sorbate was higher effective to the pathogen tested as compared to potassium bicarbonate and sodium benzoate.

Table 2. MIC and ED50 Value of Test Chemical on *Phomopsis viticola*

Test chemicals	İzmir 2				Salihli 2			
	At 4th day		At 5th day		At 4th day		At 5th day	
	MIC	ED_{50}	MIC	ED_{50}	MIC	ED_{50}	MIC	ED_{50}
Potassium sorbate	>1600	270	>1600	375	>1600	680	>1600	700
Sodium bicarbonate	>1600	1400	>1600	990	>1600	1230	>1600	1150
Sodium benzoate	>1600	>1600	>1600	>1600	>1600	1140	>1600	1040

The effects of the chemicals on the yield of pycnidia and pycnidiospores of *P. viticola* (isolates: İzmir and Salihli 2) at 20th days after inoculation are presented in *Figure 2* and *3*.

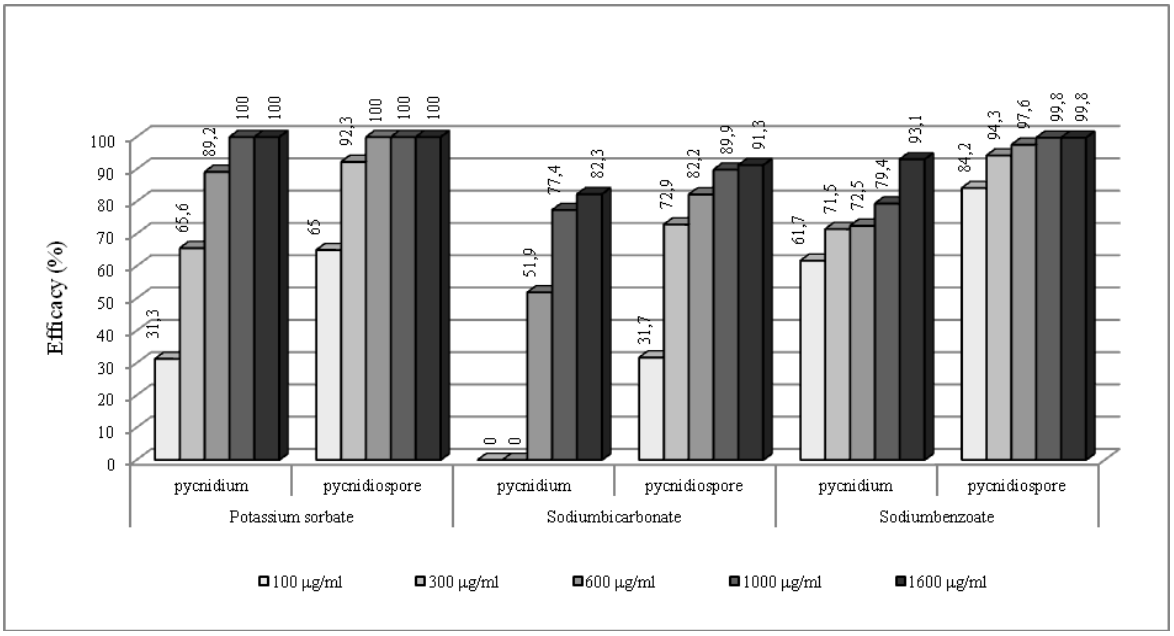


Figure 2. Efficacies of test chemicals on the yield of pycnida and pycnidiospores of *Phomopsis viticola* (isolate İzmir 2)

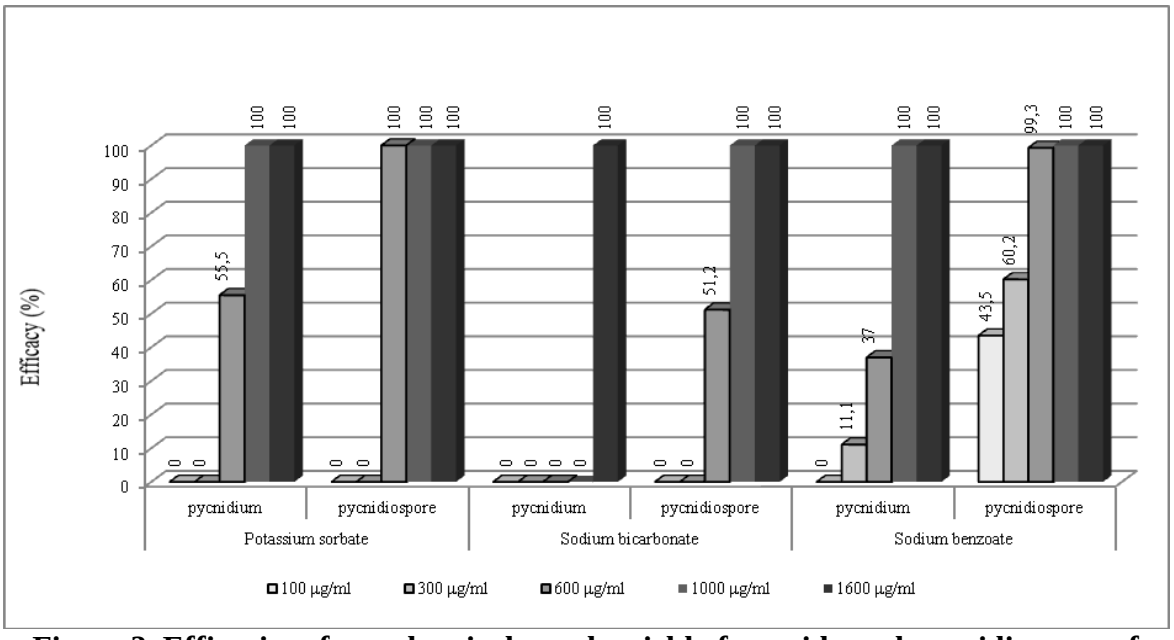


Figure 3. Efficacies of test chemicals on the yield of pycnida and pycnidiospore of *Phomopsis viticola* (isolate Salihli-2)

Test chemicals showed significant effects on the production of pycnidia and pycnidiospores of isolate İzmir 2 (*Figure 2*). Sodium benzoate and potassium sorbate were much effective to both structures of pathogen at all trial dosages. While sodium bicarbonate at the dosages between 600 and 1600 µg ml^{-1} could be effective on the pycnidia formation; it was more effective on the pycnidiospores formation at all dosages (*Figure 2*).

Effects of test chemicals on the pycnidia and pycnidiospores production of Salihli 2 were different to the effects of that isolate İzmir 2 (*Figure 3*). Test chemicals at high doses displayed important effects on pycnidium and pycnidiospore production of *P. viticola* (Salihli 2). On the other hand; potassium sorbate at doses of 100 and 300 µg ml^{-1} against both forms of pathogen, sodium bicarbonate at doses 100, 300 and 600 µg ml^{-1} against pycnidium formation and at 100 and 300 µg ml^{-1} against pycnidiospore formation, and sodium benzoate at 100 µg ml^{-1} dose against pycnidium formation were found not to be effective (*Figure 3*). However, mancozeb at application dose (0.16%) completely inhibited both forms of *P. viticola* (İzmir 2 and Salihli 2).

Minimum Inhibition Concentration (MIC) and values of ED_{50} of the test chemicals on pycnidia forming and pycnidiospore numbers of the isolates of *P. viticola* are introduced in *Table 3*.

Table 3. MIC and ED50 values of test chemicals on pycnidium and pycnidiospore formations of *Phomopsis viticola*

	İzmir 2				Salihli 2			
	Pycnidium		Pycnidospore		Pycnidium		Pycnidospore	
	MIC	ED_{50}	MIC	ED_{50}	MIC	ED_{50}	MIC	ED_{50}
Potassium sorbate	1000	185	600	<100	1000	620	600	370
Sodium bicarbonate	>1600	590	>1600	162	>1600	>1600	1600	980
Sodium benzoate	>1600	<100	>1600	<100	1000	640	1000	150

MIC values of sodium bicarbonate and sodium benzoate on both forms of pathogen were detected at 1000 µg ml^{-1} and higher doses (*Tabel 3*). Whereas MIC values of potassium sorbate on the pycnidium formation was 1000 µg ml^{-1} that was found 600 µg ml^{-1} for pycnidiospore formation. On the other hand, ED_{50} values of sodium benzoate were close to the values of mancozeb. ED_{50} values of other test chemicals were higher than that of mancozeb (*Table 3*). Among the test chemicals, sodium bicarbonate at all doses had lowest ED_{50} values on pycnidium and pycnidiospore formation of both isolates.

DISCUSSION AND CONCLUSIONS

In this study; potassium sorbate, sodium benzoate and sodium bicarbonate, which are food additives that may be alternative to classical fungicides, were analyzed in vitro conditions regarding their effects on mycelium growth and yield of the pycnidium and pycnidiospore of *Phomopsis viticola*.

Among food additives, potassium sorbate showed significant inhibition effect on mycelial growth of *P. viticola* at increasing doses. But, sodium benzoate and sodium bicarbonate couldn't inhibit the mycelial growth enough. Food additive chemicals could not completely inhibit mycelial growth of both isolates; their MIC values were found over 1600 µg/ml. However, ED50 values for potassium sorbate and sodium benzoate were lower than MIC values. Sodium bicarbonate could not show sufficient efficacy on mycelial growth (MIC value for both isolates were higher than 1000 µg ml^{-1}).

On the other hand, all the food additives at higher dosages were more successful on the pycnidia and pycnidiospores inhibition. Food additives are being used widely for a long time in cosmetic and in the field of medicine, as well as in food preservation due to their anti-microbial effects and they are higlyh efficient against yeast and mould (Wade and WELLER 1994; YILDIRIM AND YAPICI 2007). Potassium sorbate and sodium benzoate had antifungal activities against postharvest decaying fungi (ABDEL-KADER ET AL., 2011; AL-ZAEMEY ET AL., 1993; OLİVİER ET AL., 1999). The strongest inhibition among food additives against the pycnidia and pycnidiospores production of both isolates was determined in potassium sorbate with 600 µg ml^{-1} and higher doses. Potassium sorbate exhibited complete inhibition on the pycnidium production of both isolates with 1000 µg ml^{-1} and 1600 µg ml^{-1} and on the pycnidiospore production with doses between 600 and 1600 µg ml^{-1}. But, according to ED_{50} values, sodium benzoate showed better performance on the pycnidium and pycnidiospore production than potassium sorbate did. While ED_{50} values of sodium benzoate on pycnidium and pycnidiospore production of İzmir 2 was <100 µg ml^{-1}; in Salihli 2 were 640 µg ml^{-1} on pycnidium, and 150 µg ml^{-1} on pycnidiospore. MIC values of food additives may show differences not only related to the type and dosages of additives, but also on the species of microorganisms on which they act. STANOJEVICH ET AL. (2009) had reported that while MIC values of potassium sorbate on *Fusarium oxysporum*, *Trichoderma harsianum*, *Penicillium italicum* and *Aspergillus flavus* were respectively 20, 30, 20 and 50 mg ml^{-1}; of sodium benzoate were respectively 7.25, 30, 15 and 50 mg ml^{-1}. In a study with same additives, YILDIRIM AND YAPICI (2007) determined that MIC value of potassium sorbate on mycelial growth of *Botrytis cinerea* was 1000 µg ml^{-1}, of sodium benzoate was higher than 1000 µg ml^{-1}.

The results of this study demonstrate that food additives *in vitro* did not show high affection on the growth of *P. viticola*, but they have strong inhibition on the pycnidium and pycnidiospore of it. This shows that the food additives could be used against *P. viticola* in organic and traditional viticulture after field experiments.

REFERENCES

ABDEL-KADER M., EL-MOUGY N., LASHIN S. (2011): Evaluation of Grapefruit Coating with Chemical Preservatives as Control Measure Against Postharvest Decay. Phytopathologia 59: 25–38.

AL-ZAEMEY A.B., MAGAN N., THOMPSON A.K., (1993): Studies on the fruit coating polymers and organic acid on growth of *Colletotrichum musae in vitro* and postharvest control of anthracnose of bananas. Mycol. Res. 97: 1463–1468.

ARCHBOLD D.D., HAMİLTONKEMP T.R., BARTH M.M., LANGLOİS B.E. (1997): Identifying natural volatile compounds that control gray mold (Botrytis cinerea) during postharvest storage of strawberry, blackberry and grape. J. Agric. Food Chem., 45, 4032-4037.

CHAİRMAN D.L.F., JENSEN F.L., KASİMATİS A.N., KİDO H., MOLLER W.J. (1982): Grape Pest Management. Agricultural Sciences Publications: University of California. 312 pp.

HEWİTTW.B., PEARSON R.C. (1988). *Phomopsis* cane and leaf spot. pp. 16–18. In Compendium of Grape Diseas. (R.C. Pearson, A.C. Goheen, eds.). APS Press, Minnesota.

KOMAREK M., CADKOVA E., CHRASTNY V., BORDAS F., BOLLINGER J.C. (2010: Contamination of vineyard soils with fungicides: A review of environmental and toxicological aspects. Environment International. 36, 138 – 151.

OLİVİER C., MACNEİL C.R., LORİA J. (1999): Application of organic and inorganic salts to field-grown potato tubers can suppress silver scurf during potato storage. Plant Dis. 83: 814–818.

PEARSON R.C., GOHEN C. (1994): Phomopsis cane and leaf spot. In Compendium of Grape Diseases (Eds: WB Hevit, RC Pearson) pp. 17-18, APS Press, St Poul, MI.
PINE T.S. (1959): Development of grape dead-arm disease. Phythopathology 49, 738-743.
PSCHEIDT J.W., PEARSON R.C. (1989): Effect of grapevine training system and pruning practices on occurrence of Phomopsis cane and leaf spot. Plant Disease 73, 825-828.
SKIRDAL I.M., EKLUND T. (1993): Microculture model studies on the effect of sorbic acid on Penicillium chrysogenum, Cladosporium cladosporioides and Ulocladium atrum at different pH levels. J. Applied Bacteriol., 74, 191-195.
STANOJEVIC D., COMIC L., STEFANOVIC O., SOLUJIC-SUKDOLAR S.L. (2009): Antimicrobial Effects of Sodium Benzoate, Sodium Nitrite and Potassium Sorbate and Their Synergistic Action *in vitro*. Bulgarian Journal of Agricultural Science, 15 (4); 307-311.
WIGHTWICK A., ALLINSON G. (2007): Pesticide residues in Victorian waterways: a review. Australasian Journal of Ecotoxicology 13, 9 –112.
YILDIRIM İ., MERIÇLI Y.B. (2007): Inhibition of conidia germination and mycelial Growth of *Botrytis cinerea* by some alternative chemicals. Pakistan Journal of Biological Sciences 10 (8), 1294-1300.

Review on Agriculture and Rural Development 2014. vol. 3 (1) ISSN 2063-4803

INTRODUCTION TO THE FIELD OF INTELLECTUAL COMMON PROPERTY LAW

ISTVÁN GÁL

University of Szeged
Faculty of Law and Political Sciences Graduate School
Tisza Lajos krt. 54. 6720 Szeged, Hungary
galistvan@mgk.u-szeged.hu

ABSTRACT
The 21st century is the era of innovation when it has prominent role how quickly a groundbreaking and profitable solution is developed. This process can be promoted greatly if more persons, companies or a research team try to produce common result together. In this case the intellectual product created with joint work shall be seemed as an intellectual common property.
In practice, there are a number of benefits for people creating a common intellectual property. First, the time as well as the cost invested in research can be reduced. On the other hand, in the course of creation the ideas from the other party might lead to an entirely new direction and thus unexpected results, intellectual property can be formed. It is an entirely different matter that in the phase of utilisation the higher number of the entitled might be a problem.
So, in the practical life the intellectual common property law is a widespread legal institution but the legal theory has not collected the relevant knowledge related to it yet. This way researching this institution promises both practical and theoretical benefits.

Keywords: intellectual common property law, innovation, classical ownership, protection of industrial property rights, copyright

INTRODUCTION

Nowadays it is more and more common that an intellectual product is created by a research team or more persons. The 21st century is the era of innovation, research and development when certain companies are trying to develop groundbreaking and profitable solutions compared to the current state of technique. As it is said, “time is money”. An effective way of this process could be if more companies, research team seek to achieve the goal together by combining their results and developments.
Basis of legal analyzing is rooted in the fact that the intellectual common property is widespread in the practise but the jurisprudence has not worked out its legal theory yet.
Field of the intellectual property law can be divided into two parts: copyright and protection of industrial property rights. Beside the protection of industrial property rights oriented approach the copyright and different works covered by it shall be kept in mind as well. In the past and present too it is a widespread phenomenon that more creators combine their creativity in a common work increasing its artistic value. Result of this common intellectual product cannot be measured in money but in such a value that is enduring and integral part of the cultural heritage.
Name of the legal institution analyzed by the present Paper entails examination of rules applied to the “classical” common property regulated within the property law. Its main reason is that the legal institution of common property regulated by the Civil Code (PTK.) under the ownership has already been worked out by the legal theory and the judicial practise that would become starting point for later researches.
Overall using the term of intellectual common property was ignored in the past in the relevant legal literature and there is not a comprehensive work focusing on it. Furthermore,

the concept of "intellectual property law" as the name of field of law that involves the intellectual products is more and more widespread in the legal literature (FICSOR, 2000, BACHER, 2000b) and practical legal life as well. This term clearly replaces the "law of intellectual products" that is used in the Civil Code being in force. These facts and trends support for researching the intellectual common property.
Present Paper is aimed at introduction to the intellectual common property law focusing on the main frames and inspiring points.

MATERIAL AND METHOD

In the study, the conclusions are based on the examination of the primary literature dealing with this subject, analytical studies and monographs published in the Hungarian legal doctrine in this field of law, as well as on analyzing empirical data obtained from the judicature. During research, we considered the jurisprudential opinions and the conclusions drawn from the practice of everyday life.

RESULTS

Significance of the intellectual common property

First of all, significance of the intellectual property shall be analyzed. Intellectual works are such breakout points in what an individual's or a group's intellectual potential can manifest. This intellectual potential is suitable for and capable to develop such an innovative solution that may have effect on its entitled person's and its narrower and broader environment's social, labour market and economic status, shorter and longer strategy (GÖRÖG, 2012). The last thought determines in brief the social and economic significance of the intellectual property and refers to the fact that the intellectual product can be created by a community as well. This product shall be seemed as an intellectual common property.
The real value of the intellectual common property is that more persons' creativity and idea unite in one product or work. This way time can be saved during each improvement and individuals affect each other. New ideas generate newer ones and researches can be oriented in other direction. In field of copyright it can be observed as well when more artists create together and they get the most out of each other.
In case of intellectual common property creators form a community. Specific characteristic of the intellectual products is that persons and groups involved in the creation have creative ideas during the work that is a great help, but uncertain conditions may lead to conflicts among parties at stage of using and utilization.
If rights related to an intellectual work are owned by more persons, possibility of a dispute will increase. This kind of discuss may occur as well if creators develop the same new result at different places and time, but its possibility is more increased in case of a result achieved with common work.
Taking into account the mentioned above, it is necessary to arrange the parties' internal relation, their rights and obligation. Who, how and what rights entitled to and who, how and what obligations are burdened.

Legal theoretical basics

At exploring the legal theoretical basics of the intellectual common property the following issues shall be analyzed: basis of the term of intellectual property, dogmatic relationship

between the "classical" ownership ruled in the Civil Code and the intellectual property, intellectual product as the subject of ownership and the legal rules related to the intellectual common property law.

First of all, we should analyze the name of this field of law. In both theoretical and practical life the term of "intellectual property law" is more and more spreading instead of "law of intellectual products". Some international conventions and treaties, furthermore, the change of the name of Hungarian Intellectual Property Office in 2011 show this trend (MÓD. TV.). Using different name is not aimed at avoiding the repetition but it refers to the theories related to this field of law. In sum, it should be said that the term of intellectual property law can be linked to the theory that places particular emphasis on the property law aspect (CSÉCSY, 1998).

The next question is whether the intellectual property may be the subject of ownership. The basic of this issue what is seemed as thing, namely subject of ownership. In my opinion, it should be agreed that in legal term thing is what can be the subject of ownership. The thing as civil law concept is the abstract term of the subject of ownership (EÖRSY AND VILÁGHY, 1962). This way, intellectual products may be the subject of ownership (BACHER, 2000a).

In this case, the subject of property is special, namely an intellectual product. It is such a property that is basically different from the classical property: it has mental object, it is not fixed location (FALUDI, 2006) and has special characteristics.

If intellectual products are subject of ownership, consequently besides the provisions of the Act on Copyright and Protection of industrial property rights the rules on classical common property can be applied to the property law aspects of the intellectual common property.

This conclusion defines the legislative background applied to the intellectual common property that include the Act on Copyright and Protection of industrial property rights, furthermore, the provisions on classical common property of Civil Code.

Specific forms of the intellectual common property in the practical life

In field of the copyright intellectual common property manifests in common works. In this case, copyright work is created by more persons who may be joint authors or co-authors depending on whether the parts of this common work may be used independently. It is important to emphasise that copyright relation among persons will establish if all of them are participated in the creation of common work with creative activity. This way, "muse", dramaturges or lector shall not be seemed as joint authors or co-authors (FALUDI, 2006).

If the parts of common work cannot be used independently, co-authors are entitled to the copyright jointly and in equal proportion in case of doubt, but all of them have the right to take action against the copyright infringement independently (SZJT.). If the parts of common work can be used independently, copyrights related to each own part may be exercised independently (SZJT.). In the last case, creators of common work are joint authors because it is possible to establish who the each part was created by.

In field of the protection of industrial property rights common invention and common patent may be seemed as intellectual common property. In the first case parties are called joint inventors, in the second joint patentees.

Relationship among inventors is established before creating patent when more persons develop a new invention with their creative activity. The Act on Patent being in force includes only few rules on this legal institution. The Act includes the following provision: If more persons develop an invention, inventors or their successors will be entitled to the patent jointly. If there are more claimants, proportion of patent claims shall be seemed equal – unless otherwise stated.

Among inventors there is joint author relationship because a work of technical nature cannot be usually divided into parts. (VÉKÁS, 2006) Regarding the proportion of joint inventors' patent claim the Act on Patent uses the rule applied to the classical common property, namely in case of doubt proportions are equal.
Condition of joint author/co-author shall be applied in the present case as well taking the consistent judicial practice into account. So, inventor relationship will form if the involved person participates in creating the invention with his creative activity. (FALUDI, 2006) Giving advice, simple help or the control does not justify this relation. (LEGF. BÍR. PF. IV.)
According to the judicial practice, beside the inventor relationship the proportion of patent claim is also supported by the creative activity and its extent. So, the joint inventor whose participation in creating the invention has been more significant, he gets bigger proportion. (FALUDI, 2006)
The joint patentee relationship is ruled in more details in the Act (SZT.) that stipulates the detailed rules on parties' internal and external relation toward third persons. The legal institution in question is regulated similarly to the classical common property relying on its elements.
Similarly to the joint inventors, each joint patentee's percentage of share is adapted to the own creative activity (CSÉCSY, 1998) but in case of doubt proportions shall be seemed equal. (SZT.) The importance of the percentage of share is rooted in the fact that each joint patentee is entitled to the right and burdened with obligation derived from the patented invention to the extent corresponding to the own percentage of share. (FALUDI, 2006) Invention may be exploited by each patentee alone but for the others he is obliged to pay appropriate fee corresponding their percentage of share. (SZT.)

CONCLUSIONS

In sum, it will have several advantages if more persons, companies or a research team seek to produce an innovative result that is qualified as novelty compared to the prior art. On the one hand, time used to the research may be shortened because of unifying experiences and results. On the other hand, persons involved in the research affect each other continually, so the common work may lead to a new and unexpected result.
Consequently, intellectual common property is quiet widespread in the practical life but the jurisprudence has not summarised its theory yet.
Regarding to the legal theoretical basics it should be said that the term of intellectual property law may be linked to the ownership theory; furthermore, intellectual product may be the subject of ownership. The last conclusion clearly shows the legislative background applied to the intellectual common property.
As regards the practical forms of intellectual common property, this legal institution manifests in the common works in the field of the copyright and in the common invention and patent in the field of the protection of industrial property rights.
In sum, the intellectual common property law is a field of the civil law that is widespread in the practical life but the jurisprudence has not worked out it yet. So, its research promises useful results.

REFERENCES

BACHER, V. (2000a): Mi lesz a cikk főcíme. Polgári Jogi Kodifikáció. 2000. 2. pp. 56-65.
BACHER, V. (2000b): A szellemi tulajdon jogi védelme és a Ptk. Polgári Jogi Kodifikáció. 2000. 3. pp. 23-32.
CSÉCSY, GY. (1998): A szellemi alkotások joga. Novotni Kiadó. Miskolc. 204 p.
EÖRSY GY., VILÁGHY M. (1962): Polgári jog I.. Tankönyvkiadó. Budapest. 530. p.
FALUDI, G. (2006): A szellemi alkotások jogának általános kérdései. In: LONTAI, E., FALUDI, G., GYERTYÁNFI, P., VÉKÁS, G. Szellemi alkotások joga. Eötvös József Könyvkiadó, Budapest. pp. 9-38.
FICSOR, M. Z. (2001): A szellemi tulajdon és a Ptk. (észrevételek és javaslatok a polgári jogi kodifikációhoz). Polgári Jogi Kodifikáció. 2001. 2. pp. 27-28.
GÖRÖG, M. (2012): A know-how jogi védelmének alapvető kérdései. HVG-ORAC Lap és Könyvkiadó Kft., Szeged. 182. p.
LEGF. BÍR. PF. IV.: Legf. Bír. Pf. IV. 20.466/1977.
MÓD. TV.: 2010. évi CXLVIII. törvény a Magyar Köztársaság minisztériumainak felsorolásáról szóló 2010. évi XLII. törvénnyel összefüggésben szükséges törvénymódosításokról és egyes iparjogvédelmi tárgyú törvények módosításáról
PTK.: 1959. évi IV. törvény a Polgári Törvénykönyvről
SZT.: 1995. évi XXXIII. törvény a találmányok szabadalmi oltalmáról
SZJT.: 1999. évi LXXVI. törvény a szerzői jogról

Review on Agriculture and Rural Development 2014. vol. 3 (1) ISSN 2063-4803

PLANTATION OF "ENERGY WILLOW" IN SZABOLCS-SZATMÁR-BEREG COUNTY

ISTVÁN LENTI[1], SÁNDOR VÁGVÖLGYI[1], ATTILA KONDOR[2]

[1]College of Nyíregyháza, Department of Technology and Agriculture, Nyíregyháza, Hungary
[2]Agriculture and Rural Development Agency, Nyíregyháza, Hungary
lentiistvan@gmail.com

ABSTRACT
One of the basic requirements for energy willow plantations in Hungary is to determine the most suitable areas for such activity. Furthermore, it is necessary to identify the most suitable varieties for the given circumstances and to develop the adequate crop-production technology.
3,9 % of Szabolcs-Szatmár-Bereg County arable land (282.200,00 ha) is a regularly flooded area (27 181,59 ha), of which 1,4 % is left for a fallow (3.171 ha). There are several coherent, wide expanding areas in the county appropriate for growing "energy willow"; e.g.: the floodplains of the Upper-Tisza and the reservoir of the Szamos – Kraszna close (see *Figure 1*, marked in red).
Benefits of decentralized energy production by growing this plant species may play an outstanding role in the life of some settlements or even a whole region, thus reshuffling the attitude of inhabitants towards its environment. However, this is in spite of the fact that most potential biomass and renewable energy resources in general will represent only a minor role in the future of Hungary's energy balance.
The insect damage of the "energy willow" was surveyed. What we have come to establish is that the extent of damage caused by the green willow aphid (*Aphis farinosa* /syn.: A. *saliceti*) is variable, while the following species shall be considered as virus vectors(!): giant willow aphis beetle (*Tuberolachnus salignus* GMELIN), the willow-feeding leaf beetles (*Galerucella lineola* FABRICIUS), imported willow leaf beetle (*Plagiodera versicolor* LAICHARTING). We may expect further pestiferous species too.
We observed that already during the second year such insect communities invaded the "energy willow" plantations which are, on the one hand, typical to willows, and which are, on the other hand, polyphagous insects. We also saw to appear in the plantation the natural enemies of the insect species which damage the willow.

Keywords: „energy willow", Szabolcs-Szatmár Bereg county, potential area, settler insects

INTRODUCTION

Because of the decrease of the fossil energy resources and the threats and unresolved problems of atom energy, efficiency of renewable energy resources are becoming more and more prominent. Despite of the fact that renewable energy resources consumption has a relatively long history, its contribution to the global energy utilization is still fairly moderate. According to the conditions in Hungary in 2003, renewable energy consumption represents a 3.6% partial produce within the total energy use (TAR ET AL., 2005).
In Hungary, out of the "renewable energy sources", the biomass is considered to be one with almost the highest potential. We have excellent natural conditions that make the production and the energetic usage of these resources possible.
Out of the renewable energy sources, biomass is our greatest potential, as Hungary has very good endowments to produce biomass (BAI ET AL., 2005). The size of agricultural land per capita in Hungary is 0.48 hectare. Besides the area necessary for food production (0.3 ha/capita), it is 0.18 ha/capita that could be potentially suitable for energy plant production.
A plant species bearing outstanding energy-providing qualities amongst biomass energy resources is "energy willow" (*Salix viminalis* L.).

The big regions of Szabolcs-Szatmár-Bereg County, such as the riverside and watered areas of the Nyírseg, the Szatmár and the mangled Bereg are really appropriate for willow growing (SIMON, 2000). Since the willow is not particular about soil, though its nutrient demand is not very well known as yet, it is likely to be successively grown in these areas.
The *Salix viminalis* L. is not a new plant in this region. A less extended production of it was already general previously, as it was widely used for wickerwork and for the spinning of other home devices.
As botanically seen, the ”energy willow” is a grain-flowered, dicotyledonous, dioecious, insect pollinated, wooded plant. It is deciduous and has cylindrical sprouts. The leaves are lanciform and are in a diffused position (BORHIDI, 2003). This species is among the most quickly growing ones. Its sprout may grow 3-5 cm per day. In the first year, it can reach a height of 3 – 3.5m, whereas its yield might reach an average 8-10 t/ha. After the 3rd year the productivity can reach 20-40 t/ha.
The willow's cropping technology is being established in our country. One of our tasks is to work out the adequate pest control.
Croplands covered in spring melt waters reached 200,000 ha in Hungary. This regular problem results in great losses for agriculture in every year. It is a major problem to find the right crop and land use system for these lands.
„Energy willow” prefers wet, moist conditions and can tolerate flooding waterlogged conditions. Due to its preferences it can be an alternative crop besides the commonly cultivated plants in areas such as riversides, floodplains, waterlogged areas where traditional agriculture is less productive but agriculture is still needed either for environmental purposes or to provide rural population with an alternative income source besides the traditional crops.

MATERIAL AND METHOD

As a first step of exploring the possibilities of making “energy willow” growing part of plant breeding in Szabolcs-Szatmár-Bereg County, we conducted an assessment on the role this plant fulfils among woody energy-growing plants both at a county- and country-wide level.
In order to achieve improvement in the situation of “energy willow” production, we decided to explore those areas which could be suitable for the production of this plant in Szabolcs-Szatmár-Bereg County. Practically all the experts seem to agree that for poor quality lands that are unable to be utilized with food crops in an economic way and can be cultivated – due to the seasonal water coverage – only with a high production risk, growing energy-producing plants on them can be an alternative solution for their use. Therefore, we focused our assessments on two areas: on the poor quality set-aside areas, and on the emergency flood storages between the Szamos and the Kraszna.
Since the history of “energy willow” (*Salix viminalis* L.) production in Hungary began only a few years ago, not every element is clear yet in the production process. Our aim is to carry out studies which could provide us data for the draw-up of a more complex future production technology adapted to the local conditions. Within the framework of this, we initiated different experiments and made observations in “energy willow” plantation of Szalka-Pig Ltd. in Mátészalka.
We paid special attention to the introduction of the insect pests in these large, homogenous plantations with short cutting intervals.
Szalka-Pig Ltd. planted „energy willow” on 17 ha in 2005, and a further 43 ha in 2006. In the last ten days of April, 20 cm long cuttings were planted with 75 x 45-50 cm stem and

bed space in twin rows. They provided a cultivation path between every fourth rows for the production vehicles. During the herbicide treatment in the breeding period they faced up with problems that can hardly be neglected any longer

Our entomological samples were taken in the 50 acres willow (*Salix viminalis* L.) land in Mátészalka, Szalka Pig Ltd. During three occasions of supervisory outings (24. April, 03, June and 25. July) we examined feral pests of the "energy willow". We repeated our examinations four times on 25 one year-old, and 25 two year-old plants per occasions. On each outing we measured the rate of damaging and specified the species of pests.

We also ventured to observe and record imported species, in a perspective of a better professional overview to estimate forthcoming damages. We took photos and notes of the import species, and the damaged area on host plants.

RESULTS

In 2012 the total size of woody energy-producing plantations in Hungary was 6,208.42 hectares, "energy willow" covering 1201,53 hectares out of this, meaning 19.3% of share. The distribution per species varies from county to county. The number of "energy willow" plantations grew in a rapid pace between 2005 and 2008. In 2008 the total size of production areas was 1,476.4 hectares, however, despite the fact that the total area of all woody energy-producing plantations is growing, this was followed by a gradual decrease.

In Szabolcs-Szatmár-Bereg County "energy willow" was grown on 160.2 hectares in 2012. The decreasing tendency in the number of areas included in production is clearly visible in this county, too.

The size of permanently set aside areas in Szabolcs-Szatmár-Bereg County (between 2010 and 2012) was 3,171.17 ha. These arable lands may be – on certain conditions – suitable for growing "energy willow". This gives a twenty times bigger area of the current growing area.

On the basis of our model, on the area of the emergency flood storage between the Szamos and the Kraszna, a land use that would significantly increase the level of production safety, also adapting to the unusual conditions of the storage, could be reached on 1,800–1,900 hectares by including "energy willow" in production. The storage in itself already provides possibility for "energy willow" production on an area of a size almost as big as 2/3 of the arable lands not used for 3 years.

The assessment showed that the average land size of the permanently set aside emergency storage areas between the Szamos and the Kraszna exposed to seasonal floods is fairly small (2.1 ha). Taking size efficiency into account, as well as the fact that unemployment in this region is significantly higher in the national average, we concluded that carrying out certain elements of production technology manually is justified.

During our supervisory outings, we experienced that various types of pests plant themselves in our "energy willow" (*Salix viminalis* L.) plants, and damage it in the course of their feeding. Primarily polyphagous pests and willow-specific insects got planted, of which living is tightly related to it. We establish that this year the dominant pests on 1 and 2 year-old offshoots and branches are the following:

- Imported willow leaf beetle (*Plagiodera versicolor* LAICHARTING). Its young larvae are peeling the leaves in groups between July and September. When grown, they chew irregular holes and pits on the leaf, contaminating it with their black droppings. Their imagos are lacing budding plants' leaves mainly in springtime (*Figure 1*), sometimes to the extent of complete loss of foliage.

- Small willow aphid (*Aphis farinosa* GMELIN /=*A. saliceti* KALTENBACH/) (*Figure 2*). Damages in early spring season after harvesting, at the start of the sprouting time. The loss it makes is not outstanding in terms of economy, however, it is a virus-vector.
- The willow-feeding leaf beetles (*Galerucella lineola* FABRICIUS) (*Figure 3*). Its larva damages all through the breeding season. According to our assumptions it is the most important pest in Szabolcs-Szatmár-Bereg county. The blackish-brown, young larvae start damaging on the end leaves, going downwards. It can even have four generations a year.
- Giant willow aphid beetle (*Tuberolachnus salignus* GMELIN) (*Figure 4*). They appear in the second half of the breeding season at the woody stem of the shoot. Due to their damage in the willow bark, growth of the shoots and twigs is retarded, peelability of the energy willow declines.

CONCLUSIONS

Considering the ecological needs of the "energy willow" and all the natural facilities of the county, proportion of crop lands could be increased about 3.000 – 3.500 ha.
During the plantation process of the "energy willow" (*Salix viminalis* L.) we can establish that the first two production years already came with several willow-specific and polyphagous feral pests planting in the plantation. The nutrition of these pests causes economically significant damage, so it is practical to monitor their living habits, the pace and characteristics of their breeding and the rate of damaging. We can put forward an effective, on-the-purpose pest control on the technological level. Professional pest control is going to be one important chain link in the growing technology of the arable land willow.

REFERENCES

BAI A. (2005): Gazdasági tényezők. In: GONCZLIK A., KAZAI Zs. és KŐRÖS G.: Új utak a mezőgazdaságban. Energia Klub - Környezetvédelmi Egyesület, Budapest. pp. 31-36.
TAR F., KÁRPÁTI Z., MARTICSEK J. (2005): Megújuló energiaforrások termelésének és felhasználásának lehetőségei a mezőgazdaságban. FVM, Budapest. 45 p.
BORHIDI A. (2003): Magyarország növénytársulásai. Akadémiai Kiadó, Budapest. pp. 383-392.
SIMON T. (2000): A magyarországi edényes flóra határozója. Nemzeti Tankönyvkiadó, Budapest. pp. 657-660.

Review on Agriculture and Rural Development 2014. vol. 3 (1) ISSN 2063-4803

SOIL-RELATED MAP SERVERS IN HUNGARY AND THEIR ROLE IN THE DEVELOPMENT OF KNOWLEDGE-INTENSIVE SERVICES

ISTVÁN SISÁK, JÁNOS BUSZNYÁK, MIHÁLY KOCSIS, ANDRÁS BENŐ

University of Pannonia
Georgikon Faculty
16 Deák F. st., H-8360 Keszthely, Hungary
talajtan@georgikon.hu

ABSTRACT
In line with the European development, three complete, centrally edited soil maps were compiled in Hungary between 1953 and 1984. They have also been published in map servers which are up-to-date distribution tools to share spatial information with experts and the general public. Digital soil mapping is an up-coming research area in soil science with the aim to produce reliable soil maps for those areas where soil information is sparse or missing. Its general idea is that once soil forming factors can be represented with high spatial detail (maps, ortophotos), their combination will be well related to soil types and properties. In general form, this has been the axiom of soil science since the late 19th centaury but the idea of its mathematical formulation was conceived in the mid 20th centaury and it has been put into practice since the advent of the modern GIS software. The power of the approach has been proven but it is far from perfection. Much better prediction accuracy can be achieved if field observations on soils are incorporated. We give a short overview of the map servers which provide information on soils and soil forming factors, evaluate their functionality and suggest how mesh-up services of the recent GIS software should be used to combine information and enable users to formulate mental models of soil formation. Citizen science approach should be implemented to make users involved in soil related issues. The program should have two-fold objectives: 1.) to collect soft but highly detailed information on soils for research and 2.) to develop services for soil users.

Keywords: INSPIRE directive, soil related map servers, soil formation, digital soil mapping, citizen science

INTRODUCTION

Since the work of Dokuchaev, the axiom of the soil science is that soil forming factors (climate, geology, hydrology, biota, elevation, time and humans) and their specific interaction determine soil formation and soil properties. JENNY (1941) suggested that these complex relationships should be described with mathematical formulas thus, qualitative and quantitative soil properties will be predictable. MCBRATNEY ET AL. (2003) gave an overview on digital soil mapping (DSM) which is Jenny's idea put into practice with help of GIS software and geostatistical analysis. A very large number of publications have appeared for the last two decades on DSM which have clearly proven the power of the approach but it is still far from perfection. Seven soil forming factor (variables) with, let's say 10 levels within each variable give ten million combinations and the interactions between different factors are non-linear. It is no wonder that DSM approaches which utilize soil information from existing soil maps and field observations perform much better than pure theoretical constructions (MENDONCA-SANTOS ET AL., 2008). Soil maps are physical representations of the mental models of the mappers on how soil forming factors interact (BUI, 2004). They provide us a path through the almost infinite number of theoretically possible combinations to the most probable outcome.

Soil information systems are most developed in the USA. The State Soil Geographic database (STATSGO) and Soil Survey Geographic database (SSURGO) created by the Natural Resources Conservation Service are the most commonly used conventional soil

databases. The SSURGO maps, compiled at scales between 1:12000 and 1:63360, are the most detailed products of conventional soil mapping. Such conventional soil maps are widely available and used extensively for many applications (YANG ET AL., 2011). The INSPIRE directive of the European Union (EC, 2007) aims to create a spatial data infrastructure which will enable the sharing of environmental spatial information among public sector organisations and better facilitate public access to spatial information across Europe. Its full implementation required by 2019. Initially, soil information was not a top priority but soil is a crucial part of our environment and soil information is essential part of the envisaged system. The Institute of Environment and Sustainability, one of the Joint Research Centres of the EU is maintains the European Soil Data Centre MapViewer (http://eusoils.jrc.ec.europa.eu/wrb). The spatial resolution of the data is coarse but it provides harmonized soil data for whole Europe in the WRB system (IUSS WORKING GROUP, 2007). However, the EU level database cannot be a substitute for national data infrastructure.

The Georgikon Map Server played a pioneering role in Hungary in 2003 to provide soil information via the Internet (BUSZNYÁK AND SISÁK, 2012). Several map servers have appeared on the web since then and many of them contain direct soil information or soil related information. We are going to review selected map server services which provide information for the area of Hungary and we evaluate them from the point of view how they can be related to soils. Our hypothesis is that the combination of already existing data into a complex system may be a direct and immediate help for soil users and this could serve as a basis for further scientific and service development. This would also be in line with the requirements of the INSPIRE directive.

MATERIAL AND METHOD

We briefly reviewed the following sources:
- Georgikon Map server (http://map.georgikon.hu)
- the agrotopographic data base of the Research Institute of Soil Science and Agrochemistry of the Hungarian Academy of Sciences (www.mta-taki.hu/osztalyok/gis-labor/agrotopo),
- the soil map among the open access maps in the Agro-environmental Information System (http://terkep.air.gov.hu/terkep/nyilvanos/nyilvanos.htm),
- the 1:100 000 scale geological map (http://mafi-loczy.mafi.hu/Fdt100/),
- the CORINE CLC100 data base (http://www.fomi.hu/corine/clc100_index.html) and
- the Information System on Nature Conservation Areas (http://geo.kvvm.hu/tir/viewer.htm).

We also discuss the use of the
- Google Earth program and the
- Shuttle Radar Topographic Mission (http://www2.jpl.nasa.gov/srtm/cbanddataproducts.html) data base.

RESULTS

There are three centrally edited soil maps in Hungary with nationwide coverage. The first one was published in 1953 at a scale of 1:200,000 (MATTYASOVSZKY ET AL., 1953) by using more detailed previous maps (KREYBIG, 1937). It has been digitally published on the Georgikon Map Server (SISÁK AND BENŐ, 2012). The second one (popularly called AGROTOPO) was published between 1983 and 1988 on 1:100,000 sheets (MÉM, 1983-1988) and also relied on the Kreybig soil maps. This was released in digital form in the early 1990's and has been recently published on the web by the Research Institute for Soil

Science and Agrochemistry of the Hungarian Academy of Sciences (MTA ATK TAKI, 2013). The third one (genetic soil map) was compiled by the experts of the agricultural extension agency of the agricultural ministry in 1984 at scale of 1:200,000 (MÉM-NAK, 1984). It was compiled independently from the Kreybig soil maps and it was also digitally published (AIR, 2013).

Each of the three soil maps has advantages but also serious drawbacks. The first map has not been digitized until recently (SISÁK AND BENŐ, 2012) and it does not contain soil units of the recent Hungarian soil classification since it is older than the existing classification system. It contains several soil categories (texture, chemical reaction, fertility constraints) but also other categories (land-cover: forests, temporarily flooded areas). However, this is the most detailed (21306 polygons) regarding its spatial resolution despite the nominal scale of 1:200,000. The AGROTOPO has only a rough spatial resolution since it covers the area of the country (93000 km^2) with 3311 polygons. Regarding soil classification, it is also rough because it contains only 30 % of the categories in the Hungarian system. However, it has a complete coverage of the landscape and it has several data layers (parent material, texture, soil reaction, clay mineral assembly, organic matter content etc.). The genetic soil map provides a complete display of the Hungarian soil classification, better resolution (5972 polygons) than AGROTOPO and it contains data on parent material, texture and chemical reaction but does not show soil data for forests. The topology of the AGROTOPO is satisfactory but it is not so for the other two maps. The AGROTOPO has a topographic layer to guide the users but the other two have not.

One of the most important maps exhibiting soil forming factors is the geological map at 1:100,000 scale published by the Geological Institute of Hungary (PELIKÁN AND PEREGI, 2005). It has very good resolution (50163 polygons) and excellent additional layers to help the users (roads, railroads, populated areas, water courses, lakes). The geological classification is much more detailed thematically than it is necessary for DSM but still lacks important texture information. CORINE CLC100 database is available at the website of the Hungarian Institute of Geodesy, Cartography and Remote Sensing (FÖMI, 2013A) but it is more an illustration than a functional map server. Zooming is limited and restricted to the central part of the country in spite of the fact that the database is freely available from the webpage (http://www.eea.europa.eu//themes/landuse/dc) of the European Environment Agency data centre. The spatial resolution is very good (39849 polygons). The Information System on Nature Conservation Areas is very rich in topographic information and exhibits points of protected nature conservation objects and polygons of protected areas with some additional information. Google Earth has free and commercial versions and exhibits ortho-rectified space images. Even the free version has very good functionality and its file formats are supported by the major GIS softwares. The Shuttle Radar Topographic Mission (SRTM) produced digital elevation model with 90x90 and 30x30 m pixel sizes and various vertical accuracies. It is a freely available product.

DISCUSSION AND CONCLUSIONS

Neither of the three soil maps is complete or sufficiently detailed spatially with regard to the recent need for soil information. However, weaknesses of one map could be easily corrected with the strengths of the other map once they are collated as different layers of a GIS system. This could be the up-to-date and publicly available version of the concept map-stage in traditional soil mapping where all the background information was gathered and a mental model was formulated by the mapper on how soil forming factors interact and how they determine soil class and soil properties at a given place. Then, concept maps were validated by field work. Advanced GIS software (e.g. ArcGIS 10.x) are able to use

various layers from the web geo-services and combine them with own sources. However, this is still a remote possibility for ordinary users and soil experts in most parts of the public and commercial sector.

To overcome knowledge gap and software constraints, already freely accessible data should be assembled into a combined data service which would provide enormous synergies for the economy. The most promising platform could be the Google Earth because its spatial detail far exceeds any of the other data sources, thus the users could interpret the general information of the relatively large polygons accordingly. Citizen science approach (SILVERTOWN, 2009) could be used to make the users involved in collection of soil related problems, thus soil scientists could be made directly aware of the interest of the soil users and scientific focus would be better directed towards economic needs. The signals from the users would be valuable source of information, too.

The new inputs could steer scientific research and policy making. For the research part, even the harmonization of a few polygon maps is more than trivial (SISÁK AND BENŐ, 2014) if we use scientific scrutiny. However, the formulation of a mental models and the intuitive local solution of the interaction problem could be done by large number of users once the digital source maps are assembled. For the policy part, user demand may initiate new mapping efforts which have been overdue for a long time.

Even brief investigation of the discussed maps gives us a hint on the direction of further research. At a local scale, geology, DEM and hydrology are the most influential soil forming factors. More detailed geological maps than the freely accessible 1:100,000 scale map exist, and DEM with 5x5 m pixel size was produced from contour lines of the 1:10,000 topographic maps by the Hungarian Institute of Geodesy, Cartography and Remote Sensing (FÖMI, 2013B). The thematic details of the geological maps are usually too high for DSM purposes, the categories must be simplified (LAWLEY AND SMITH, 2008). However, geological maps usually lack sufficient texture information. Detailed soil maps overcome this problem (SISÁK AND BENŐ, 2014). High resolution DEM can be used to calculate several terrain attributes but in many cases only a few of them explain most of the total variance (CARRÉ ET AL., 2008). SRTM is suitable for countrywide studies, its vertical resolution can be improved and it also can be used to estimate vegetation height (KELLNDORFER ET AL., 2004).

Our expectation is that the synergies from the assembly of all the soil and soil related maps in one map server would drive much better utilization of the data due to interpretation of the users on their own, due to rapidly developing knowledge intensive services for the users and due to more intensive user oriented research.

ACKNOWLEDGEMENTS

This research was supported by the European Union and the State of Hungary, co-financed by the European Social Fund in the framework of TÁMOP-4.2.4.A/ 2-11/1-2012-0001 National Excellence Program and the TÁMOP-4.2.2.A-11/1/KONV-2012-0064 project.

REFERENCES

AIR (2013): Agrár-környezetgazdálkodási Információs Rendszer nyilvános térképek (http://terkep.air.gov.hu/terkep/nyilvanos/nyilvanos.htm)

BUI, E. (2004): Soil survey as a knowledge system. Geoderma 120 (1–2) pp. 17–26.

BUSZNYÁK, J., SISÁK, I. (2012): A Georgikon Térképszerver helye és szerepe a térinformatikai adatbázisok hálózatában. LIV. Georgikon Napok, Keszthely, 2012. október 11-12. 2012-es előadások (ISBN 978-963-9639-48-5) pp. 90-96. http://napok.georgikon.hu/cikkadatbazis-2012/cat_view/3-cikkadatbazis/4-2012/10-vii-szekcio-vizgazdalkodas

CARRÉ, F., REUTER, H. I., DAROUSSIN, J., SCHEURER, O. (2008): From a Large to a Small Scale Soil Map: Top-Down Against Bottom-Up Approaches. In: HARTEMINK, A.E., MCBRATNEY, A., MENDONCA-SANTOS, M.L. (ed) Digital Soil Mapping with Limited Data. Springer, pp. 203-212.

EC (2007): Directive 2007/2/EC of the European Parliment and of the Council of 14 March 2007 establishing an Infrastructure for Spatial Information in the European Community (INSPIRE).

FÖMI (2013A): CORINE Land Cover 1:100 000 adatbázis http://www.fomi.hu/corine/clc100_index.html

FÖMI (20123B): Termékek http://www.fomi.hu/portal/index.php/termekeink

IUSS WORKING GROUP WRB, (2007) World Reference Base for Soil Resources 2006, first update 2007. World Soil Resources Reports No. 103. FAO, Rome.

JENNY, H., (1941): Factors of Soil Formation, A System of Quantitative Pedology. McGraw-Hill, New York.

KELLNDORFER, J., WALKER, W., PIERCE, L., DOBSON, C., FITES, J. A., HUNSAKER, C., VONA, J. CLUTTER, M. (2004): Vegetation height estimation from shuttle radar topography mission and national elevation datasets. Remote sensing of Environment, 93(3) pp. 339-358.

KREYBIG, L. (1937): A M. Kir. Földtani Intézet talajfelvételi vizsgálati és térképezési módszere. Budapest

LAWLEY, R., SMITH, B. (2008): Digital soil mapping at a national scale : a knowledge and GIS based approach to improving parent material and property information. In: HARTEMINK, A.E.; MCBRATNEY, A.; LOURDES MENDONCA-SANTOS, M.L., (ed.) Digital soil mapping with limited data. Springer, pp. 173-182.

MCBRATNEY, A., MENDONCA SANTOS, M.L., MINASNY, B. (2003): On digital soil mapping. Geoderma. 117. p. 3–52.

MATTYASOVSZKY, J., GÖRÖG, L., STEFANOVITS, P. (1953): Mezőgazdasági talajtérkép 1:200.000. Tervgazdasági Könyvkiadó, Budapest

MÉM, (1983-1988): Magyar Népköztársaság: agrotopográfiai térkép 1:100 000. [Budapest] MÉM Országos Földügyi és Térképészeti Hivatal; 1983-1988. 84 térképlap 51 x 66 cm

MÉM-NAK, (1984) Magyarország genetikus talajtérképe 1:200,000. Budapest

MENDONÇA-SANTOS, M. D. L., SANTOS, H. G., DART, R. O., PARES, J. G. (2008): Digital mapping of soil classes in Rio de Janeiro State, Brazil: data, modelling and prediction. In: HARTEMINK, A.E., MCBRATNEY, A., MENDONCA-SANTOS, M.L. (ed) Digital Soil Mapping with Limited Data. Springer, pp. 381-396.

MTA ATK TAKI, (2013) www.mta-taki.hu/osztalyok/gis-labor/agrotopo

PELIKÁN, P., PEREGI, ZS. (ed) (2005) Magyarország földtani térképe 1:100 000,© Magyar Állami Földtani Intézet http://mafi-loczy.mafi.hu/Fdt100/

SILVERTOWN, J. (2009): A new dawn for citizen science. Trends in ecology & evolution, 24(9) pp. 467-471.
SISÁK, I., BENŐ, A. (2012): Az 1:200.000 méretarányú mezőgazdasági talajtérkép digitális publikációja a Georgikon Térképszerveren. LIV. Georgikon Napok, Keszthely, 2012. október 11-12. 2012-es előadások (ISBN 978-963-9639-48-5) p. 431-436. http://napok.georgikon.hu/cikkadatbazis-2012/cat_view/3-cikkadatbazis/4-2012/10-vii-szekcio-vizgazdalkodas
SISÁK, I., BENŐ, A. (2014): Probability-based harmonization of digital maps to produce concept maps of soil. Agrokémia és Talajtan. 63. 1. (in press)
YANG, L., Y. JIAO, S. FAHMY, A-X. ZHU, S. HANN, J. E. BURT AND F. QI, (2011): Updating Conventional Soil Maps through Digital Soil Mapping. Soil Science Society of America Journal, 75(3) pp. 1044-1053.
MAP SERVERS AND SOURCES ON THE INTERNET:
http://www.sciencedirect.com/science/article/pii/S0034425704002330 - aff5
(http://eusoils.jrc.ec.europa.eu/wrb
(http://geo.kvvm.hu/tir/viewer.htm)
(http://map.georgikon.hu)
(http://mafi-loczy.mafi.hu/Fdt100/)
(http://terkep.air.gov.hu/terkep/nyilvanos/nyilvanos.htm)
(http://www.eea.europa.eu//themes/landuse/dc)
(http://www.fomi.hu/corine/clc100_index.html)
(http://www.mta-taki.hu/osztalyok/gis-labor/agrotopo),
(http://www2.jpl.nasa.gov/srtm/cbanddataproducts.html)

Review on Agriculture and Rural Development 2014. vol. 3 (1) ISSN 2063-4803

LEAF MACRONUTRIENT COMPOSITION OF GRAPES IN SOUTH PLAIN HUNGARIAN VINEYARDS

JUDIT PETŐ, ATTILA HÜVELY, ENDRE PÖLÖS, IMRE CSERNI

Kecskemét College
Faculty of Horticulture
Department of Horticulture
Kecskemét, Erdei F. tér 1-3. 6000
peto.judit@kfk.kefo.hu

ABSTRACT
In our study analysis of samples of vine leaves taken in the different phases of vegetation was carried out in three years, 2010-2012. Our analysis confirmed the translocation of nutrient elements in varying degrees. Laboratory tests were made on about eight thousand leaf samples in our laboratory (Soil and Plant Testing Laboratory of Faculty of Horticulture, Kecskemét College). The results of sample tests, largely arriving from the Southern Hungarian plain region, mainly Bács-Kiskun county, showed that the level of the main nutrient elements from bloom to the completion of maturation tends to decrease. In the case of phosphorus, a continuous slow decline was shown, while N and K varied according to a curve; increase in the beginning of ripening and significant decrease afterwards. Changing in the ratios of some main nutrients (N/K and K/Mg) was also shown. Low level of potassium and phosphorus was observed in about one fifth of the samples, so increase in P and K fertilization may be proposed.

Keywords: leaf sample, macro nutrients, analysis, grape

INTRODUCTION

Grape is not designed specifically as a high nutrient demanding plant. Apart from the very extreme soils (highly acidic, saline, airless meadow, bog), it is able to grow in a wide range of soils. As a sugar accumulating plant, however, its potassium demand is significant. Potassium deficiency can be caused by the potassium-poor sandy soil, inhibited uptake due to the antagonism of the Mg and Ca, drought or tending to dry weather (SZŐKE, 2006). Magnesium is also an important nutrient; but the lack of this in plantation is rare. Magnesium deficiency may develop on loose soils, without structure or as a consequence of the high degree of soil acidification. Demand for nitrogen is not great, but the N deficiency and excess weight can also be harmful (SCHREINER, 2006; NÉMETH, 2006). The importance of boron among the micro nutrients can be highlighted, however, in some areas (Balaton Uplands) iron deficiency can cause distraction.
The absence of most nutrients may be followed by leaf analysis. On the basis of the result of the leaf blade investigation we may conclude the uptake of nutrients, as well as the nutrient supply disturbances. In addition to the soil test results it can be used to determine the nutrient needs of grapes. As prescribed by regulation relating to sampling, leaf samples should be collected in the opposite to the first cluster; two optional dates are blooming and ripening (harvest).
According to nutrient uptake dynamics in general, the uptake of the main nutrient elements are the largest from budbreak to veraison, and during the ripening process continues to decrease. The exception to this is magnesium, because the level of it is almost constant in the full season (SZŐKE, 1995). The uptake of the micronutrients compared to macroelements is a little later in the time, with a maximum reached at the first phase of

ripening. Each level and relative ratio of some nutrient elements may cause adverse effects, so the critical values are worded in generally accepted guidelines (KOVÁCSNÉ, 1981).
Our tests determined the level of the most important macroelements by grape leaf analysis, and the results were processed according to the different stages of the growing season. On the other hand, a brief comparison was made in the 2010-2012 period of the possible effect of the different weather conditions. Our laboratory studies were made on the basis of samples from more than a thousand clients.

MATERIAL AND METHOD

The collection of samples from the plants was carried out by the farmers, in the management period between 1. May and 15. September of 2010, 2011 and 2012. Grape plantations were located in southern plain region of the country, mainly in county Bács-Kiskun. We have developed test results of 2580, 2220 and 3050 grape leaf samples in 2010, 2011 and 2012, respectively. According to the regulation of the ministry on agro environmental management program 61/2009 (V. 14)/, characteristic leaves opposite the first cluster should be collected for testing in the phase of bloom or ripening, once a year, on a compulsory basis. The taking and handling of plant samples and the scope of the tests was made taking into account relevant legislation.
Analytical testing methods were made in the Soil and Plant Testing Laboratory of Faculty of Horticulture (Kecskemét College). Our laboratory uses standard methods involved in accreditation certificate (NAT-1-1548/2011).
Petiole was removed, and then leaf blade samples were thoroughly washed. Leaf samples were dried at 70 °C. The air-dry samples were thoroughly minced. For elemental studies powdered samples were digested in a microwave device by means of concentrated nitric acid and hydrogen peroxide (Milestone Ethos Plus). Main macro element content was measured by optical emission spectrometer (ICP-AES method). Nitrogen content in leaf blades was determined using the Kjeldahl method after sulphuric acid digestion (FOSS Kjeltec 2300). Macro element (N, P, K, Ca, Mg, Na) contents were calculated in m/m% dry matter.
The required tests according to the regulation include measurement of the N, P, K, Ca, Mg content. In nearly 20% of the samples, micronutrient contents were also tested however, the results of these are evaluated in our other study.
The results of analysis were divided into 9 sections according to the phenological phases (from completion of the maturation to total ripening), the length of these periods was two weeks on average. The nutrient contents were shown graphically in the 3 consecutive years and the frequency of deficiency symptoms was also evaluated. The ratio of N to K and K/Mg ratio were also calculated. For estimating changes in the concentration of the main nutrients Student's two-pair t-probe was applied.

RESULTS

Main macroelements in leaves were N and Ca, followed by K, Mg and P. At different stages of the phenological phases (1-9) nitrogen, phosphorus, potassium, levels of the grape leaf samples in three consecutive years, are illustrated in *Figures 1-3*.

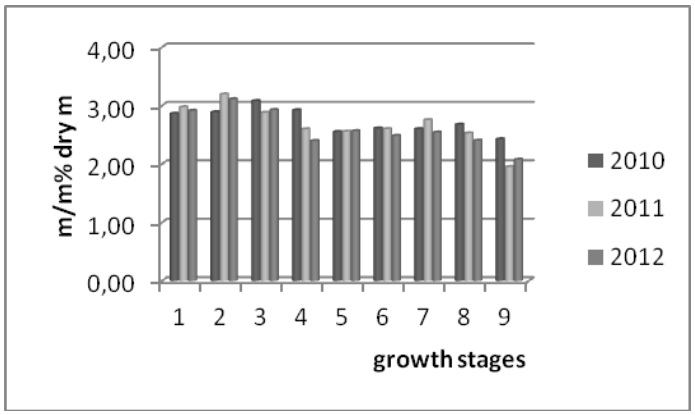


Figure 1. Changes in nitrogen content of grape leaf blades in different growth stages (1-9) from bloom to total ripening in 2010, 2011 and 2012

Nitrogen content in leaves increased significantly after blooming to the beginning of ripening (to stage 2 or 3), whereas it decreased thereafter ($p<0.001$).
As for potassium content of grape leaves, there was a tendency to increase after bloom, the highest level was reached at growth stage 4 in every year, and it sharply decreased afterwards (*Figure 2*).

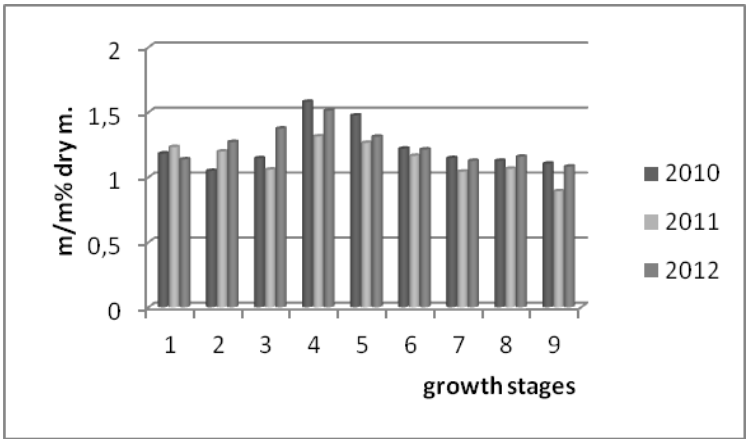


Figure 2. Changes in potassium level (m/m% dry matter) in grape leaves in different growth stages (1-9)

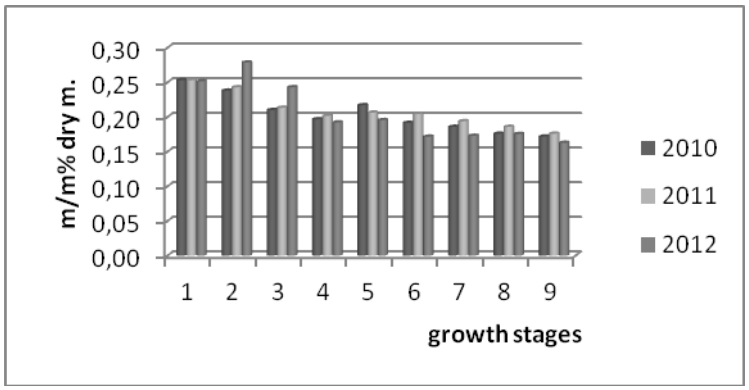


Figure 3. Changes in phosphorus level in grape leaves in different growth stages (1-9)

Phosphorus levels decreased continuously in the study period till harvest ($p<0.001$). Slight increase was shown after blooming only in 2012.

A slight continuous increase in Ca level was shown until stage 7-8 (from 1.88 to 2.76 mg/kg dry matter) reflecting weak mobilization of this element. Magnesium concentration increased from 0.31 in the beginning to the maximum of approximately 0.42; remaining almost constant in the observed vegetation period. Ca deficit was frequent in the rainy 2010 year (lower than 1.5 m/m% dry matter in 14.1% of the samples), whereas Mg deficiency was more common in the dry 2011 year (lower than 0.2% in 14.0% of the samples).

According to the ratio of nitrogen to potassium, a biphasic elevation-decrease wave was observed, mainly as a consequence of sharp changes in potassium level (*Figure 4*). High N/K ratio (threshold limit 5m/m% dry matter) was shown only in about 3% of the samples.

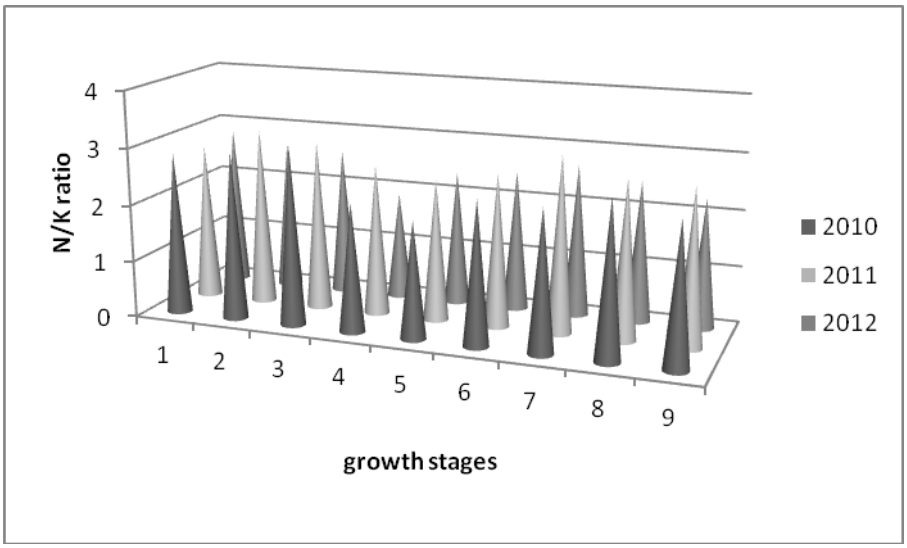


Figure 4. Changes in nitrogen/potassium ratio in different growth stages of grape in three consecutive years.

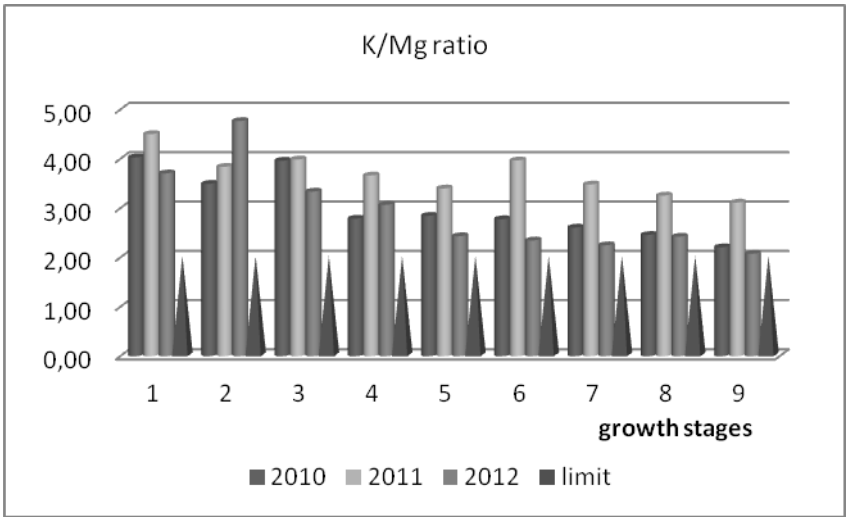


Figure 5. Potassium/magnesium ratio in different phenological phases of grape

Potassium to magnesium ratio decreased to the end of harvest (*Figure 5*). Threshold limit (2 m/m% dry matter) was reached in about 20-25% of the samples, due to decrease in potassium and moderate increase in magnesium.

CONCLUSIONS

In our three-year study period we examined changes in macronutrient levels in grape leaves, the frequency of the extremely high or low levels and ratios of main nutrients, that are taken into account in scientific literature. As we reported earlier, our laboratory makes leaf tests of about 10% of the nationally relevant plantations of the environment management grant cycle between 2010 and 2014 in Hungary. The majority of the tested plantations are vineyards. The most common types are Bianca, Cserszegi and Kékfrankos (PETŐ et al., 2011). In the Danube-Tisza region vine-growing is recommended primarily in mold sand soils (CSERNI-FÜLEKY, 2008). Weather and precipitation can also significantly affect nutrient management and water balance in plants. Only a small part of the vineyards is irrigated.

Grapes take up nutrients necessary for development at a different rate in the growing season. Nutrient content of the leaves therefore largely depends on the time of sampling (SCHREINER, 2006; SZŐKE, 1995). Taking into account varying nutrient uptake dynamics and movement, our results confirm that only test results carried out during the same period are comparable. The level of the main nutrients decreased in grape leaves from blooming towards harvest in our study. Nitrogen content was satisfactory in the vast majority of our samples in the whole examined vegetation period. Two maxima of nitrogen content were observed, immediately after blooming and in the last third of maturity. Maximum concentration of potassium appeared about two-four weeks later. Experienced changes in their concentrations may be associated with their mobility. Average potassium levels were in the lower concentration range. Potassium uptake was the lowest in the dry 2011 year. Phosphorus content seemed to be the least mobile element with a constantly falling leaf concentration. Phosphorus level decreased continuously, and stayed in the lower concentration range during the whole vegetation period. Low phosphorus levels in leaves occurred in about 25% of samples, mostly in 2012, and typically in the second half of the vegetation period. In the tested grape plantations it is recommended to increase the amount of potassium and phosphorus fertilization.

The ratio of some nutrients may be more informative than the simple concentration of them. Most commonly accepted is the N/K ratio. The appearance of high N/K ratio was not typical in the tested vineyards. However, the ratio of potassium to magnesium decreased to the end of harvest (*Figure 5*) and seemed to be low in about 20-25% of the samples, due to aforementioned low level and decrease in potassium and moderate increase in Mg concentration.

Our results emphasize the importance of leaf analysis in addition to the soil test results. Leaf blade analysis recording the actual nutrient uptake and mobilization is important in considering the nutrient supply. The effects of changes in weather conditions need further investigations.

ACKNOWLEDGEMENTS

The authors wish to thank Mónika Virág for instrumental measurements on ICP-AES.

REFERENCES

CSERNI I., FÜLEKY GY. (2008): A Duna-Tisza közi homokhátság talajainak vízgazdálkodása, special issue of Talajvédelem (Ed.: L. SIMON) pp. 53-62.
KOVÁCSNÉ MÉREI ZS. (1981): Állókultúrák fenntartó műtrágyázási irányelvei. Budapest. MÉM Növényvédelmi és Agrokémiai Központ, p. 50.
NÉMETH, T. (2006): Nitrogen in the soil-plant system, nitrogen balances. Cereal Research Communications 34: 61-65.
PETŐ J. BORSNÉ, A. HÜVELY, I. BUZÁS, E. HOYK (2011): A talaj- és növényvizsgáló laboratórium tevékenységének bemutatása és működésének tapasztalatai, Erdei F. Tudományos Konferencia, Kecskemét, pp. 569-573.
SCHREINER, R.P., C.F. SCAGEL, J. BAHAM (2006): Nutrient uptake and distribution in a mature 'Pinot Noir' vineyard. HortScience 41(2) pp. 336-345.
SZOKE, L., G. VANEK, T. SZABO (1995): Nutrient uptake dynamics of grapevine during the vegetation. Proceedings of the International Symposium on Grapevine Physiology, pp. 165-168.
SZŐKE L. (2006): A kálium szerepe a szőlőtermesztésben, Agrárágazat **7** 40-43.

Review on Agriculture and Rural Development 2014. vol. 3 (1) ISSN 2063-4803

EFFECT OF ADDITION OF LIVE YEAST CULTURE ON FATTENING PERFORMANCE ON SOME BLOOD AND RUMEN FLUID PARAMETERS IN MALE KIDS FED WİTH SUCROSE SUPPLEMENTED CONCENTRATE

KADIR EMRE BUGDAYCI[1], M. NUMAN OGUZ[1], FATMA KARAKAS OGUZ[1], SIMA SAHINDURAN[2]

[1]Mehmet Akif Ersoy University, Veterinary Faculty, Department of Animal Nutrition and Nutrition Diseases, Turkey
[2]Mehmet Akif Ersoy University, Veterinary Faculty, Department of Internal Medicine, Turkey
kebugdayci@mehmetakif.edu.tr

ABSTRACT
The aim of this study were to evaluate the effects of live yeast culture (LYC) as a feed additive on fattening performance, some blood and rumen fluid parameters in male goats fed with sucrose (S) supplemented concentrate. Totally 18 male Saanen goat kids were divided into three groups, no S and LYC (S(-)) as control, 3 % S (S(+)) and 3 % S plus LYC group (S+LYC), each containing 6 kids. Concentrates of groups were formulated as isonitrogenic and isocaloric. LYC (Rumisacc®, Integro Food Industry and Trade Co., İstanbul, Turkey (containing live yeast cell 344 x 10^{10} cfu per gram) was included in the concentrate at 2% as feed basis. Feeding schedule was established with only concentrate, feed was given *ad libitum* and roughage was not given. Addition of LYC plus S to concentrate increased ruminal ammonia-N and decreased ruminal pH compeared with sucrose unsupplemented control group. Addition of live yeast culture and sucrose did not affect fattening performance and blood parameters significantly on $P<0.05$ except HGB and HCT.

Keywords: Live yeast culture, fattening performance, blood parameters, rumen parameters, kid

INTRODUCTION

Grain feeding can sometimes be a controversial topic among goat and sheep producers. Some producers feed a lot of grain to their livestock, while others do not feed any grain at all. The decision to feed grain should be based primarily on economics, including marketing advantages realized by not feeding grain or by feeding grain (SCHOENİAN, 2014).

Live yeast cultures as microbial feed additives have been used in ruminant nutrition as rumen fermentation stimulant or performance enhancer. To avoid grain sickness, it is important that animals digestive system are allowed to gradually adapt to the grain. On the other hand microbial feed additives can be used for this adaptation period.

DESNOYERS ET AL., (2009), indicated that the positive effect of yeast supplementation on rumen VFA concentration increased with dry matter intake and crude protein levels. Related with active dryed yeasts in young ruminants, CHAUCHEYRAS-DURAND ET AL., (2008) also mentioned that yeast have an stabilization function on rumen pH.

However supplementation of yeast culture in diets of ruminants had conflicting results on rumen fatty acid (VFA) concentration (DOLEZAL ET AL., 2005; ÖZSOY ET AL., 2013). These differences may depend on many factors such as diet composition, forage to concentrate ratio, type of forage feed, yeast dose, feeding strategy and stage of lactation (YALÇİN ET AL., 2011).

For many years, scientists have shown greater interests in manupulating the microbial ecosystem of the rumen to improve production efficiency by domestic ruminants. The benefits of live yeast culture are well understood however researchs in small ruminants are limited. Resent investigations indicated that addition of *Saccharomyces cerevisiae* live

yeast cultures has improved live weight gain (ÖZSOY ET AL., 2013; KAMAL ET AL., 2013), dry matter intake (KAMAL ET AL., 2013) and feed conversion ratio (HADDAD AND GOUSSOUS, 2005; JİNTURKAR ET AL., 2009), incresed ruminal pH (ÖZSOY ET AL., 2013; ABD EL-GHANİ, 2004) in small ruminants.

The purpose of feeding grain to livestock is to provide nutrients that the forage part of the diet is not providing. For example, forage diets often cannot meet the nutritional needs of lambs and kids with the genetic potential for rapid growth. For this reason, supplements are often provided to enable livestock to reach their genetic potential for growth (SCHOENİAN, 2014).

One of the prefered dairy goat species is Saanen in Turkey. Male kids have less economic value for dairy farms in birth season when compeared with femails. They are generally fed with forages by the families and slaughtered without getting economic value. Effects of supplementing live yeast culture (Rumisacc® İntegro Gıda AŞ, Turkey) to concentrate rations fed to fattening male Saanen kids have not been studied. Therefore, the objective of this study was to evaluate the effects of live yeast culture supplementation to fattening diets of male Saanen kids on feed intake, growth performance, some blood parameter and ruminal volatile fatty acids.

MATERIAL AND METOD

The animals used in this experiment were cared for in accordince with the guidelines from the Veterinary Faculty of Mehmet Akif Ersoy University regulations for care and treatments of animals.

A total of 18 male Saanen kids aged 1months were used at the study.All the animals were treated for internal and external parasites using Ivomec (Novakim; active ingredient: 10 mg/ml Ivermectin; dose: 1ml/50 kg live weight) 2 weeks before the experiment started.

This study was conducted at the commercial feedlot for 21 weeks from April 2013 to August 2013.

Kids were housed individual cages (2m x 3m) under the shed with concrete floor with sawdust and dryed manure as bedding material for the entire period of the experiment. Saanen goat kids were divided into three groups, no S and LYC (S(-)) as control, 3 % S (S(+)) and 3 % S plus LYC group (S+LYC), each containing 6 kids.Concentrates were prepared as a mash feed. LYC (Rumisacc®, Integro Food Industry and Trade Co., İstanbul, Turkey; Live yeast cell 344 x 10^8 cfu per gram) was included in the concentrate at 2% on feed basis.Feeding schedule was established with only concentrate, feed was given *ad libitum* and roughage was not given.

The ingredients and the chemical composition of the concentrates are presented in *Table 1*.

Table 1: The ingredients and chemical composition of the concentrate feeds

	Dietary treatments		
Ingredients, % as feed basis	**S(-)**	**S(+)**	**S+LYC**
Corn	35.5	30	30
Barley	24	25	25
Wheat Bran,	9	10	10
Full fat soy	15	13	13
Sunflover meal, 36 % Crude Protein	9.5	10	10
Soybean meal, 48 % Crude protein	7	6	6
DCP	2	2	2
Canola oil	3	3	3
DL-methionine	0.2	0.2	0.2
L-Lizin hidrochloride	0.2	0.2	0.2
Sucrose	-	3	3
Live yeast culture[1]	-	-	2
Lime stone	1	1	1
Salt	0.4	0.4	0.4
Vitamin mineral premix[2]	0.2	0.2	0.2
Analysed composition, % as feed basis			
Dry matter, %	91.77	92.15	92.27
Crude protein, %	15.40	15.11	15.35
Ether extract, %	5.70	5.44	5.81
ME, kcal/kg ME	2806.19	2794.70	2830.03

CON: Control group; YC:group fed with diet containing live yeast culture;YVM: group fed with died containing the combination of live yeast culture with vitamin and mineral; 1 RumiSacc, Integro Food Industry and Trade Co., İstanbul, Turkey; 2 Each kilogram of vitamin-mineral mix contains 12 000 000 IU A vit, 20 000 mg E vit, 50 000 mg Mn, 50 000 mg Fe, 50 000 mg Zn, 10 000 mg Cu, 800 mg I, 150 mg Co, 150 mg Se

Live yeast culture (Rumisacc®, Integro food Industry and Trade Co., Istanbul, Turkey) was included in the concentrates at 2,0 %. During the study concentrates and fresh water were given *ad libitum* and the ration was not containing roughage. Feed refusals were collected once a week and weighed to accuretly determine to dry matter intake.

Nutrient composition of concentrates, live yeast culture and its vitamin-mineral combination product were determined according to the AOAC (2000).The metabolizable energy levels of concentrate feeds were determined by using the following formula of TSI (1991).

ME (kcal/kg OM) = 3260 + (0.455xCP) – (4.037xCF) + (3.517xEE) where CP (crude protein), CF (crude fibre) and EE (ether extract) were expressed as g/kg OM (organic matter) and converted dry matter (DM) basis.

Animals were individually weighed at the beginning of the experiment and every two weeks. The daily weight gain over the duration of experiment was determined individually. Daily dry matter intakes of the kids were determined and feed conversion ratio was calculated as kg feed per kg live weight gain of kids individually.

Rumen fluid samples were collected in two bottles from all kids in each group during the slaughtering process. Rumen fluid sample in one bottle was used for the measurement of pH and other was for VFA. The pH was measured immediately by a pH meter (Hanna pH meter, model no: Hi917hN). Rumen fluid samples were filtered from cheese cloth before VFA analysis. After centrifugalize (10.000 rpm, 10 min at +4^{o}C) concentrations of VFA in the supernatant were determined by HPLC system of Agillent 1260 series (Agillent Technologies, Waldronn, Germany) equipped with a Agilent-detector (1260 MVDVL)

operated at 210 nm. Separation of acids was conducted using an organic acid analysis column (300 x 7.7 mm; Hi-plexH-organic acid column), with 0.005 M H_2SO_4 as eluent, at flow rate of 0.6 ml/min, and with the column temperature of 55^oC. Concentrations of ammonia-N were determined by distillation (Gerhard, vapodest 2000) and titration, by using 5 ml of the rumen fluid which filtered by from cheese cloth (ANONYMUS, 2014).

Blood samples were taken in two tubes from jugular vein containing EDTA for hematological analysis and without EDTA for biochemical analyzes with the aid of the cannula at the last day of the experiment.

Tubes for biochemical analysis were centrifugalized at 3000 rpm at room temperature for 5 minutes and then serum was carefully harvested for determination of total cholesterol, triglyceride, glucose and blood urea nitrogen (BUN) were analyzed by VET TEST 8008 Autoanalyzer (IDEXX Laboratories, inc Westbrook ME 04092 USA).

Other blood samples for hematological analyses (WBC, RBC, HGB, HCT, MCV, MCH, MCHC, RDWc) were freshly analized by Abacus Junior Vet Hemmatology Analyzer (Diatron MI PLC. Hungary).

Statistical analysis has done using computer programme. One way ANOVA was performed to detect the differences among groups. The significance of mean differences between groups were tested by Tukey (DAWSON AND TRAPP, 2001). Values were given as mean ± standard error. Level of significance was taken as $P<0.05$.

RESULTS

Protein analysis of live yeast culture (Rumisacc®) showed that it is rich in protein content (44.31%). Other results of analysis, dry matter, crude ash, eter extract and crude fibre ingradients are 93.45; 11.65; 3.89 and 3,07% respectively.

Dietary live yeast supplementation did not significantly affect live weight *(Table 2)* and live weight gain of kids during the study. Interestingly the live weight gain of S+LYC has developed more stable than the other groups. Dietary live yeast culture significantly ($p<0,05$) increased live weight gain compeared with other groups at the hot (middle of summer) final weeks of the study however this result was not reflected to avarage live weight gain at the end of the experiment.

Avarage feed intake and feed conversion ratio were not significantly affected by dietary treatments *(Table 3).* In the present study kids fed diet containing live yeast culture fed more feed than the control group at the first 4 week of the experiment. On the other live yeast supplemented group consumed less feed than control group in significantly during the study - except final week of the experiment.

Live yeast culture did not affect hot and cold carcass yield significantly compeared with other groups (*Table 4).* In the present study ruminal pH of sucrose supplemented both S(+) and S+LYC groups were negatively affected ($p<0,05$).

Also for the same groups the ruminal ammonia-N concentration were significantly increased ($p<0,05$) compeared with unsupplemented Suc (-) CON group (*Table 5*).

In the present study initial (*Table 6*) and final (*Table 7*) blood chemistry results of total cholesterol, glucose, trigliceride, BUN and some hematologycal parameters were not altered -except HGB and HCT- by dietary live yeast culture supplementation.

Ruminal VFA concentrations (*Table 8*) were not affected by dietary inclusion of live yeast culture or sucrose.

Table 2. Effects of dietary treatments on body weight (BW),kg.

Days	Dietary treatments			p
	S(-)	S(+)	S+LYC	
Initial BW, kg	8850.00 ± 681.66	9241.66 ± 652.10	9790.00 ± 620.16	0.622
Day 14	10416.66 ± 817.38	10933.33 ± 633.59	11520.00 ± 659.46	0.578
Day 28	12800.00 ± 978.34	13391.66 ± 934.38	13330.00 ± 720.86	0.876
Day 42	15025.00 ± 921.75	15341.66 ± 1164.00	14930.00 ± 589.61	0.951
Day 56	17658.33 ± 1049.08	17141.66 ± 1240.12	16530.00 ± 568.02	0.757
Day 70	19800.00 ± 1241.16	18175.00 ± 1461.26	17790.00 ± 465.67	0.514
Day 84	23366.66 ± 1345.03	20416.66 ± 1889.95	20320.00 ± 865.10	0.283
Day 98	26058.33 ± 1834.32	22175.00 ± 1982.62	23670.00 ± 1272.06	0.264
Day 112	25816.66 ± 1483.95	22400.00 ± 2012.95	25060.00 ± 968.42	0.304
Day 119	25841.66 ± 1443.68	24458.33 ± 2304.82	26280.00 ± 1022.08	0.749

n=6, p<0.05

Table 3. Effects of dietary treatments on performance parameters

Avarage results	Dietary treatments			p
	S(-)	S(+)	S+LYC	
Weight gain, g/d	142.78 ± 11.13	127.87 ± 16.25	138.57 ± 8.63	0.694
Feed intake, g/d	753.76 ± 37.77	735.72 ± 41.97	714.09 ± 27.50	0.766
Feed conversion ratio, (Feed intake/weight gain)	5.33 ± 0.19	6.07 ± 0.55	5.20 ± 0.55	0.249

n=6, p<0,05

Table 4. Effects of dietary treatments on hot and cold carcass weights and yields

Item	Dietary treatments			p
	S(-)	S(+)	S+LYC	
Hot carcass weight, kg	12.26 ± 0.72	10.93 ± 1.26	12.28 ± 0.54	0.512
Cold carcass weight, kg	12.03 ± 0.72	10.63 ± 1.24	12.16 ± 0.54	0.447
Hot carcass yield, %	47.44 ± 0.62	44.28 ± 1.13	46.76 ± 1.31	0.102
Cold carcass yield, %	46.53 ± 0.71 a	43.04 ± 1.21 b	46.30 ± 1.23 a	0.060

n=6, p<0.05

Table 5. Effects of dietary treatments on rumen pH and rumen -NH_3- N

Item	Dietary treatments			p
	S(-)	S(+)	S+LYC	
Rumen pH	6.35 ± 0.20 a	5.79 ± 0.07 b	5.70 ± 0.15 b	0.021
	S(-)	**S(+)**	**S+LYC**	**p**
Rumen NH_3-N,mg/l	686.56 ± 105.06 b	1134.56 ± 94.21 a	1143.85 ± 77.33 a	0.004

p<0.05

Table 6. Initial hematological and blood chemistry results of kids

Item	Dietary teratment			p
	S(-)	S(+)	S+LYC	
WBC, 10^9 /L	10.76 ± 2.09	9.92 ± 0.99	12.65 ± 2.31	0.591
RBC, 10^{12}/L	17.09 ± 0.47	16.75 ± 0.52	16.20 ± 0.47	0.480
HGB, g/dl	8.20 ± 0.38	7.53 ± 0.28	7.66 ± 0.51	0.446
HCT, %	22.23 ± 1.33	20.39 ± 0.43	20.78 ± 1.12	0.422
MCV, fl	12.83 ± 0.47	12.16 ± 0.30	12.60 ± 0.40	0.493
MCH, Pg	4.80 ± 0.14	4.51 ± 0.13	4.70 ± 0.18	0.423
MCHC, g/dl	37.11 ± 0.70	36.90 ± 0.72	36.78 ± 0.60	0.942
RDWc, %	48.30 ±0.88	49.60 ± 0.72	47.36 ± 0.74	0.179
Total cholesterol , mmol/L	4.77 ± 0.52	3.69 ± 0.37	3.53 ± 0.43	0.142
Glucose, mmol/L	4.27 ± 0.42	5.02 ± 0.74	5.75 ± 0.88	0.353
BUN, mmol/L	5.03 ± 0.63	4.21 ± 0.43	4.42 ± 0.44	0.517
Triglceride, mmol/L	0.24 ± 0.03	0.18 ± 0.04	0.38 ± 0.49	0.089

n=6, $p<0.05$

Table 7. Final hematological and blood chemistry results of kids

Item	Dietary teratment			p
	S(-)	S(+)	S+LYC	
WBC, 10^9 /L	12.73 ± 2.88	10.90 ± 1.02	11.25 ± 1.07	0.777
RBC, 10^{12}/L	18.65 ± 0.57	17.20 ± 0.57	17.40 ± 0.70	0.217
HGB, g/dl	10.60 ± 0.37 a	9.03 ± 0.28 b	9.34± 0.52 b	0.027
HCT, %	27.57 ± 0.71 a	24.10 ± 0.79 b	25.35 ± 1.12 ab	0.034
MCV, fl	14.66 ± 0.42	14.16 ± 0.47	14.80 ± 0.58	0.636
MCH, Pg	5.68 ± 0.08	5.25 ± 0.11	5.36 ± 0.19	0.083
MCHC, g/dl	38.41 ± 0.65	37.58 ± 0.91	37.09 ± 1.01	0.565
RDWc, %	44.80 ± 1.28	45.40 ± 0.79	44.60 ± 1.08	0.863
Total cholesterol, mmol/L	3.11 ± 0.41	2.52 ± 0.28	2.05 ± 0.12	0.104
Glucose, mmol/L	4.02 ± 0.32	4.45 ± 0.24	4.08 ± 0.23	0.496
BUN, mmol/L	6.66 ± 0.49	7.96 ± 0.68	6.80 ± 0.34	0.207
Trigliceride, mmol/L	0.38 ± 0.06	0.29 ± 0.02	0.26 ± 0.03	0.222

n=6, $p<0.05$

Table 8. Effects of dietary treatments on volatile fatty acids of ruminal fluid (mg/l)

Item	Dietary teratment			p
	S(-)	S(+)	S+LYC	
Lactic acid[1]	44.39 ± 19.00	6737 ± 17.94	63.86 ± 17.96	0.647
Acetic acid[1]	1062.79 ± 195.56	1087.32 ± 323.58	1921.59 ± 232.00	0.116
Propyonic acid[1]	406.79 ± 130.90	1475.43 ± 416.96	1251.76 ± 227.19	0.119
n-butyric acid[1]	264.32 ± 65.02	338.41 ± 61.68	477.03 ± 129.34	0.284
Iso-butyricacid[1]	20.48 ± 4.11	33.50 ± 17.88	81.59 ± 38.51	0.190

[1]Results of formic acid used analysis n=6, $p<0.05$

DISCUSSION AND CONCLUSIONS

Avarage live weight gain results of present study is not statistically different among groups. It is similar with the study in lambs and goat kids (TİTTİ ET AL., 2008). However there is a series of study in goats (ÖZSOY ET AL., 2013; KAMAL ET AL., 2013) and in lambs (HADDAD AND GOUSSOUS, 2005), which were reported that live yeast supplementation increased live weight gain. Related with feed intake and feed converision ratio results KAMAL ET AL., (2013) reported that live yeast supplementation significantly improved dry matter intake (DMI) per kg gain. There is several studies which have mentioned improvement in feed conversion ratio due to yeast feeding in lambs (HADDAD AND GOUSSOUS, 2005) and in goats (JİNTURKAR ET AL., 2009). However TİTTİ ET AL., (2008), reported that yeast culture supplementation incresed digestibility with no effect on growth, feed intake or feed conversion ratio of fattening Awassi lambs and Shami kids.

Hot and cold carcass yield parameters are similar with TİTTİ ET AL., (2008) which reported that yeast culture supplementation did not affect cold dressing proportion and hot carcass weight of Shami goat kids.

Studies that have examined effects of yeast cultures on ruminal pH have reported variable results. In contrast to the results of ours, significant increases in ruminal pH associated with yeast supplementation have been reported in goats (ÖZSOY ET AL., 2013; ABD EL-GHANİ, 2004). On the other hand a series of study which have shown that ruminal pH was not affected by the supplementation of *Saccharomyces cerevisiae* (KAMAL ET AL., 2013; GALİP, 2006A; GARCİA ET AL., 2000). This difference may be attributed to composition of the rations and strain of the yeast culture. In the present study kids were adapted to concentrate in early age, this situation may have influence the S(-) group's ruminal pH stability.

Ruminal ammonia-N results of present study is similar with several studies which reported that ruminal ammonia-N concentrations were significantly increased by dietary yeast culture supplementation on goats (ÖZSOY ET AL., 2013) and on rams (GALİP, 2006B). However AYDİN ET AL., (2003) and MOYA ET AL., (2009) reported that dietary yeast culture supplementation did not affect ruminal ammonia-N concentration on sheeps and heifers respectively.

Our final blood chemistry results are similar with the studies on goats (ÖZSOY ET AL., 2013) related with plasma cholesterole and trigliceride concentrations and on dairy cows (YALÇİN ET AL., 2011) related with plasma glucose, cholesterole and trigliceride concentrations. On the other hand, dietary yeast supplementation did not change serum trigliceride and cholesterole levels in rams (GALİP, 2006A).

There is a series of study (ÖZSOY ET AL., 2013; AYDİN ET AL., 2003; GARCİA ET AL., 2000) which have similar results with ruminal fluid VFA concentration of the present study. KAMAL ET AL., (2013) indicated that total volatile fatty acid concentration was significantly higher in live yeast culture fed kids at 2 and 4 months of age.

It is concluded that addition of live yeast culture at the level of 2% to 3% sucrose supplemented concentrate increased ruminal ammonia-N and decreased ruminal pH compared with sucrose unsupplemented group.

More reasearch needs with more replicates to be conducted to determine the affects of live yeast culture on kids.

ACKNOWLEDGEMENTS

The authors say thanks for Integro Food Industry and Trade Co., Istanbul for the support of their research work.

REFERENCES

ANONYMOUS (2014): ITU çevre mühendisliği laboratuvarları temel parametre analizleri, Azot Tayini. http://web.itu.edu.tr/~itucevrelab/dokuman/Foyler/AZOT.pdf

ABD EL-GHANİ, A.A. (2004): Influence of diet supplementation with yeast culture *(Saccharomyces cerevisiae)* on performance of Zaraibi goats. Small Ruminant Research, Volume 52. pp. 223-229.

AOAC (2000): Official Methods of Analysis. 17th ed. Association of Official Analytical Chemists. AOAC International, Maryland.

AYDİN, C., GALİP, N., YAMAN, K., CENGİZ, F., TÜRKMEN, I., BİRİCİK, H. (2003): Effect of *Saccharomyces cerevisiae* live yeast culture on ruminal metabolites and protozoa in Kıvırcık male yearlings fed high forage and concentrate diet. Turkish Journal of Veterinary and Animal Sciences., Volume 26. pp. 1433-1440.

CHAUCHEYRAS-DURAND, F., WALKER, N.D., BACH, A. (2008): Effects of active dry yeasts on the rumen microbial ecosystem: Past, present and future. Animal Feed Science and Technology, Volume 145. pp 5-26.

DAWSON, B., TRAPP, R.G. (2001): Basic and Clinical Biostatistics. 3rd ed. Lange Medical Books/McGraw-Hill Medical Publishing Division, New York, pp. 161-182.

DESNOYERS, M., GİGER-REVERDİN, S., BERTİN, G., DUVAUX-PONTER, C., SAUVANT, D. (2009): Meta-analysis of the influence of *Saccharomyces cerevisiae* supplementation on ruminal parameters and milk production of ruminants. Journal of Dairy Science, Volume 92. pp. 620- 632.

DOLEZAL, P., DOLEZAL, J., TRİNACTY, J. (2005): The effect of *Saccharomyces cerevisiae* on ruminal fermentation in dairy cows. Czech Journal of Animal Science, Volume 50. pp. 503-510.

GALİP, N. (2006a): Effect of supplemental yeast culture on ruminal protozoa and blood paameters in rams. Revue de Médecine Vétérinaire, Volume157. pp. 519-524.

GALİP, N. (2006b): Effects of dietary *Saccharomyces cerevisiae* live yeast culture supplementation on ruminal digestion and protozoa count in rams fed with diets with low or high ratio forage/concentrate. Revue de Médecine Vétérinaire, Volume 157. pp. 609-613.

GARCİA, C.C.G., MENDOZA, M.G.D., GONZALEZ, M.S., COBOS, P.M., ORTEGA, C.M.E., RAMİREZ, L.R. (2000): Effect of a yeast culture *(Saccharomyces cerevisiae)* and monensin on ruminal fermentation and digestion in sheep. Animal Feed Science and Technology, Volume 83. Number 2. pp. 165-170.

HADDAD, G., GOUSSOUS, S.N. (2005): Effect of yeast culture supplementation on nutrient intake, digestibility and growth performance of Awassi lambs. Animal Feed Science and Technology, Volume 118. pp. 343-348.

JİNTURKAR, A.S., GİJAR, B.V., CHAUHAN, D.S., PATİL, R.A. (2009): Effect of feeding probiotics on the growth performance and feed conversion efficiency in Goat. Indian Journal of Animal Research, Volume 43. Number 1.pp. 49-52.

KAMAL, R., DUTTA, T., SİNGHA, M., KAMRAB, D.N., PATEL, M., CHOUDHARYB, L.C., AGARWALB, N., KUMARC, S., ISLAMA, M. (2013): Effect of live *Saccharomyces cerevisiae* (NCDC-49) supplementation on growth performance and rumen fermentation pattern in local goat. Journal of Applied Animal Research, Volume 41. Number 3. pp. 285-288.

MOYA, D., CALSAMİGLİA, S., FERRET, A., BLANCH, M., FANDİNO, J.I., CASTİLLEJOS, L., YOON, I. (2009): Effects of dietary changes and yeast culture *(Saccharomyces cerevisiae)* on rumen microbial fermentation of Holstein heifers. Journal of Animal Science,Volume 87. pp. 2874-2881.

ÖZSOY, B., YALÇİN, S., ERDOĞAN, Z., CANTEKİN, Z., AKSU, T. (2013): Effects of dietary live yeast culture on fattening performance on some blood and rumen fluid parameters in goats. Revue de Médecine Vétérinaire, Volume 164. Number 5. pp. 263-271.

SCHOENİAN, S. (2014). The truth about grain:Feeding grain to small ruminants Small Ruminant, In*f*o Sheet by http://www.sheepandgoat.com/articles/graintruth.html

TİTTİ, H.H., DMOUR, R.O., ABDULLAH, A.Y. (2008): Growth performance and carcass characteristics of awassi lambs and shami goat kids fed yeast culture in their finishing diet. Animal Feed Science and Technology, Volume 142. pp. 33-43.

TSI (1991): Animal feeds-determination of metabolizable energy (Chemical method). TS9610. Turkish Standards Institution, Turkey, pp. 2-3.

YALÇİN, S., YALÇİN, S., CAN, P., GÜRDAL, A.O., BAĞCİ, C., ELTAN, Ö. (2011): The Nutritive Value of Live Yeast Culture (Saccharomyces cerevisiae) and its effect on milk yield, milk composition and some blood parameters of dairy cows. Asian - Australian Journal of Animal Sciences, Volume 24. Number 10. pp.1377-1385

Review on Agriculture and Rural Development 2014. vol. 3 (1) ISSN 2063-4803

THE USE OF COST-BENEFIT ANALYSIS FOR ENVIRONMENTAL PROJECTS

LINDA SZŐKE, SALEH MOHAMED RASHAD Z., MOHAMED ITIMAD IBRAHIM G.

Szent István University, Faculty of Economics and Social Sciences
Doctoral School of Management and Business Administration
Institute of Regional Economics and Rural Development
H-2100 Gödöllő, Páter Károly u. 1.
linda890206@gmail.com

ABSTRACT
In research, we analysed the way cost-benefit analyses (CBA) were carried out in governmental and self-governmental projects which were partly financed by the European Union. The primary aim was to establish how the way these CBAs are carried out can be improved in the case of these institutions. By taking account of the environmental endowments and social factors, it became obvious that the quantity and presence of externalities is usually more significant than in the case of the assessment of economic factors. The presence of quantified benefits in the development documents could make it much easier for the decision makers to decide whether the investment possesses suitable characteristics in an economical, environmental and social sense too, in the case of projects and development concepts, or not. Therefore, its realization will certainly modify the welfare curve in a positive direction. In spite of this it can be stated that the incorrect methodical approach of the economic factors result many extern effects in the evaluation, which place the certain development programmes in the centre of the preferred economic decisions in a way that they cause many social and environmental damages.
Keywords: cost-benefit analysis, external effects, self-governmental projects, benchmarking, indicators

INTRODUCTION

Nowadays, because of the effects of the economic depression, it is more and more imperative to make the decisions concerning the planned investments be level-headed. Because of this, the European Union has a requirement that the CBAs be pre-emptively done for the higher cost investments. The goal of CBAs is, after all, to determine if the investment will produce an economically long-lived and sufficient result, while also helping to filter and quantify all the relevant external effects (TÓTH, 2008). I also made an effort to unveil how CBA was used for governmental, and self-governmental projects where European Union funds were used, which is important because it's becoming more imperative in this delicate and difficult economic situation to make the invested aid produce the highest level of efficiency, and generate the highest amount of positive impact. The actual process of my analysis can be divided into two main parts, first of which is the introduction and study of the actual CBA methodology. Our goal is to introduce the need and importance of doing this analysis in the preparatory planning phase, before the actual beginning of the execution of investment plans. The methodology provides a chance to examine the refunding of the investments in long-term, while not discarding the non-monetary and not easily quantified pros and cons. In this phase of the analysis, the document, made according to the criteria of the European Union on „general methodical know-how of making cost-benefit analyses" was of great help and benefit to me, which also covers the importance of the estimation of external effects in economical cost-benefit analyses (NFÜ, 2008). This stresses the importance of including the external effects in the highest possible detail (NFÜ 2009). The quantification methods however, vary from project to project. During the analyses, this text introduces different charts which summarize quantification methods of the effects, which help make the effect

quantifications and the interpretations easier. However, it might happen that some of the data can't be quantified, in which case it's important to comment on why that's the case, and at least give a qualitative explanation to the variable. The use and importance of this is that it shows that the non-monetary pros and cons have an overall lower importance during a decision-making phase than the monetary ones (SAMUELSON-NORDHAUS, 2000). During the actualization of the next segment of the analysis, we rate the CBAs of five chosen investments, by the strengths and weaknesses of their respective methodologies. The chosen five projects undertaken by different self-governments all include the use of partial financing from the European Union, for which the cost-benefit analyses were all made before the beginning of the projects, as part of actualization analyses. The professional documents have served as a baseline to choose the three projects for benchmarking analyses since further rating projects which were the methodically best CBAs. This is important, because when choosing the indicators of the benchmarking analyses, I strived to create a pointer-system which can be used to filter the CBAs by their applicability regarding external effects. The benchmarking analyses were made with three aspects, regarding three projects, after which were summarized the results.

MATERIAL AND METHOD

During the creation of analysis, we chosen the CBA documents of five self-governmental projects, by methodologies used, which are as follows: 1- The rehabilitation program of city central by the Self-government of Szentes and partners; 2- Area-plan for city central by Sárbogárd; 3- Creation of a Cycling Community Transportation System in Budapest"; 4- The project for sewage and canalisation of Tompa; 5- The establishment of a sewage farm in Nagykálló. We choosed these documents because they include CBAs made with different methodologies, and they have good examples of pros and cons of said methodologies. At first, we analysed the CBA documents of my chosen projects, and listed their methodological pros and cons. These results served as a base for the next part of my analysis, by choosing the three best as a sample for my benchmarking analysis. According to Champ (CHAMP 1998 and see more in COWI KFT 2010)), benchmarking in a newer interpretation means the finding and execution of so-called „best practice" elements, which are already proven and working exercises. Using the benchmark process, we analysed the aggregation of many externals, and defined the exact number of said externals.

The reason for this is simple – it is important to take note of all these externals, be it positive or negative, since the exclusion of them from the analysis may lead to incorrect assessments and decisions. These externals are also in a synergy; therefore we felt the need to summarize them. At the end of the analysis, the averages of these sums were used, since this is what defines the approximated average external-content of the systems, therefore, the average of the minimums and maximums would produce the optimum, in terms of the analysis. The „best" project will be chosen by process of elimination, leaving the one which has the number of externals closest to said optimum in its assessment. As a first step to this analysis, we created an indicator-group which may be used to assess the used methodology of the respective CBAs, meaning their applicability to the measurement and quantification of externals (*Table1*).

The indicators were grouped into three different categories: economical, environmental and social aspects. In all aspects, there are three indicators of status, and three indicators of performance. These were defined, and then used and evaluated on a -2 to +2 scale, then summarized the results.

Table 1. Indicators

Indicators of Status		**Indicators of Performance**	
Economical Aspects			
1.	Net Present Value (NPV)	1.	Change in Net Present Value (NPV)
2.	Economical Rate of Return (ERR)	2.	Change in proportions of Economical Rate of Return (ERR)
3.	Cost / Benefits Rate (CBR)	3.	Change of Cost / Benefits Rate (CBR)
Environmental Aspects			
1.	Effects on environmental characteristics	1.	Change in the quantified effects of environmental effect change
2.	The environmental effects of soon-to-be introduced technological systems	2.	Impact of the effects of soon-to-be introduced technological systems on the environment
3.	Effect on transportation and transport systems	3.	Change of the effect on transportation and transport systems
Social Aspects			
1.	Effects on health	1.	Change of effects on health
2.	Effect on employment and established workplaces	2.	Effects of the change of workplaces (both positive and negative)
3.	Effects on education	3.	Change of effects on education

Source: self-made and edited, 2012

RESULTS

The analyse of the results of evaluating the documents

The following three projects were used for the benchmarking: „Creation of a Cycling Community Transportation System in Budapest" (project 1), the project for sewage and canalisation of Tompa (project 2), and the establishment of a sewage farm in Nagykálló (project 3). The criteria for this decision was the evaluation of the methodologies of the various CBAs the projects used, because the choice of indicators was based on the ability to filter the applicability of the methodologies of each CBAs to external effects. At this point, both the amount, the applicability and the rateability of the information in the documents of the chosen projects was sufficient.

Evaluation of the results of the benchmarking analysis

During the evaluation, the numbers were various aspects, which were shown in the last row of the chart. To evaluate it, we used the average of the minimum and maximum numbers, and chose as an optimal value the one which was closest to this number.

Table 2. Evaluation of Economical Aspects

Code	**1. project**	**2. project**	**3. project**
1.	+2	-1	+2
2.	+1	0	+2
3.	+1	-2	+2
Sum	*(+)4*	*(-)3*	*(+)6*

Source: self-made and edited, 2012

While evaluating the economic aspects, the project which contained the least amount of externals was project one. Here, the average was 4,5. Even though, the positive externals in this case are less than the third project, the second project amasses the highest amount of negative externals in the economical indicators. However, the value closest to the average is the first project (see *Table 2 and Table 3*).

Table 3. Evaluation of Environmental Aspects

Code	1. project	2. project	3. project
1.	+1	+1	+2
2.	+1	+1	+1
3.	+2	+1	+1
Sum	*(+)4*	*(+)3*	*(+)4*

Source: self-made and edited, 2012

When evaluating the environmental aspects, all three projects produced a similar number, which are all relatively close to the defined optimum, in this case, 4. Fundamentally, all three projects have rather positive prospects, and their environmental load is relatively low. If we go by the change in state of the environmental elements, the third project is the best, since all three indicators are expected to change for the better. There is no shocking innovative positive impact regarding any of the technologies waiting to be implemented, however, the actual standard of previous technologies will probably improve either way. The load on transport systems is lowered by the first project the most; however, there is a positive change in three projects.

Examining the project from a social standpoint, all three are relatively close to the defined optimum, which in this case there is a 3.5. Therefore, in all three projects, the resulting externals are positive. If we take health care, the realisation of all three projects is important. There is also a distinct change for the better in terms of employment. In the first project, the chances of the unemployed get better, since they have better options of travelling to their respective workplaces, while the other two projects need new manpower and staff for both establishment and continued business. As for raising the level of education, the contribution of the third project is highest, since the new establishment requires specific technological studies from its workers (see *Table 4*).

Table 4. Evaluation of Social Aspects

Code	1. project	2. project	3. project
1.	+2	+2	+2
2.	+1	+1	+1
3.	0	0	+1
Sum	*(+)3*	*(+)3*	*(+)4*

Source: self-made and edited, 2012

CONCLUSIONS

When summarizing the results of the benchmarking analysis, the difference in externals is clearly visible (*Table 5*). When summarizing the results, we also defined the optimum in this case, which would be 8.5. The project closest to this optimum is project one, since for this project, there are the minimum expected externals (see *Figure 1*), therefore, it doesn't cause major problems in the market, even if they were disregarded during the financial planning. In case of projects having too many or too few externals however, disregarding them may cause a major problem, and through the improper data and results, it can

conclude in wrong decisions. It is visible from the results of the benchmarking analysis, that the projects show different values in terms of the economical effects, which differ in the methodologies examined, from simplified economic calculations to professional CBAs. Also, the evaluations shed light on the fact that the projects have many externals, which weren't properly quantified and included in the calculations of the CBAs. The environmental properties and the social indicators also clearly have more externals, then the economical indicators.

Table 5. Summary of benchmarking analysis results

1. project	2. project	3. project
(+)4	(-)3	(+)6
(+)4	(+)3	(+)4
(+)3	(+)3	(+)4
(+)11	**(+)3**	**(+)14**

Source: self-made and edited, 2012

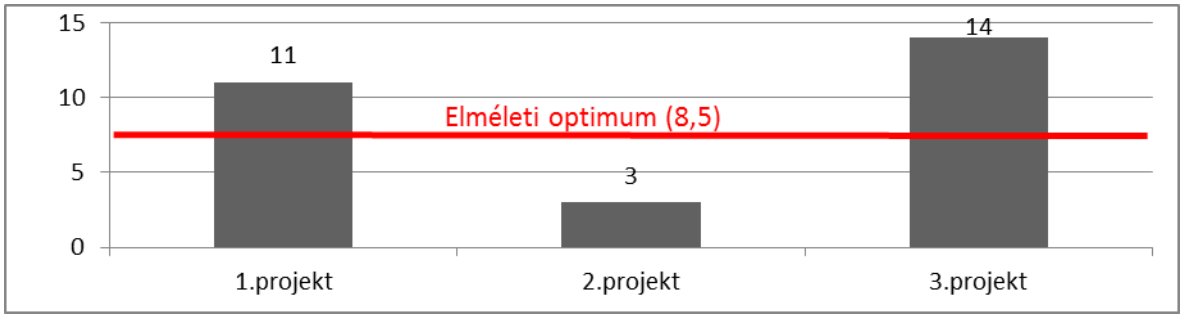


Figure 1. Summary of benchmarking analysis results
The red line shows the defined optimum
Source: self-made and edited, 2012

Some conclusions and suggestions, which are as follows: the goal of the cost-benefit analyses, or CBAs, is to monetarily define the benefits and costs of a project which raises the prosperity of the populace, and to make it obvious and clear to the ones making the decisions. It makes investment planning simpler, while also simplifying the continued actuation, since it reduces the many costs and benefits to a single dimension – in this case, money. Or at least, that would be the goal, if it were that easy. This is the double edge of the sword in our case – the main opportunity, and the main threat – because the pros and cons which can't be quantified in terms of money have less of an impact on the planning of a project than the ones which can be. Therefore, without their internalisation, the systems can't be displayed and evaluated in their true form, which concludes that it's necessary to both define and quantify these external effects to the utmost degree for the various investments and projects. It can be generally said regarding the evaluated projects, that no actually useful monetary and economic calculations were made by the ones doing the analyses (see *Table 5; Figure 1*).

Only the investment costs and the social values were properly calculated, but even the methodology of this was presented in an insufficient manner. It's quite common that there are no sensitivity analyses and risk analyses in the projects, and there were no maintainability calculations either. In essence, these important methodological bits are not present, these documents are therefore unable to provide the necessary assistance for the decision-makers to help them make a proper decision, even though after the NPV was calculated, they were given the green light. It is also clearly visible from the results of the

benchmarking analysis, that the evaluated systems of the projects show differing values and stats in terms of the economical effects, and this differentiation is irrelevant of us looking at it using either simplified economical calculations, or professional CBAs. Therefore, we can state that the incorrect assumptions made in the economical aspects result in many extreme effects that put the development programs in the centre of economical decisions, and in a way that they don't generate sufficient social, economical and environmental benefits.

The benchmark analysis revealed that the projects include many improperly handled externals. This causes a problem, because properly quantified benefits in the documentation of the project would lessen the burden on decision-makers, and make it easier for them to decide if the various projects and concepts hold sufficient economical, environmental and social benefits, or not, and if they have the required characteristics.

REFERENCES

CHAMP, R. C. (1998): Üzleti folyamat benchmarking, Budapest, Műszaki könyvkiadó

COWI KFT, (2010): Kerékpáros közösségi közlekedési rendszer kialakítása Budapesten II. fázisú Megvalósíthatósági tanulmány és költség-haszon elemzés (2010) Downloaded: 20.09.2012 13:21 (http://www.parking.hu/dok/kerekpar/kkkr/KKKR_MT2.pdf)

NAGYKÁLLÓ szennyvíztisztító telep létesítése (2009): Részletes megvalósíthatósági tanulmány, Downloaded: 05.09.2012. 22:41 (http://www.nagykallo.hu/szennyviztelep/dokumentumok/nagykallo_rmt_090305.pdf)

NFÜ (NEMZETI FEJLESZTÉSI ÜGYNÖKSÉG, 2008): Általános módszertani útmutató költség-haszon elemzéshez, Budapest

NFÜ (NEMZETI FEJLESZTÉSI ÜGYNÖKSÉG, 2009): Módszertani útmutató költség-haszon elemzéshez, KEOP támogatáshoz, Budapest

SAMUELSON, P.A., NORDHAUS, W.D. (2000): Közgazdaságtan. KJK—KERSZÖV, Budapest

SÁRBOGÁRD városközponti akcióterület költség- haszon elemzése (2011) Downloaded: 10.09.2012. 16:42 (http://www.sarbogard.hu/_user/browser/File/IVS/2012/6_mell%C3%A9klet_A%20S%C3%A1rbog%C3%A1rd%20k%C3%B6zponti%20akci%C3%B3ter%C3%BClet%20k%C3%B6lts%C3%A9g-haszon%20elemz%C3%A9se_02.pdf

SZENTES város végleges akcióterületi tervének költség-haszon elemzése (2011) Downloaded: 10.09.2012. 15:30 (http://www.szentes.hu/wp-content/uploads/2011/04/2011_04_04_ATT_3_melleklet.pdf)

TOMPA város szennyvíztisztításának és szennyvízcsatornázásának kiépítése, Részletes megvalósíthatósági tanulmány (2010), Downloaded: 08.09.2012 09:32 (http://www.tompa.hu/dokumentumtar/doc_view/75-reszletes-megvalosithatosagi-tanulmany

TÓTH I. J. (2008): Az externália új dimenziói, Tanulmány, Magyar Tudomány, 05: 593.

Review on Agriculture and Rural Development 2014. vol. 3 (1) ISSN 2063-4803

PROFITABILITY OF SOME CERTAIN SENSITIVE SECTORS – EXAMINATIONS CONSIDERING THE SPECIALTIES OF AGRICULTURAL POLICY AFTER 2015

LÍVIA KRÁNITZ[1], ROLAND TÓTH[1], MIKLÓS VÁSÁRY[2]

Szent István University, Faculty of Economics and Social Sciences, 1 Páter K. str., 2103 Gödöllő, Hungary
livi11b@gmail.com, roland.toth87@gmail.com, vasary.miklos@gtk.szie.hu,

ABSTRACT
The Common Agricultural Policy (CAP) entering into force in 2015 includes several new components. In the case of direct payments, member states have the opportunity to choose from more voluntary supports, increasing the member states' freedom of choice and providing flexibility. Taking into account the interest of farmers and the particularities of farming, besides the mandatory components, such as the „greening" and the payment for young farmers, there are more optional components at farmers' disposal. One such is coupled support. The current payment system also contains such a support, but with limited application and budget. Regarding the next programming period, the current share of 3.5 percent of coupled support is going to increase significantly. Coupled support granted to certain sectors can make up 13 percent of the national ceiling, and member states are allowed to use another 2 percent to foster the production of protein crops. Coupled support can be used in certain sectors and for certain products. In order to use the budget effectively, it is necessary to determine the exact amount of support, considering profitability of the sectors. This paper attempts to sum up the efficiency and profitability of some relevant sectors.

Keywords: common agricultural policy, agricultural support, coupled support, profitability

INTRODUCTION

After years of negotiations the approval of the reform of the common agricultural policy has come to its final phase. The political decision of the CAP reform package was made by the agricultural ministers of the European Union in June 2013, and was ratified by the European Parliament 20 November 2013. The basis of the new CAP is defined by the four base acts (direct payments, common market organizations, rural development, horizontal regulation) finalized at the meeting of Agricultural and Fishery Council 16-17 December 2013. Among direct payments laid down by Regulation EU No 1307/2013 there are several new measures, such as the greening or the young farmer payment scheme. Although it is not a new component, the structure of coupled support has significantly been changed. The field of sectors entitled to be granted support from this scheme has been broadened compared to the previous system. Besides rice, milk and dairy products, sheep and goat meat, cattle and calf, sugar-beet as well as fruit and vegetable are also included. Moreover, the amount Hungary is entitled to use for coupled support grew from 3.5 percent to 13 percent of its financial envelope set by the EU, and another 2 percent can be granted to support the production of protein crops. It amounts to 15 percent together, meaning approximately 190 million euro a year. The decision of the EU of authorizing member states to use a growing proportion of their total direct payments for coupled support might contradict the outcomes of previous reforms, but it is crucial for the sensitive sectors.

MATERIAL AND METHOD

To determine the reasonable level of the financial sources that can be allocated to some certain sectors it is necessary to examine the cost-to-income ratio of the given sectors. The Data we used stem from the database of Research Institute of Agricultural Economics (RIAE). Three different sensitive sectors were examined, namely the sugar-beet, the milk and the bovine. The analysis does not mean that these sectors are surely going to be supported within the frame of coupled support, but it stresses the importance of analyses of this kind when deciding about the allocation of subsidies. In addition, it is important to note that this paper is not to determine the amount of subsidy either. The studied sectors received direct supports earlier, too, though it was coupled only in the case of milk. As milk sector is of a great importance and the cessation of milk quota in the EU in 2015 might have an adverse impact of the sector, it would seem justified to fund the sector. As for sugar-beet, the newly introduction of coupled supports in the sector makes it worthy to be dealt with. In the case of bovine, it is originally among sensitive sectors and it has never been given EU subsidy in Hungary. We focused on the examination of the efficiency, gross margin, efficacy of the sectors as well as the effects of direct payment on these indicators.
National average data covering the time period 2004-2012 were used for the analysis. Data of private units and agricultural enterprises were weighted based on their share of cost and income; consequently, they depict the real cost and income items. Time series enabled us to assess the changes occurred in the efficiency and efficacy of the sectors. In order for us to be able to scrutinize the given sectors the following indicators were used (SZŰCS ET AL., 2008):

- result of the sector = total sectoral revenue–total production cost;
- gross margin of the sector = result of the sector – total production cost;
- expected result of the sector = (average selling price * yield) – (productions cost of main product * yield), the indicator shows the difference of the expected revenue and the total production cost of the main product;
- the efficiency of the sector = result of the sector / expected result of the sector, it is the difference of the revenue (from the database) and the production cost divided by expected result of the main product;
- real efficiency of the sector = gross margin of the sector/expected result of the sector.

RESULTS

According to data coming from the RIAE the average size of agricultural units in the sugar-beet sector was between 27 and 57 hectares with a relative high ("golden crown") value. The output reached its highest (65 tons) in 2008, while its lowest (45 tons) was in 2007. Selling prices, similarly to the output, was volatile. In the year of accession to the EU, sugar-beet was sold for 11 thousand HUF per ton, but prices saw a significant decrease in the following years, to 2 thousand HUF. The nadir was in 2007, when sugar-beet price was as low as 800 HUF per ton. A rise began only in 2011, with prices going up to 11 thousand HUF and it continued (13 thousand HUF) in 2012, too, increasing the profitability of the sector. Revenues from sugar-beet production dropped after the accession to the EU and hit its lowest point (387 thousand HUF per ton) in 2007. The market then was characterized by low buying prices, which were attributed to depressed demand caused by duty free sugar import and to drop in revenues generated by low output. (POPP ET AL., 2007). Owing to favorable output and the rise in prices the trend turned in

2011. Seed, fertilizers and pesticides account for the majority of the expenses of sugar-beet sector. These direct variable costs increased significantly in the examined period. The price of seed grew by 24 percent, the price of fertilizers by 110 percent and the price of pesticides by 47 percent. Production is greatly affected by the cost of machinery and agricultural services, too, of which the price of the latter doubled between 2004 and 2012. Production cost of the sector increased from 317 thousand HUF per to 506 thousand HUF. It is apparent that despite the rise of the expenses result of the sector was positive in the whole period. It was the lowest (36 888 HUF) in 2010, and the highest in 2011 (*Figure 1*).

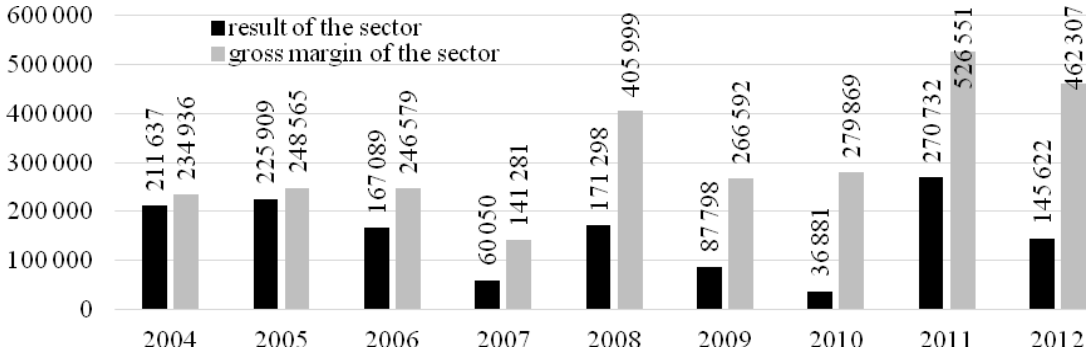


Figure 1. The result and the gross margin of the sugar-beet production (2004-2012, HUF)

Source: own calculation on the basis of RIAE database, 2013

Gross margin of the sector shows the result augmented by the subsidy. It is clear that the revenues of the producers covered their expense, and subsidies increased the efficiency further. The amount of subsidy provided to the producers, with the exception of 2009, increased steadily from 23 thousand HUF per hectare in 2004 to 316 thousand HUF in 2012. Growing subsidies biased the efficiency of the sector. With respect to efficiency the year with the lowest result was 2010, but with respect to gross margin 2004 and 2007 were the most unfavorable. Higher subsidies are ascribed to the rise in the amount of single are payments scheme (SAPS) payment, separate sugar payment and national additional sugar payment. The database enabled us to examine the efficiency of the sector, as it contained data both on average production prices and costs. Contrasting the difference with the result it is conspicuous that sugar-beet production was efficient in the 2011 and 2012. If the indicator is below 1, it means that the production is inefficient, while an indicator with a value above 1 reflects efficiency. In the examined period the production was inefficient in three years, namely in 2004, 2006 and 2010. It is an interesting phenomenon that despite poor result caused by low prices and output in 2007 the efficiency of the sector reached its highest (1.5) (*Figure 2*).

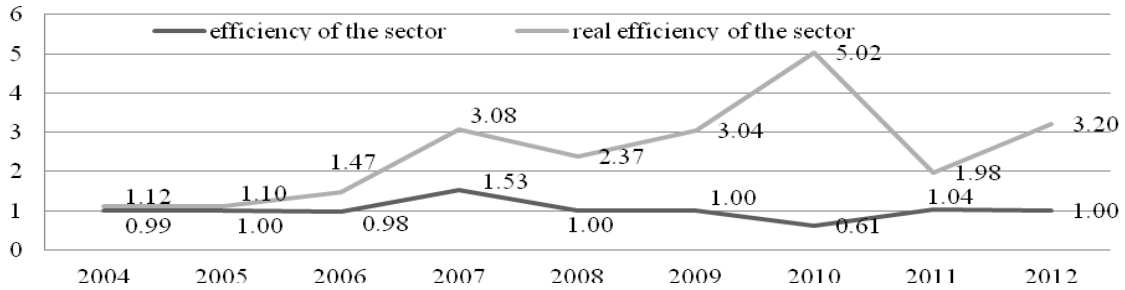


Figure 2. Sector efficiency of the sugar-beet production (2004-2012)

Source: own calculation on the basis of RIAE database, 2013

The lowest efficiency was seen in 2010, when the favorable output was offset by low selling prices and high production costs, resulting in low efficiency (0.61). In case if we focus on the real efficiency of the sector (ratio of gross margin to expected results of the sector) it can be stated that direct payments multiple the efficiency in many cases. In years characterized by low efficiency direct payments significantly improved the indicator even in years with low direct payments, such as in 2004 and 2005.

Milk producers in Hungary kept on average 18 to 36 cows in the examined period, with a yield moving between 6100 and 6900 liters per cow. At business unit level it meant 140 to 233 liters milk produced. Selling price of milk increased by 43 percent between 2004 and 2012 then it decreased by 20 HUF per liter to 63 HUF. Forage cost accounts for approximately 70 percent of variable costs of milk production. Although animal health costs compared to forage costs are negligible, it is still the second highest expenditure item. Owing to rising forage costs, total costs of milk production grew by 52 percent to 421 thousand HUF per liter between 2004 and 2012. In the year of accession to the EU direct payment per cow was 23 thousand HUF, and it increased, with a greater rise occurring in 2006, until 2011, reaching 93 thousand HUF. In 2012 it was 75 thousand HUF per cow. In the examined period result fluctuated significantly. In 2004 it was only 8 thousand HUF per head, while in 2008 it exceeded 100 thousand HUF. The crisis the milk market saw in 2009 had an adverse effect on the result of the sector, reducing prices to the former level of 8 thousand HUF, which then rose to 100 thousand HUF by 2011 again. Looking at the gross margin of the sector, it can be asserted that direct payments increased the value of result per cow leading to the sector being able to cover production cost even in the worst year (*Figure 3*).

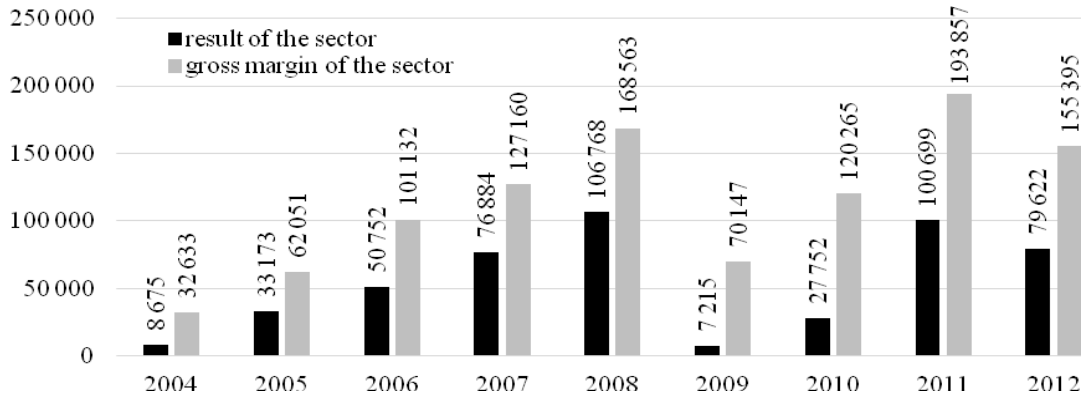


Figure 3. The result and the gross margin of the milk production (2004-2012, HUF)

Source: own calculation on the basis of RIAE database, 2013

As for the efficiency of the sector it is apparent that low result does not necessarily entail weak efficiency. Selling prices and production costs of the main product resulted in a deficit in 2004 and 2009 (*Figure 4*). In contrast, total revenue of the production and production costs led to a low, though positive result. The indicator of sector efficiency, that is a quotient of sector result and expected sector result, was below 1 in 2006, 2008, 2010 and 2012. However, in years with unfavorable sector results, the efficiency was above 1. It is put down to the fact, that the low result of the sector exceeded the expected sector result, giving a high quotient. It is conspicuous that the subsidy significantly increased the sector efficiency, especially in years with low sector results, namely in 2004 and 2009. In these years the direct payment multiplied the sector efficiency. Bovine in Hungary is classified as a sensitive sector. In the examined period farmers kept on average 7 to11 bulls,

amounting to an output of 5 to 9 tons a year. Bulls were sold with a weight of 650 to 720 kilograms.

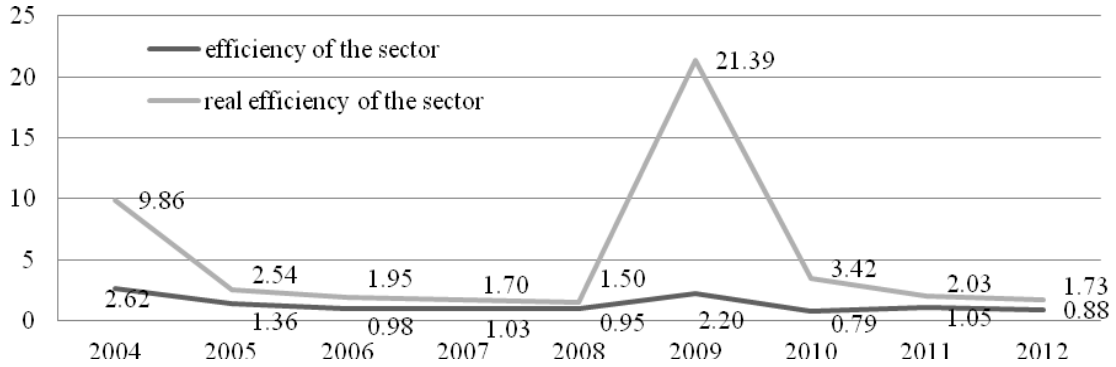


Figure 4. Sector efficiency of the milk producers (2004-2012)
Source: own calculation on the basis of RIAE database, 2013

Due to the high European demand, the output was outstanding in 2008 and 2009, in these years farmers had more than 10 animals. Selling prices also grew between 2004 and 2012. In the year of accession it was below 300 HUF per kilogram, it exceeded 400 HUF in 2009 and reached 621 HUF in 2012. Similarly to selling prices, direct payments also increased. In 2004 it was 10 HUF per kilogram; it went up to 64 HUF in 2010, and then dropped back to 30 HUF in 2011. Forage costs account for 36 percent of total cost, raw material costs make up 41 percent. Animal health cost, labor cost and the general expenses are also significant. Expenses in the examined period increased in this sector, too. Total production cost grew from 347 HUF per kilogram to 537 HUF, with a huge rise occurring in 2006 and 2007, when the production of 1 kilogram meat increased by 100 HUF (*Figure 5*).

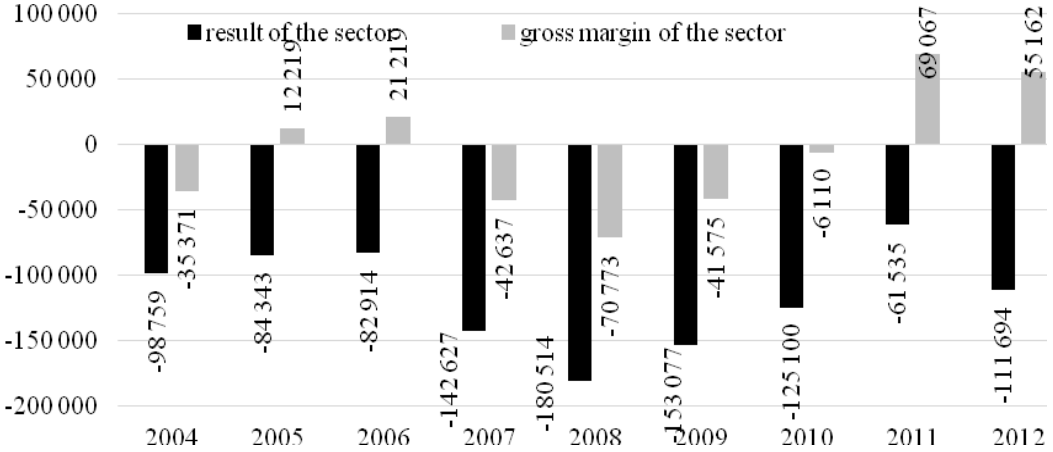


Figure 5. The result and the gross margin of the bovine sector (2004-2012, HUF)
Source: own calculation on the basis of RIAE database, 2013

Although the rise in the total revenue of the sector exceeded that of total cost, sector result was negative in every year. However, direct payments were sufficient to offset the result, leading to positive values in several years (2005, 2006, 2011 and 2012). In the last two years of the examination growing demand in our export markets had favorable effects on the results, with selling prices increasing, too. It can be stated that the result of the sector is highly dependent on the extent of direct payments. In the case of the indicator of the efficiency of the sector and of real efficiency of the sector, corrections had to be made. When multiplying selling prices by the yields, bony meat was taken instead of the output

of the main product. This way the values of the indicator improved, but they are still far from favorable efficiency. It was the highest in 2011 with a value of 0.77, and the lowest in 2010 with a value of 0.03 (*Figure 6*). Examining the real efficiency of the sector, that show the value increased by the direct payments, it is apparent that direct payments manifolded the efficiency, resulting in outstanding values even in years (2005 and 2010) with the lowest efficiency. The significant rise in the value of the indicator in these years is caused by low value of the expected result being in the denominator as well as by the large amount of direct payments.

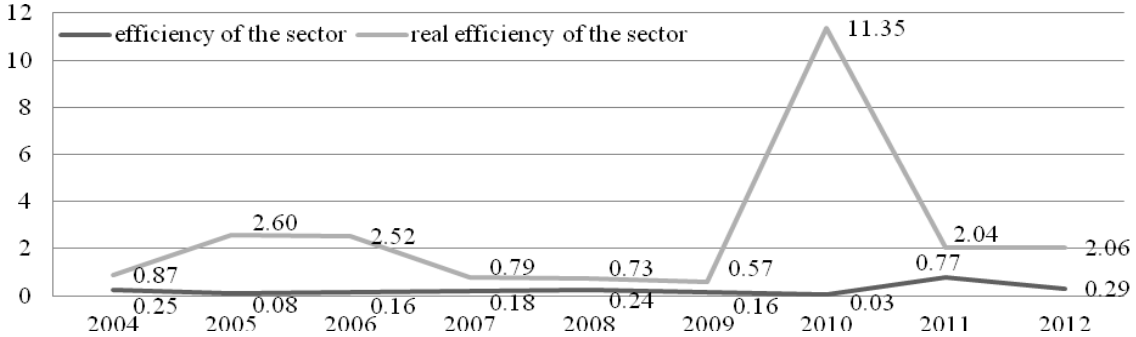


Figure 6. Efficiency of the bovine sector (2004-2012)

Source: own calculation on the basis of RIAE database, 2013

CONCLUSIONS

Based on the results of our examination, it can be asserted that even in years characterized by low output and selling prices, direct payments are able to increase efficiency significantly. The lower the result is in the denominator, the bigger the real efficiency is. In the case of sugar-beet, the sector has been operating effectively and efficiently. In the case of milk, the sector has seen some drop in the result and efficiency as well. In the case of bovine, direct payments are decisive.

REFERENCES

COUNCIL REGULATION (EC) No 73/2009 of 19 January 2009 establishing common rules for direct support schemes for farmers under the common agricultural policy and establishing certain support schemes for farmers, amending Regulations (EC) No 1290/2005, (EC) No 247/2006, (EC) No 378/2007 and repealing Regulation (EC) No 1782/2003

POPP J., POTORI N., UDOVECZ G. (2007): Főbb mezőgazdasági ágazatok várható kilátásai az EU-csatlakozás után Szaktudás Kiadó Ház Rt. 176. p.

POPP J., POTORI N., UDOVECZ G. (SZERK.)(2009): A versenyesélyek javításának lehetőségei a magyar élelmiszergazdaságban https://portal.agr.unideb.hu/media/Versenyeselyek_AKI_Agrarkamara_9122.pdf (10. 02. 2014)

RESEARCH INSTITUTE OF AGRICULTURAL ECONOMICS (2014): Ágazati adatok Tesztüzemi Rendszer

SZŰCS I., FARKASNÉ F, M, (2008): Hatékonyság a mezőgazdaságban Agroinform Kiadó 358 p.

Review on Agriculture and Rural Development 2014. vol. 3 (1) ISSN 2063-4803

SOME ALTERNATIVES OF IMPROVEMENT THE COW MILK PRODUCTION EFFICIENCY IN ALBANIA *(CASH FLOW ANALYSIS)*

MAKSIM MEÇO, REMZI KECO, ILIR KAPAJ, ALQI NAQELLARI

Economy and Agribusiness Faculty, Agricultural University of Tirana, Albania
maksmec@yahoo.com

ABSTRACT
Any major new capital investment, such as the purchase of land, machinery, buildings or animals, can have a large effect on cash flows, particulary if additonal capital is borrrowed to finance the purchase. Borrowed capital requires principial and interest payments. The questions to answer before making the new investment is: Will the investment generate enough additional cash income to meet its additional cash requirments? In other words, is the investment financially feasible, as oposed to economically profitable?
Farms with high production efficiency are more successful due to three factors. High levels of production result: (1) low cost per unit of output, (2) with an increase in the effective size of the farm business, and (3) with an increased effectiveness of labor and machinery (Ronald D, Kay, farm management 1994).
The high level of production provides a simple and effective method of increasing farm size. Farms with high agricultural productivity and high levels of productivity per head resulting in a large volume of business compared with farms with the same size but with lower production levels. This additional business volume is the result of working more effectively, without increasing the surface of the land or the size of the activities.
The main methods of raising the level of productivity of livestock production are: i) selection and improvement of breed; ii) choice of a balanced food ration in relation to the level of production, iii) sheltering conditions and health care, iv) appropriate and timely nutrition and; v) a good combination between use of pasture and concentrated food.

Keywords: cash flow, cow farms, milk quality, net farm income,

INTRODUCTION

The Republic of Albania is currently in the process of preparing for the EU Instrument for Pre-Accession Assistance on Rural Development (IPARD). The IPARD Programme should be based on analyses of the current situation in the rural areas and on in-depth analysis of the sectors concerned in the country.
The objective of this dairy sector analyses is to give a quantitative and qualitative description of the Albanian dairy sector, addressing both production and processing.
The methods to carry-out of the study had been desk studies, meetings and collection of detailed information of 104 dairy farms with cows. A questionnaire has been designed and data collected during several focus group meetings.
The results of the analyses is prioritising key areas for potential intervention to contribute upgrading to EU standards, strengthening the overall competitiveness and performance of Albanian milk sector as well as fostering the sustainable development of the sector in the EU accession context.
The current structure of dairy sector of Albania is characterised by large number of small milk producers. About 226 thousand dairy cow farms with total 360 thousand cows and 82 thousand farms with small ruminants (SR) with some 1.9 million milking sheep and goats are producing in total about 1 million ton of milk. About 86% of milk production is coming from cow milk. The average number with 1.58 milking cows per farm or 23 milking ewes or does per SR farm is very low in comparison with EU-27 average. The land privatization initiated in 1991 created a structure of primary production that is

characterized by extremely small plot and herd sizes. Private farm business re-started in 1991 quasi from zero.
Most milk producers are semi-subsistence households. Only up to 46% of milk production is delivered to milk processors. The rest is used for self consumption, direct sale to consumer or for feeding of animals. The average size of farms in the country is just 1.2 ha and the size of single plots about 0.3 ha. Typical farm feature is a high level of land fragmentation.
About 3 thousand dairy cow farms have more than 5 cows per farm and about 12 thousand SR farms have more than 50 sheep or goats per farm. However the structural change started during the last years particularly in the cow milk production. Some farms became more commercial oriented and specialised on milk production with the modernisation and extension of the dairy farm business. With the support of the IPARD programme those farms can achieve further steps to come closer to EU standards.

RESULTS

In general, milk production is labour intensive in comparison with other sectors. Therefore the IPARD investment support should give the dairy sector priority. The analysed investments on animal production are in most cases based on scenarios which keep the same quantity of animals and try to improve economic performance, following also the IPARD approach, which is focused in improving quality and performance of animal production, rather than aiming at increasing the number of heads. However, one scenario is also simulating the increase in the number of milking cows from 5 to 10, using the natural growth of the herd, as IPARD resources cannot be used to buy livestock.
Investment scenarios are inter-combined with gross margin analysis in the context of dynamic analyses.

1. Cattle dairy farm, investing in improving quality of milk quality, with constant quantity *(The first Scenario)*

Key cost figures and basic assumptions
Assumptions and parameters used for the simulations are listed below.

Key cost figures and basic assumptions		
Size	**Yield**	**Total production cost**
5 milk cows	*5,000 lit/head* *4 calves per year available for sale* *305 days lactation*	*591,250 ALL*
Land required for animal feed production	**Farm gate sales prices**	**Primary target**
owned	*Milk: 50 ALL per litter* Calf: 25,000 ALL per head	*Quality*
Investment cost	**Annual Percentage Rate**	**Loan duration**
10,000 Euro, of which 50% is a grant and 50% is obtained through a loan	*1scenario: 12 %*	*Scenarios ranging between 3 years (the shortest) and 5 years (the longest)*

The investment is **not focused on maximising quantity of milk**, so that it is assumed that the animals are properly fed, and genetically good, but are not according the best performing ones.
At present, the average production per cow is about 2,500 lit, but it may range up to 4,000. The assumptions of raising it to 5,000 litres/year is therefore already an ambitious target.

Table 1 shows the feed requirements for optimising milk production

Table 1. Feed requirements to produce 5,000 litters milk

No	Item	Quantity/head (kg)
1	Concentrate	5
2	Hay	5
3	Silage	25

The yearly cash flow generated by the breeding activity has been calculated as shown in *Table 2* below.

Table 2. Yearly cash flow budget for a milking cow farm (5 cows)

Item	Unit	Quantity	Price	Amount	
				ALL	Euro
I. Income					
Milk	litter	25,000	40	1,000,000	7,407
Calves sold	Head	4	25,000	100,000	741
Total income				**1,100,000**	**8,148**
II. Expenses					
Concentrate	Kg	9,125	25	228,125	1,690
Straw	Kg	9,125	8	73,000	541
Silage	Kg	45,625	5	228,125	1,690
Veterinary services				25,000	185
Electric power				12,000	89
Stable maintenance				10,000	74
Expendable equipment				15,000	111
Total expenses				**591,250**	**4,380**
Net farm Income				**508,750**	**3,769**

1 Euro=135 ALL

Table 3 below shows the cash flow scenarios of the holding, including the surplus or deficit after paying for the costs, loan and the equivalent of two minimal wages.

Table 3. Cash flow analysis for a milking cow farm (size 5 cows)

Item	**Year**				
	1	**2**	**3**	4	5
Cash inflow (in Euro)					
Net farm Income (milk &Calf)	**4,848.8**	**4,848.8**	**4,848.8**	**4,848.8**	**4,848.8**
Cash outflow (in Euro)					
Two full time minimal wages	**3,352**	**3,352**	**3,352**	**3,352**	**3,352**
Principal payments	1,667	1,667	1,666		
Interest payments	600	400	200		
Total outflow (in Euro)	**5,619**	**5,419**	**5,218**	**3,352**	**3,352**
Net cash flow (in Euro)	**-770.2**	**-570.2**	**-369.2**	**1,496.8**	**1,496.8**

1 Euro=135ALL

The quality milk improment is a long-lived capital investment, so it is important to look at the cash flow over a number of years, rather than month by month for one year as done for the whole-farm cash flow budget.

To guarantee two full time minimal wages requires 3352 Euro and the new loan requires a principal payment 1667 Euro each year of the three-year loan, plus interest on the unpaid

balance. This obligation generates a large cash outflow requirement during the first three years, causing a negative net cash flow for these years. Once the loan is paid off in the third year, there is a positive net cash flow in following years. This result is common when a large part of purchase price is borrowed and the loan must pay off in relatively short time.

This investment is obviously going to cause a cash flow problem the first three years. Does this mean the investment is a bad one? Not necessarily. Investment on improvement of milk quality should last for more than the five years shown in the table and will continue to generate a positive cash flow in later years. Over the total life of the investment, there would be a positive net cash flow, perhaps a substantial one. The problem is how to get by the first three years.

1. At this point, the investment on improvement milk quality should be incorporated into a cash flow budget for the entire farm. This budget may show that other parts of farm business are generating enough excess cash to meet the negative cash flow that would result from investment on improvement milk quality.
2. If not, one possibility would be to negotiate with the lender for a longer loan with smaller annual payments. This solution would help reduce the cash flow problem but would extend principal and interest payments over a longer period and increase the total amount of interest paid.
3. Another alternative is that cash flow for the third first years required to guarantee one full time minimal wages and not two how is planed in initially scenarios

Key findings and comments

This farm cannot afford such investment, unless additional sources of income are available. Otherwise, the farm size should be larger.

2. Cattle dairy farm, investing in increasing quantity of milk per milking cow, with land owned by beneficiary *(The second Scenario)*

Key cost figures and basic assumptions

Assumptions and parameters used for the simulations are listed below.

Size	**Yield**	**Total production cost**
5 milk cows	*From 5,000 to 6,100 lt/head* *4 calves per year available for sale* *305 days lactation*	*682,500 ALL*
Land required for animal feed production	**Farm gate sales prices**	**Primary target**
owned	*Milk: 40 ALL per litter* Calf: 25,000 ALL per head	*Quantity*
Investment cost	**Annual Percentage Rate**	**Loan duration**
10,000 Euro, of which 50% is a grant and 50% is obtained through a loan	*1 scenario: 12 %*	*Scenarios ranging between 3 years (the shortest) and 5 years (the longest)*

The main methods of raising the level of productivity of livestock production are: i) selection and improvement of breed; ii) choice of a balanced food ration in relation to the level of production, iii) sheltering conditions and health care, iv) appropriate and timely nutrition and; v) a good combination between use of pasture and concentrated food.

In view of this objective, the applicant aims at increasing farm mechanization. The applicant wants to buy a mini tractor and its equipments and to improve the storage conditions of feed, building of a new storage facility. With this number of animals, purchasing an animal feed a mixer cannot be profitable.

Table 4 shows the feed requirements for optimising milk production.

Table 4. Feed requirements to produce 6,100 litters milk

No	Item	Quantity/head (kg)	**Total**
1	Concentrate	5	2,555
2	Hay	5	1,825
3	Silage	25	9,125

The yearly cash flow generated by the breeding activity has been calculated as shown in *Table 5* below.

Table 5. Yearly cash flow budget for a milking cow farm (5 cows)

Item	**Unit**	**Quantity**	**Price**	**Amount**	
				ALL	**Euro**
I. Income					
Milk	litter	30,500	40	1,220,000	9,037
Calf	Head	4	25,000	100,000	741
Total income				**1,320,000**	**9,778**
II. Expenses					
Concentrate	Kg	12,775	25	319,375	2,366
Straw	Kg	9,125	8	73,000	541
Silage	Kg	45,625	5	228,125	1,690
Veterinary services				25,000	185
Electric power				12,000	89
Stable maintenance				10,000	74
Expendable equipment				15,000	111
Total expenses				**682,500**	**5,056**
Net farm Income				**637,500**	**4,722**

1 Euro=135 ALL

Table 6 below shows the cash flow scenarios of the holding, including the surplus or deficit after paying for the costs, loan and the equivalent of two minimal wages.

Table 6. Cash flow analysis for a milking cow farm (size 5 cows)

Item	**Year**				
	1	**2**	**3**	4	5
Cash inflow (in Euro)					
Net farm Income (milk &Calf)	**5319.9**	**5319.9**	**5319.9**	**5319.9**	**5319.9**
Cash outflow (in Euro)					
Two full time minimal wages	**3352**	**3352**	**3352**	**3352**	**3352**
Principal payments	1667	1667	1666		
Interest payments	600	400	200		
Total outflow (in Euro)	**5619**	**5419**	**5218**	**3352**	**3352**
Net cash flow (in Euro)	**-299.1**	**-99.1**	**101.9**	**1967.9**	**1967.9**

1 Euro=135 ALL

Key findings and comments

The improvement quantity of milk per cow is a long-lived capital investment, so it is important to look at the cash flow over a number of years, rather than month by month for one year as done for the whole-farm cash flow budget.

To guarantee two full time minimal wages requires 3352 Euro and the new loan requires a principal payment 1667 Euro each year of the three-year loan, plus interest on the unpaid balance. This obligation generates a large cash outflow requirement during the first and second year, causing a negative net cash flow for these years. Once the loan is paid off in thesecond year, there is a positive net cash flow in following years. This result is common when a large part of purchase price is borrowed and the loan must pay off in relatively short time.
The alternatives of solving the problem (negative cash flow for the three–year) for this scenario are the same as the first scenario. But the possibility of solutions is easier.

3. Cattle dairy farm, investing in increasing quantity of milk per milking cow, with rented land *(The third Scenario)*

Key cost figures and basic assumptions
Assumptions and parameters used for the simulations are listed below.

Size	**Yield**	**Total production cost**
5 milk cows	*From 5,000 to 6,100 lt/head* *4 calves per year available for sale* *305 days lactation*	*742,500 ALL*
Land required for animal feed production	**Farm gate sales prices**	**Primary target**
***Rented** (3ha)*	*Milk: 40 ALL per litter* Calf: 25,000 ALL per head	*Quantity*
Investment cost	**Annual Percentage Rate**	**Loan duration**
10,000 Euro, of which 50% is a grant and 50% is obtained through a loan	*1 scenario: 12%*	*Scenarios ranging between 3 years (the shortest) and 10 years (the longest)*

A farmer is keeping **five** milking cows, which produce 5000 liters per head (305 days lactation). He wants that feed for cows to produce in the farm. No land owned. But, he is leasing the land. The rent that is paying is **150 Euro/ha**. To produce the necessary feeds for cows, he is leasing **three** hectares of land.
He wants to invest in **improvement of quantity** of milk per milking cow from 5000 to **6100** per milking cow (20 liter/day per milking cow).
In view of this objective, he aims to increase the level of farm mechanization. The farmer wants to buy a mini tractor and its equipments and to improve the storage conditions of feed through the building of a new store. *Table 7* below shows the feed requirements for optimising milk production

Table 7. Animal feed inputs

No	Item	Quantity/head (kg)	**Total**
1	Concentrate	5	2,555
2	Hay	5	1,825
3	Silage	25	9,125

Table 8 shows the yearly cash flow generated by the breeding activity.

Table 8. Yearly cash flow budget for a milking cow farm (5 cows)

Item	Unit	Quantity	Price	Amount	
			ALL	ALL	Euro
I. Income					
Milk	Litter	30,500	40	1,220,000	9,037
Calf	Head	4	25,000	100,000	741
Total income				**1,320,000**	**9,778**
II. Expenses					0
Concentrate	Kg	12,775	25	319,375	2,366
Straw	Kg	9,125	8	73,000	541
Silage	Kg	45,625	5	228,125	1,690
Rent of land	Ha	3	20,000	60,000	444
Veterinary services				25,000	185
Electric power				12,000	89
Stable maintenance				10,000	74
Others				15,000	111
Total Expenses				**742,500**	**5,500**
Net farm income				**577,500**	**4,278**

1 Euro=135 ALL

Table 9 below shows the cash flow scenarios of the holding, including the surplus or deficit after paying for the costs, loan and the equivalent of two minimal wages.

Table 9. Cash flow analysis for a milking cow farm (size 5 cows)

Item	Year				
	1	**2**	**3**	4	5
Cash inflow (in Euro)					
Net farm Income (milk &Calf)	**4878.7**	**4878.7**	**4878.7**	**4878.7**	**4878.7**
Cash outflow (in Euro)					
Two full time minimal wages	**3352**	**3352**	**3352**	**3352**	**3352**
Principal payments	1667	1667	1666		
Interest payments	600	400	200		
Total outflow (in Euro)	**5619**	**5419**	**5218**	**3352**	**3352**
Net cash flow (in Euro)	**-740.3**	**-540.3**	**-339.3**	**1526.7**	**1526.7**
1 Euro=135 ALL					

Key findings and comments

The improvement quantity of milk per cow is a long-lived capital investment, so it is important to look at the cash flow over a number of years, rather than month by month for one year as done for the whole-farm cash flow budget.

To guarantee two full time minimal wages requires 3352 Euro and the new loan requires a principal payment 1667 Euro each year of the three-year loan, plus interest on the unpaid balance. This obligation generates a large cash outflow requirement during the first three years, causing a negative net cash flow for these years. Once the loan is paid off in the third year, there is a positive net cash flow in following years. This result is common when a large part of purchase price is borrowed and the loan must pay off in relatively short time.

The alternatives of solving the problem (negative cash flow for the three–year) for this scenario are the same as the first scenario.

4. Cattle dairy farm, investing to increase the number of milking cows *(The fourth Scenario)*

Key cost figures and basic assumptions
Assumptions and parameters used for the simulations are listed below.

Size	Yield	Total production cost
Initial: 5 milk cows *Final: 10 milk cows*	*From 5,000 to 6,100 lt/head* *305 days lactation* *90% fertility* *20% replacement of animals*	*Initial: 682,500 ALL* *Final:1,403,000 ALL*
Land required for animal feed production	**Farm gate sales prices**	**Primary target**
Owned; sufficient for 10 cows	*Milk: 40 ALL per litter* Calf: 25,000 ALL per head	*Quantity*
Investment cost	**Annual Percentage Rate**	**Loan duration**
10,000 Euro, of which 50% is a grant and 50% is obtained through a loan	*2 scenarios: 10 and 15 %*	*Scenarios ranging between 3 years (the shortest) and 10 years (the longest)*

The scenario foresees a gradual increase in the number of milking cows, either keeping the heifers or using the sale revenues of calves to buy more heifers.
Table 10 below shows the feed requirements for optimising milk production

Table 10. Animal feed inputs

No	Item	Quantity/head (kg)	**Total**	**Price/kg ALL**
1	Concentrate	5	2,555	25
2	Hay	5	1,825	8
3	Silage	25	9,125	5

Table 11. Expected evolution of parameters used to calculate the yearly cash flow

Item	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7-10
I. Stock							
Cows at the beginning of the year	5	7	9	10	10	10	10
Cows at the end of the year	7	9	10	10	10	10	10
Of which: Milking cows in full productivity	5	5	5	5	7	9	10
Cows not yet in full production	0	0	0	2	2	1	0
Cows not yet in production	2	4	5	3	1	0	0
Calves born	5	5	5	7	8	9	9
Calves retained for expansion/replacement	3	3	2	1	2	2	2
II. Outputs							
Calves sold	2	2	2	3	5	6	7
Milk produced (litters)	30,500	30,500	30,500	39,650	51,850	59,475	61,000
III. Inputs							
Concentrate (kg)	12,775	17,885	22,995	25,550	25,550	25,550	25,550
Straw (kg)	9,125	12,775	16,425	18,250	18,250	18,250	18,250
Silage (kg)	45,625	63,875	82,125	91,250	91,250	91,250	91,250
Veterinary services (cost ALL)	25,000	35,000	63,000	126,000	126,000	126,000	126,000
Electric power (cost ALL)	12,000	12,000	12,000	12,000	12,000	12,000	12,000
Stable maintenance	10,000	11,000	12,100	13,310	13,310	13,310	13,310
Others	15,000	16,500	18,150	19,965	19,965	19,965	19,965

In the first years, the expenses are higher than in other scenarios, as young cows are eating, but not producing, while revenues are lower, as part of the value of calves' sales is

balanced by the investments in buying more cows. *Table 11* shows the evolution of parameters over the years.
Based on the above, the cash flow has been calculated, as shown in *Table 12* below.

Table 12. Cash flow evolution

Item	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7-10
I. Incomes							
Calves	50,000	50,000	75,000	125,000	150,000	175,000	175,000
Milk	1,220,000	1,220,000	1,220,000	1,586,000	2,074,000	2,379,000	2,440,000
Total Incomes	**1,270,000**	**1,270,000**	**1,295,000**	**1,711,000**	**2,224,000**	**2,554,000**	**2,615,000**
II. Expenses							
Concentrate (ALL)	319,375	447,125	574,875	638,750	638,750	638,750	638,750
Straw (ALL)	73,000	102,200	131,400	146,000	146,000	146,000	146,000
Silage (ALL)	228,125	319,375	410,625	456,250	456,250	456,250	456,250
Veterinary services (cost ALL)	25,000	35,000	63,000	126,000	126,000	126,000	126,000
Electric power (cost ALL)	12,000	12,000	12,000	12,000	12,000	12,000	12,000
Stable maintenance	10,000	11,000	12,100	13,310	13,310	13,310	13,310
Others	15,000	16,500	18,150	19,965	19,965	19,965	19,965
Total Expenses	**682,500**	**943,200**	**1,247,900**	**1,402,000**	**1,403,000**	**1,403,000**	**1,403,000**
Gross cash flow	**587,500**	**326,800**	**47,100**	**309,000**	**821,000**	**1,151,000**	**1,212,000**
Equivalent in Euro	**4,352**	**2,421**	**349**	**2,289**	**6,081**	**8,526**	**8,978**

1 Euro=135 ALL

In any scenario, the cash flow is not sufficient to cover the costs of the loan and to pay for 2 persons minimum wages **in the first four years**, when expenses for animal feed are high and output is low. In particular, in the third year, when all the young cows are eating, but not producing milk and the income form sale of calves is lower, the cash flow is even not sufficient to repay the loan instalment, apart from any wage.
However, the business is sustainable and profitable in the medium term. The accrued cash flow becomes positive only from the seventh year (i.e. the total income obtained from the beginning of the investment exceeds total expenditures from the seventh year on), as shown in *Table 13* below.

Table 13. .Net yearly and accrued cash flow (three year loan repayment period, 10% interest)

	Financial flow in Euro						
Item	**Year 1**	**Year 2**	**Year 3**	**Year 4**	**Year 5**	**Year 6**	**Year 7-10**
Gross cash flow	4,352	2,421	349	2,289	6,081	8,526	8,978
Loan repayment	1,936	1,936	1,936				
2 minimum wages	3,200	3,200	3,200	3,200	3,200	3,200	3,200
Net cash flow	- 784	-2,715	-4,787	-911	2,881	5,326	5,778

The figures changes if a 15% annual percentage rate on the loan is applied, but the conclusion is the same: the yearly cash flow turns positive from the fifth year.
Table 14 shows the cash flow scenario of the holding, including the surplus or deficit after paying for the costs, loan and the equivalent of two minimal wages in the case of cattle dairy farm, applying investment related to increased number of milking cows.

Table 14. Cash flow analysis for a milking cow farm (size growing from 5 to10 cows)

Duration of the loan in years	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Gross cash flow in the period	7,121	9,410	15,492	24,018	32,996	41,973	50,951	59,929
10 % annual percent rate loan								
Loan repayment	5,808	6,087	6,374	6,669	6,972	7,284	7,602	7,929
Accrued two people minimal wages	9,600	12,800	16,000	19,200	22,400	25,600	28,800	32,000
Net cash flow	*-8,287*	*-9,477*	*-6,882*	*-1,852*	*3,623*	*9,090*	*14,549*	*20,000*
15 % annual percent rate loan								
Loan repayment	6,240	6,679	7,137	7,612	8,105	8,614	9,139	9,680
Accrued two people minimal wages	9,600	12,800	16,000	19,200	22,400	25,600	28,800	32,000
Net cash flow	*-8,718*	*-10,069*	*-7,645*	*-2,794*	*2,491*	*7,760*	*13,012*	*18,249*

Key findings and comments

The cash-flow in the first years of business is negative, so that if the investment period is shorter than 5 years, the business is not able to generate enough cash to pay for two minimal wages and repay the loan. Two more years are necessary to recover the unbalances of the previous years and to obtain a profit exceeding the minimal cost/opportunity of labour.

The main constraint is linked to the initial investment: 10,000 euro are not sufficient to increase the size of the stable, buy the necessary equipment and purchase new adult cows; as a result, the number of cows must be gradually increased and in the first years the income is lower, as production is lower.

For this kind of business it is better to invest more from the beginning and buy adult cows, entering immediately in full production. Yearly repayments will be higher, but so will be the income from the first year. Costs will be not minimised, but profits will be maximised.

However, in the long run, a family farm with two permanent work force can manage 10 milking cows, getting a better profit than with 5 milking cows.

REFERENCES

LEONETI, L., SENA, S., MEÇO, M. (2010): Cash flow scenarios of the selected agriculture activities in the field of livestock, September 2010.

SCHRÖDER, E., URUÇI, M., MEÇO, M. (2010): Analysis of dairy sector. Prepared by the GTZ implementing EU - IPA 2008 - Project "Capacity Building for the Implementation of the Rural Development Strategy", Tirana, Albania

CELA, R., MECE, M., MUSABELLIU, B. (2009): An assessment of the competitiveness of the dairy food chain in Albania. AgriPolicy Enlargement Network for Agripolicy Analysis, February 2009. 31 p.

MAFCP, 2007: Strategjia Sektoriale e Bujqësisë dhe Ushqimit (SSBU) 2007–2013. Published by MAFCP.

Review on Agriculture and Rural Development 2014. vol. 3 (1) ISSN 2063-4803

THE IMPACT OF PAYMENT REALLOCATION IN CASE OF DIRECT AGRICULTURAL SUBSIDIES IN 2012

MIKLÓS VÁSÁRY[1], CSABA DOMÁN[2], ZOLTÁN KOVÁCS[3], ZSOLT BARANYAI[1]

[1]Szent István University, Faculty of Economics and Social Sciences, 1 Páter K. str., 2013 Gödöllő, vasary.miklos@gtk.szie.hu, baranyai.zsolt@gtk.szie.hu,
[2]Hungarian Research Institute of Agricultural Economics 3-5 Zsil str.,1093 Budapest, doman.csaba@aki.gov.hu
[3]University of Szeged, Faculty of Engineering 7, Mars square, 6724 Szeged, zoltan.kovacs@mailbox.hu

ABSTRACT
In the grant year of 2012, the reallocation of payment in the frames of modulation was a new element in the national agricultural subsidy system. The procedure means that when the total amount of first-pillar direct subsidies are above 5000 EUR which is, 10% payment reduction, when it is above 300 000 EUR, an additional 4% payment reduction should be applied.
The implementation in Hungary – according to the principles of the European Union - included the development of a system, which enabled to decrease substantially the actual volume of grant reallocation owing to modulation. In the course of this, the national supplementary titles which were not actually announced and the "unused" items of some titles are also included in the calculation. The present paper introduces and analyses the impacts of reduction in case of enterprises concerned are quantified on the basis of the databases belonging to the Research Institute of Agricultural Economics.

Keywords: common agricultural policy, agricultural payments, modulation, profitability

INTRODUCTION

The reform of Common Agricultural Policy (CAP) in 2003 has restructured the basic operation of aid system and in this regard the key objective was to expand the funds of rural development (2nd pillar) reinforced in the frames of CAP reform in 2003. Rural development policy should handle new challenges (climate change etc.) emerging due to the gradually increasing expectations on behalf of society and member states. During the period between 2007 and 2013 the considerable part of required financial funds can be collected through modulation by gradually increasing the pace of reduction of direct payments. The measures aim to create better balance between special policies and to reinforce sustainable agriculture and rural development. The disproportion is concerning the allocation of direct subsidies - which means that considerable part of payments are given to relatively few beneficiaries who get rather large amounts - was to be eased by the measure which was observed in Hungary for the first time in the course of transferring the direct subsidies requested in 2012, on the basis of decree no. 73/2009/CE. On the basis of the Health Check of 2008 which corrected the reform policy of 2003, 10% reallocation had to be provided in case of any 5000 euros allotted in the given calendar year, in the first year of its domestic implementation. The volume of reduction grows by a further 4% if the amount of aid for which the farmer is entitled exceeds 300.000 euro. (VM, 2012) In case of implementation in Hungary it means that the total amount of direct subsidies (SAPS, separated special grants and restructuring programs) and complementary national direct payments (top-ups) shall be reduced above 5000 euro. (EB, 2012) In the course of domestic implementation, quite a few title groups should be distinguished when the aid reallocation is calculated. The aim is that those elements of grants which cannot be paid or

only partly due to lack of budget sources could also be considered. The groups considered in the calculation are the following: (1) Not announced (inactive) top up titles: these titles are not announced due to the national budget sources (Cereals, oilseeds and protein crops – COP top up, rice and sucker cow premium) (2) In case of some titles, the difference between the actually transferred grant and the maximum amount of grant that can be paid. These items (e.g. premium for beef cattle breeding) which could be operated with larger grants according to the approval of the Committee but, due to the limited national budget, the maximum amount cannot be paid. In the course of modulation, these unpaid items should also be considered. (3) Actually transferred grants: In those cases when the above two items are exhausted or are not available at all, the withdrawal shall be made from the amount to be paid. If the actually payable grants should be reduced, it is made in a specific order. (VM, 2012; VÁSÁRY, 2013)

MATERIAL AND METHOD

Before the examination it should be noted that only one aspect of payment reallocation is outlined in the present study. The aim of the paper is to quantify the main impacts observed in case of the producers concerned and the consequences in respect to profitability. The conclusions concerning the first-pillar measures are made on the basis of the payment data about approximately 174.000 producers, processed by the Agricultural and Rural Development Agency (MVH) in the grant year of 2012. The analysis was made by using a database updated in 2013, containing data for each producer, without personal details. The database included the result of former appeals and approvals. Another support for the main objective of the paper was provided by the database of the National Tax and Customs Administration (NAV), including balance sheet and profit-and-loss statements compiled by the Institute of Agricultural Economics. Due to the nature of the database, information is available only about the enterprises performing double entry book-keeping, thus the analysis is narrowed to them. The research is based on the data of 2012, but – due to lack of data – information from the year 2011 was used in 13 cases.

RESULTS

According to the expectations (VÁSÁRY, 2013), the payment reallocation in the frames of modulation did not concern too many producers. As the result of the actually occurring withdrawal process, the MVH made the withdrawal in regard to 6 national and 8 community titles, altogether in 3685 cases (*Table 1*). On the basis of the data it can be concluded that withdrawal at the expense of community funds was made altogether in 871 cases. The most significant item was the SAPS title, because an amount of 1.09 billion HUF was withdrawn in case of 414 producers. The highest per producer reduction was made in this regard: it amounted to 33.7 million HUF. In addition to this, there was high number of reductions in case of separated sugar subsidy (147 clients) and special milk subsidy (120 clients). Since some producers can be concerned in respect to more titles, in fact only 2473 farmers were hit by the payment reduction. It is 1.4% of the total number of beneficiaries. Clustering according to the number of titles can be a reference point concerning the impact of reduction. It is obvious from the aggregated data of enterprises analysed in the frames of the study that in case of the 594 producers concerned, those with one title are still in the highest number, (*Table 2*) although their ratio is hardly 20% compared to the total number of beneficiaries, and only 24% on average. In contrary to

this, in case of enterprises related to more titles, this ratio is gradually increasing. By examining the amounts affected by reduction, it can be seen that it covers 74.4% of the total reduction. This classification represents the total population to a much larger extent than the number of those concerned. Thus, those concerned only with one title make up for about 20%, they represent two-third of the total reduction. In case of producers connected with three titles, this value increases to 91%. The above correlations well demonstrate that the specific value of reduction was multiplied in the categories concerned. In respect to the average, the rise is threefold.

Table 1. Distribution of modulation according to titles concerned (2012, pics, 1000 HUF)

Categories	Number of concerned by modulation	Amount withdrawn due to modulation	Average amount withdrawn due to mod.	Max. amount withdrawn due to modulation
Single Area Payment Scheme - SAPS	414	1 097 778	2 652	33 731
separated sugar payment	147	258 829	1 761	12 115
separated fruit and vegetable payment	9	17 992	1 999	8 356
special rice payment	4	9 795	2 449	3 908
special milk payment	120	158 794	1 323	7 378
ruminant restructuring payment	109	73 982	679	3 806
fruit, vegetables and tobacco restructuring payment	24	70 808	2 950	32 782
insurance fee support form EAGF*	44	8 784	200	1 209
total form EAGF	871	1 696 761	14 012	103 286
milk payment (decoupled)	76	13 759	181	10 258
suckler cows payment	666	311 324	467	13 359
bovine extensification payment (decoupled)	116	52 505	453	15 673
male bovine payment (decoupled)	199	26 188	132	4 973
ewe payment	1 350	185 542	137	6 686
ewe kept on unfavorable areas (decoupled)	407	118 432	291	9 968
total from national budget	2 814	707 750	1 661	60 917
Sumtotal	3 685	2 404 511	15 673	164 203

Source: own calculation on the basis of ARDA 2013 *:European Agricultural Guarantee Fund

Table 2. Distribution of titles concerned by modulation (2012)

Number of titles concerned by reduction (pcs)(A)	Number of those concerned and examined (pcs)(B)	Ratio compared to the total number of concerned (%)	Total amount withdrawn from the concerned and examined (HUF)(C)	Ratio compared to the total number of concerned (%)	Specific value reduced from the examined (HUF)(C/B)	Ratio of withdrawal from the examined compared to total subsidies (%)
1	304	19.49	417 824 910	66.17	1 374 424	0.88
2	175	25.33	506 393 003	68.75	2 893 674	0.61
3	83	52.53	507 864 395	91.40	6 118 848	0.33
4	28	53.85	304 697 994	83.42	10 882 071	0.14
5	4	36.36	52 211 474	68.25	13 052 869	0.02
6	0	0.00	0	0.00	0	0.00
Total	594	24.02	1 788 991 777	74.40	3 011 771	-

Source: own calculation on the basis of ARDA 2013

It is obvious from *Table 3* that in case of funds withdrawn by the examined enterprise the payment reallocation due to modulation concerned hardly 1% of the subsidies. It was mostly due to the calculation scheme and the great proportion of EU funds which were not reduced until the 300 000 euro limit. In case of the analysed enterprises the EU sources amounted to 73 billion HUF, while the national funds gave 5 billion HUF. In respect to the examined farms it could be stated that out of them 131 could be regarded as micro farms, 268 small-scale farms, 186 medium and 9 large-scale farms. Fifty-six % operated as limited liability companies (Ltd), further 28% as joint-stock companies. In addition to them, about 10% is the ratio of cooperatives, the remaining 5% operates in five other types of corporations. As regards their scope of activity, field crop farming is strongly determinant. Altogether 310 farms, 52% of the examined sample deal with this activity. Besides, dairy farms (79 pc, 13%) and grazing livestock farms (72 pc, 12%) are also significant. In case of the remaining 22%, further eight activities emerge, like for example enterprises performing pig farming, poultry raising, fruit and vegetable farming or forest management.

In respect to enterprises, the paper also aimed to examine the ratio expressed to the basic indicator which serves for the evaluation of farming and can be recorded in the balance sheet report. The size properties are clearly reflected in *Table 3*, where the values are classified according to the enterprise categories. The ratio of total payment and modulation is the greatest in case of micro and large-scale enterprises, the former one emerges owing to the lower ratio of EU grants, the latter is due to the threshold of 300 thousand euro. It is obvious that payment reduction means harder load to micro-farms compared to equity, as well as the net price income of sale (7.77%) and other income (3.24%). Parallel with this, when the size is growing the impact of modulation is gradually decreasing, or in some cases, e.g. in regards to other income it is increasing at large-scale enterprises. In respect to the earnings before tax, the value of ratio is considerable in all the four categories. Although it is obvious that the profitability of micro-enterprises is still affected the worst: the impact of reduction was 30.55% on the earnings before tax.

Table 3. Impact of modulation on the examined enterprises according to size categories (2012 %)

Categories	Total payment/ modulation	Equity/ modulation	Net sales revenue/ modulation	Other income/ modulation	Earning before tax/modulation
micro	1.67	3.18	7.77	3.24	30.55
small	0.61	0.46	0.44	0.94	11.21
medium sized	0.91	0.29	0.48	1.23	4.21
large	1.35	0.37	0.29	1.51	6.12

Source: own calculation on the basis of ARDA 2013

As regards the form of business - limited liability company - which appears in the highest ratio it can be seen that the modulation value compared to the total payment is average considering the 0.95% value of the examined companies. It is also obvious that this value is much higher in case of private ventures (4.2%) or non-profit limited liability companies (2.5%). Although representativity cannot be stated in their case because 2 farms belonged to the former category and one to the latter category. By analysing the corporate forms largely representing the total examined population, it is clear that joint stock companies and cooperatives farming on bigger areas are less exposed to the effect of modulation, than limited liability companies.

On the basis of the values of all the enterprises in the sample it can be concluded that the

ratio of equity and modulation is 1%, while this value is 2.1% in case of net sales revenue and 1.5% in case of other income. In respect to the earnings before tax, the degree is 13.2% unlike the former lower values. In case of limited liability company, the earnings before tax exceeds the average value: it amounts to 20%. It should be noted, however, that - also referring to the high values in *Table 4*, observed in case of micro and small-scale enterprises - it often occurred in case of Ltd. that the earnings before tax were extremely low. It may refer to the low profitability of farming in the given year, due to which - the low value of earnings before tax - the value of the index increases substantially. The high value may also indicate the farming difficulties generally observed in the course of business, but also to the practical presence of tax optimization.

Table 4. Effect of modulation on the examined enterprises, according to the form of corporation, 2013 (%)

Categories	Total payment/ modulation	Equity/ modulation	Net sales revenue/ modulation	Other income/ modulation	Earnings before tax/modulation
Limited Liability Company	1.012	1.47	2.71	1.76	20.24
Joint Stock Company	0.82	0.27	0.32	1.08	3.40
Agricultural Cooperative	0.59	0.29	0.76	1.06	3.42
Other cooperative	0.61	0.25	0.26	0.92	2.15
Unlimited liability company	1.36	1.86	6.15	1.89	3.38
Limited partnership	1.43	1.27	7.17	2.24	9.51
Private venture	4.20	2.28	8.76	11.55	26.08
Nonprofit limited liability company	2.51	2.04	9.13	2.34	5.07
Nonprofit public limited company	0.83	0.48	8.28	0.56	2.10

Source: own calculation on the basis of ARDA 2013

By examining not only the form of corporation but also the major business activities, it is obvious that there are significant differences in respect to the activities. Although it must be underlined that the main scope of activities, in most cases, does not mean exclusivity, however many farms have diversified business activities which may substantially affect values and thus only limited conclusions can be drawn. The outcomes can also be distorted by the delay in converting business activities and that in some cases the main activity (e.g. regarding forestry) does not but marginally belong to the scope of direct subsidy system and, consequently, modulation.

As regards the scope of activities, crop production is dominant with its share of 52%, due to the single area payment scheme. In their case - on the basis of *Table 5* - it is obvious that the impact of modulation is much lower compared to the average values.

In case of farms dealing mostly with forest management, the ratio of modulation is significant compared to the total payments, just like in respect to equity or income. In case of pig and poultry sectors regulated indirectly by CAP, the narrow funding possibilities (mostly SAPS) resulted in low values. By reviewing the sensitive sectors, however, there are outstanding values in regard to ruminant livestock breeding by grazing, which gives 12% of the total base population. Even in case of total payments, the value of modulation exceeds the average level, but peak values appear in case of the net sales income (10.89%) and the earnings before tax (21.31%). The impact is very significant in case of ruminant sector, partly owing to the payment scheme, partly to the consequent narrow room for maneuver resulted by the payment reallocation calculations. Presumably, in case of mixed-profile farms which give 9% of the examined enterprises, the presence of livestock farming and its impact on farming activities may cause the extreme values. In this latter row, there

is a high value, 65% in ratio of the earnings before tax and payment reduction.

Table 5. Impact of modulation on the examined enterprises according to the main profile, 2013 (%)

Categories	Total payment/ modulation	Equity/ modulation	Net sales revenue/ modulation	Other income/ modulation	Earnings before tax/ modulation
poultry farm	1.02	0.25	0.56	1.16	5.54
other	1.43	5.21	4.26	2.45	14.65
forestry	1.88	6.45	1.74	2.02	4.26
fruit farm	0.89	0.64	0.65	0.74	8.75
ruminant farm	1.72	2.25	10.89	3.78	21.31
corn farm	0.75	0.53	0.60	1.09	4.98
pig farm	0.82	0.39	0.68	1.07	6.68
dairy farm	0.71	0.55	0.68	0.97	4.95
mixed farm	1.05	1.27	0.80	1.83	65.04
vegetable farm	1.17	0.67	2.49	1.85	3.55

Source: own calculation on the basis of ARDA 2013

CONCLUSIONS

On the basis of the research made in the frames of the study it can be concluded that the payment reallocation in respect to modulation has not had any significant impact. Our research has proved that hardly 1% of the total payment was reallocated in case of some farms performing double entry book-keeping. Considering this and also using the database of the Hungarian Taxation and Customs Administration we have examined the trends observed in respect to some outcome indicators selected according to certain ways of classification. On the basis of these it can be concluded that there is a significant correlation in regard to micro- and small-scale enterprises. In close relation with this, the analysis was carried out in respect to the form of enterprise, too, and it was revealed that the modulation value was very significant concerning the earnings before tax in case of the dominant form of enterprising, namely the limited liability company. It refers rather to the profitability of farming and not to the impact of modulation. Considering the quantifiable impacts in regard to the main scope of activities, grazing activity - which indicates ruminant livestock management - can be highlighted. In this case, the impact of modulation is very substantial, referring primarily to the low earning capacity and the specialties of the payment scheme. In total, it can be declared that the payment reallocation in the frames of modulation in respect to year 2012 - although it has not concerned any significant amounts and in general it has not meant any considerable impacts - has caused difficulties in case of farms, the profitability of which is behind the average of the sector.

REFERENCES:

EUROPEAN COUNCIL (2009): Council Regulation (EC) No 73/2009 of 19 January, 2009 establishing common rules for direct support schemes for farmers under the common agricultural policy and establishing certain support schemes for farmers

EUROPEAN COMMISSION (2012): Modulation and other financial transfers from EAGF to EAFRD, 01.03.2013, http://ec.europa.eu/agriculture/direct-support/pdf/factsheet-modulation_ en.pdf

AGRICULTURAL AND RURAL DEVELOPMENT OFFICE (2013): Database about the payment of subsidies in 2012

VÁSÁRY M. (2013): A moduláció magyarországi alkalmazásának várható hatása a közvetlen támogatásokra: Modellszámítások a 2012. támogatási év értékei alapján GAZDÁLKODÁS 57:(4) pp. 344-355.

MINISTRY OF RURAL DEVELOPMENT (2012): Decree No 32/2012 (2 Apr) VM about certain issues of using the single-area payment scheme (SAPS) financed from the European Agricultural Guarantee Fund and the related top up funds in 2012

Review on Agriculture and Rural Development 2014. vol. 3 (1) ISSN 2063-4803

EFFECT OF PESTICIDES ON THE GROWTH AND SECRETED CHYMOTRYPSIN-LIKE ACTIVITY OF A BIOCONTROL STRAIN OF *BACILLUS AMYLOLIQUEFACIENS*

MÓNIKA VÖRÖS, LÁSZLÓ MANCZINGER, CSABA VÁGVÖLGYI

University of Szeged, Faculty of Science and Informatics, Department of Microbiology
6726 Szeged, Közép fasor 52. Hungary
voros.monesz@gmail.com

ABSTRACT
Biocontrol is an alternative approach to reduce the harmful effects of pathogen species in the agriculture. Pesticide-tolerant biocontrol agents are preferred in the integrated pest management because they can be applied together with different fungicides, herbicides and insecticides. A potent biocontrol agent, *Bacillus amyloliquefaciens* SZMC 22206 strain was isolated and studied previously. It was revealed, that the extracellular chymotrypsin-like protease and fengycin secretion of the strain resulted its antagonistic effect. The aim of our present study was to analyse the effect of different pesticides on the growth and activity of the extracellular chymotrypsin-like proteases of this *Bacillus* strain. The tested pesticides were a fungicide (carbendazim), and three frequently used herbicides (linuron, chlortoluron and 2,4-dichlorophenoxyacetic acid). The tested *Bacillus* strain was able to grow in the presence of the pesticides, but the activities of the extracellular chymotrypsin-like proteases were significantly reduced in some cases.

Keywords: *Bacillus*, biocontrol, pesticides, extracellular enzyme, chymotrypsin-like protease

INTRODUCTION

The biological control is an alternative method against the phytopathogenic microbes in the agriculture. An organism which can interfere with pests or pathogen species is referred to as biological control agent. Natural isolates of antagonistic microorganism can be used in pest control. The biological control agent can compete for niche and nutrients in the rhizosphere, can inhibit the growth of plant pathogens with antibiotics and extracellular lytic enzymes and can act indirectly, promotes the plant growth, elicits the defensive systems of plants against pathogens (COOK 1993, STICHER ET AL. 1997, CHEN ET AL. 2000). The use of biological control may not always be sufficient against pathogenic species. In this case we need to use combined methods as biological control agents with pesticides and sufficient cultivation (CLOYD 2005). The biocontrol agent needs to be tolerant against the used pesticides in combined treatments (LEW ET AL. 2009, MOHIDDIN AND KHAN 2013, RODRIGUEZ-KABANA AND CURL 1980). The *Bacillus* genus contains more species with potential biocontrol capabilities. *Bacillus* species were used successfully to control late blight disease caused by *Phytophthora infestans.* These strains significantly reduced the disease and enhanced the growth of plants (LAMSAL ET AL. 2013). *Bacillus amyloliquefaciens* SZMC 22206 had been isolated and studied as a potential biocontrol agent in our laboratory. Our aims were to investigate the effect of pesticides on the growth and secreted chymotrypsin-like activity of this strain.

MATERIAL AND METHOD

Bacterium strain and growth conditions

A biocontrol bacterium strain *Bacillus amyloliquefaciens* SZMC 22206 was used in these investigations. *B. amyloliquefaciens* was maintained on nutrient agar medium (0.2%

glucose, 0.2% yeast extract and 2% agar) at 25 ^{0}C. The medium for the investigation of pesticide tolerance contained 0.2% glucose, 0.2% yeast extract and 0.25; 0.125; 0.0625 or 0.025 mM of a distinct pesticide. The tested pesticides were 2,4-dichlorophenoxyacetic acid (2,4D), carbendazim, linuron and chlortoluron. The growth of the bacterial strain was followed by measuring optical density at 620 nm.

Enzyme assay

The chymotrypsin-like activity of the strain was detected in its ferment broth with N-succinyl-Ala-Ala-Pro-Phe-p-nitroanilide chromogenic substrate at 405 nm. For measuring the secreted enzyme in the presence of pesticides, the cells were centrifuged at 10000 g for 5 minutes. The supernatant was analyzed with the chromogenic substrate: to 50 µl phosphate buffer pH 6.6, 50 µl chromogenic substrate and 50 µl supernatant was added. This mixture was incubated at room temperature for 20 minutes. After incubation 50 µl 10% Na_2CO_3 was added to stop the reaction, then the yellow product was measured on microtiter plate with spectrophotometer at 405 nm. The concentration of the substrate was 3 mM.

RESULTS

The aim of this work was to analyse the effect of different pesticides on the growth and activity of the extracellular chymotrypsin-like proteases of *Bacillus amyloliquefaciens* SZMC 22206 strain. After 10 days incubation, bacterial growth and chymotrypsin-like activities were determined, both in the control and in the presence of pesticides. According these measurements, growth was less inhibited in the presence of 2,4-dichlorophenoxyacetic acid and chlortoluron. The growth of the strain was inhibited already by low concentrations of carbendazim and linuron (*Figure 1*). The enzyme activities in the ferment broths were inhibited by all the investigated pesticides. The most significant inhibitions were produced by chlortoluron and carbendazim (*Figure 2*). The reduction of chymotrypsin-like activities could be caused by the lower cell mass in the presence of 2,4-dichlorophenoxyacetic acid, linuron and chlortoluron plus some disturbances in the cytoplasmic membrane and enzyme secretion system. The most significant reduction was generated by carbendazim.

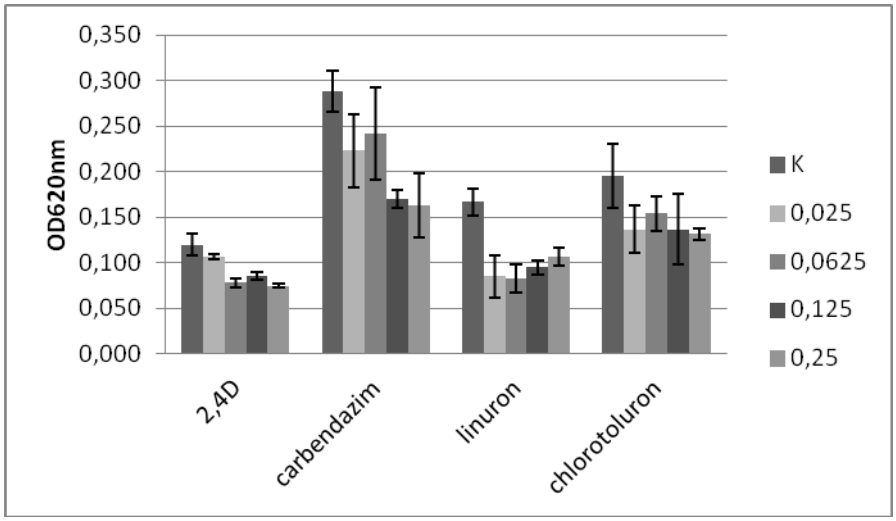


Figure 1. Effect of pesticides on the growth of *Bacillus amyloliquefaciens*

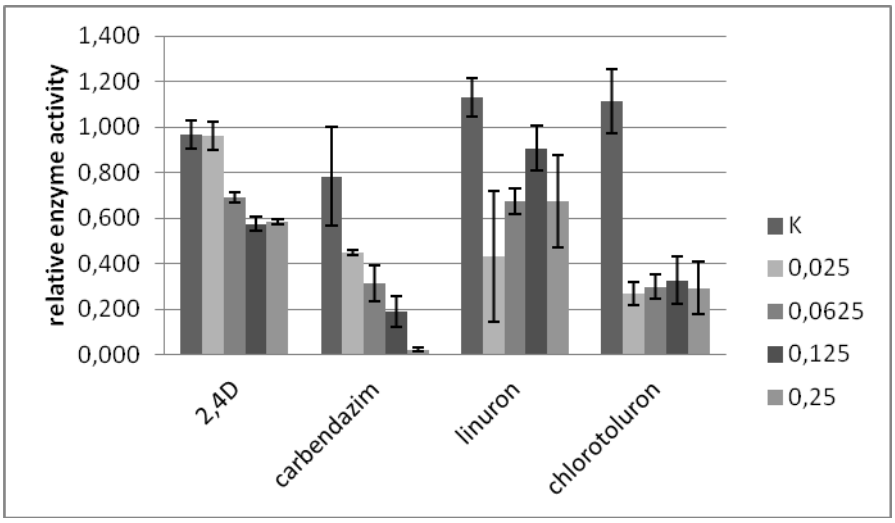


Figure 2. Effect of pesticides on the chymotrypsin-like enzyme activities

CONCLUSIONS

In the present study, the effects of four pesticides (2,4D, carbendazim, linuron and chlortoluron) on the growth and the secreted chymotrypsin-like activity of *Bacillus amyloliquefaciens* SZMC 22206 were analysed. The results indicate that both the bacterial growth and the tested exoenzyme activities are significantly reduced in the presence of these pesticides. These finding suggests that presence of chemical pesticides (e.g. in agricultural soils) can strongly affect the behaviour and effectiveness of the non-target biocontrol bacterial species.

ACKNOWLEDGEMENTS

The Project is supported by the European Union and co-financed by the European Social Fund (grant agreement no. TÁMOP-4.1.1.C-12/1/KONV-2012-0012) and connected to the project BIOXEN which is co-financed by the European Union through the Hungary-Serbia IPA Cross-border Co-operation Programme (HU-SRB/0901/214/150).

REFERENCES

CHEN C., BÉLANGER R.R., BENHAMOU N., PAULITZ T.C. (2000): Defense enzymes induced in cucumber roots by treatment with plant growth-promoting rhizobacteria (PGPR) and *Pythium aphanidermatum*. Physiological and Molecular Plant Pathology 56: 13–23.

CLOYD R. (2005): Compatibility conflict: Is the use of biological control agents with pesticides a viable management strategy? Second International Symposium on Biological Control of Arthropods, Switzerland- September 12-16, 2005

COOK R.J. 1993. Making greater use of introduced microorganisms for biological control of plant pathogens. Annual Review of Phytopathology 31: 53–80.

LAMSAL K., KIM S.W., KIM Y.S., LEE Y.S. (2013): Biocontrol of late blight and plant growth promotion in tomato using rhizobacterial isolates. Journal of Microbiology Biotechnology 23: 897-904.

LEW S., LEW M., SZAREK J., Mieszczynski T. (2009): Effect of pesticides on soil and aquatic environmental microorganisms - a short review. Fresenius Environmental Bulletin 18(8): 1390-1395.

MOHIDDIN F.A., KHAN M.R. (2013): Tolerance of fungal and bacterial biocontrol agents to six pesticides commonly used in the control of soil borne plant pathogens. African Journal of Agricultural Research 8(43): 5331-5334.

RODRIGUEZ-KABANA R., CURL E.A. (1980): Non-target effects of pesticides on soilborne pathogens and diseases. Annual Review of Phytopathology 18: 311–332.

STICHER L., MAUCH-MANI B., MÉTRAUX J.P. (1997): Systemic acquired resistance. Annual Review of Phytopathology 35: 235–270.

Review on Agriculture and Rural Development 2014. vol. 3 (1) ISSN 2063-4803

SPATIAL DISTRIBUTION OF BENZIMIDAZOLE RESISTANCE OF *CERCOSPORA BETICOLA* SACC. IN SERBIA

NENAD TRKULJA, ANJA MILOSAVLJEVIĆ, ERIKA PFAF-DOLOVAC, NENAD DOLOVAC, JELENA BOŠKOVIĆ

Institute for Plant Protection and Environment
Teodora Drajzera 9, Belgrade, Serbia
Megatrend University, Faculty of Biofarming
Maršala Tita 39, Bačka Topola, Serbia
trkulja_nenad@yahoo.com

ABSTRACT
In order to check distribution of resistance of *C. beticola* isolates to benzimidazole fungicides we collected samples from four distinct geographical districts with different fungicides history in Serbia. From all localities about 40 - 50 isolates of *C. beticola* were collected and subjected to testing sensitivity to benzimidazoles in the laboratory. Due to RG of isolates on the discriminatory concentrations of carbendazim and thiophanate methyl we concluded level of resistance to benzimidazoles. Discriminatory concentration for carbendazim was 1 mg/l while for thiophanate methyl was 5 mg/l. Very high frequency of resistance of *C. beticola* isolates to benzimidazole fungicides on locality West Bačka (98 %), Srem (100%) and Moravica (97%), while on locality Rasina decrease frequency of benzimidazole resistance with 18% was established. Frequency of resistance of *C. beticola* populations to benzimidazoles was stable on locality where benzimidazoles were applied in the past, while on locality where they have never been applied it varies.

Keywords: Sugar beet, *C. beticola*, fungicides, benzimidazoles resistance, distribution

INTRODUCTION

Cercospora leaf spot caused by the fungus *Cercospora beticola* Sacc. is a destructive foliar disease of sugar beet (*Beta vulgaris* L.), present in all regions worldwide where sugar beet grows (HOLTSCHULTE, 2000). Severe epidemics of Cercospora leaf spot in production regions that prevails high temperature and humidity can cause substantial decreases in yield of sugar beet and extracted sucrose (SHANE AND TENG, 1992). In order to control Cercospora leaf spot disease in the sugar beet crop, farmers are applying an integrated concept that includes cultivation of resistant varieties of sugar beet to *C. beticola*, crop rotation and application of fungicides (MILLER ET AL., 1994). The benzimidazoles were first sistemic fungicides which used to control Cercospora leaf spot wherever the sugar beet grows. Benzimidazoles perform their fungicidal activity by binding to the β-tubulin protein, which is a subunit of the microtubule spindle, thus interfering with microtubule formation and mitosis (DAVIDSE, 1986). After several years of application of benzimidazole fungicides, resistant populations of *C. beticola* to benzimidazoles was recorded, first in Greece (GEORGEPULOS AND DOVAS, 1973) and then Italy (D`AMBRA ET AL. 1974), as well as in Serbia (MARIĆ ET AL., 1976). Benzimidazole resistance has developed independently in a number of fungal species and it has always been associated with point mutations in the β-tubulin gene (MA AND MICHAILIDES, 2005). In the case of *C. beticola*, resistance results from a single-step change in the β-tubulin gene, causing amino acid substitution of glutamic acid with alanine at position 198 (DAVIDSON ET AL., 2006) and tyrosine with phenylalanine at position 167 (TRKULJA ET AL., 2013). Due to fact that resistance relies on single mutations (qualitative resistance), pathogen such as *C. beticola* with abundant sporulations and fewest cycles in one growing season can quickly evolve

from mainly sensitive populations to mainly resistant. Recent studies conducted in Serbia revealed very high frequency of resistant populations of *C. beticola* to benzimidazoles in all localities where they were intensively used to control sugar beet, but also presence of benzimidazole resistance was recorded in beet root crop in the localities where benzimidazoles have never been used to control Cercospora leaf spot disease (TRKULJA ET AL., 2009; TRKULJA ET AL., 2012).

This study is carried out in order to determine spatial distributions of *C. beticola* resistant populations to benzimidazole fungicides in a different geographical districts in Serbia. Accurate decisions have to be made in the terms of implementation of the benzimidazole in the management for control Cercospora leaf spot disease, in accordance with the resistant strategies and environmental policy.

MATERIAL AND METHOD

Samples were collected during August and September of 2013. Four different geographical districts in Serbia with different history of fungicide application were chosen. Benzimidazole fungicides were applied at West Bačka and Srem districts while at Moravica and Rasina districts they have never been used to control Cercospora leaf spot disease *(Table 1.)*. Samples derived from districts of West Bačka and Srem originated from sugar beet crops while from districts of Moravica and Rasina originated from beet root crops.

Sampling and pathogen isolation

Sugar beet or beet root leaves with serious symptoms of Cercospora leaf spot and abundant sporulation of *C. beticola* were collected at 10 different sites within a district. The leaves are packed in paper bags, after that were stored in hand fridge and transferred to the laboratory. Conidia derived from one spot per a leaf were transferred to the water agar medium in order to establish monosporial culture of *C. beticola*. After two days single germinated conidia were transferred on a fresh potato-dextrose agar (PDA) and incubated ten days at 25 °C in the dark. List of isolates obtained per locality is shown in the *Table 1*.

Table 1. Locality and the number of tested isolates of *C. beticola*

Locality	Host	Number of isolates	History of benzimidazole applications
West Bačka	sugar beet	48	used
Srem	sugar beet	46	used
Moravica	beet root	44	not used
Rasina	beet root	50	not used

Quantitative sensitivity testing

In order to determine frequency of resistant isolates per locality we used appropriate discriminatory concentration for carbendazim 1 µg/ml (KARAOGLANIDIS AND BARDAS, 2006) and thiophanate-methyl 5 µg/ml (WEILAND AND HALLOIN, 2001). Primely fungicides were dissolved in sterilized distilled water to adjast appropriate dilution. Autoclaved Petri dishes with PDA cooled to 40 – 50 ºC and amended with fungicide solution were used. Control was PDA medium amended with sterile water. The radial growth (colony diameter) of each isolate was measured with the original mycelial plug diameter (5 mm) subtracted from this measurement, after 7 days of incubation at 25 °C. A relative growth is calculated by dividing an average growth of conidia on PDA treated with a fungicide with an average growth in control. Fungal isolates were classified as resistant if

the colony growth on discriminatory concentration was ≥50% compared to these in control (RUSSEL, 2004). Test for each isolate was carried out in two trials, with three replicates within each trial.

RESULTS

In the current study, sensitivity of the isolates of *C. beticola* to benzimidazole fungicides (carbendazim and thiophanate methyl) was set up. Isolates originated from four different districts in Serbia with different history of fungicide applications. In the district of West Bačka where benzimidazole fungicides has been continually applicated for the past four decades, we determined very high frequency of resistant isolates of *C. beticola* which was 98%. In another region, where benzimidazole fungicides were continually applied, also to control *C. beticola* populations, frequency of resistance was very high reaching up 100% *(Fifure 1.)*. Isolates which originated from beet root crop, which has never been treated with fungicides to control *C. beticola,* from the district of Moravica controversy revealed presence of resistant populations, although selection pressure of fungicides missing. From the 44 analyzed samples, 43 were resistant and determined frequency of resistance to benzimidazole fungicides was 98%. On the other hand in the region of South Serbia, where benzimidazoles likewise has never been used to protect beet root crop, frequency of resistant isolates of *C. beticola* to benzimidazoles was significantly lower with 16% presence of resistant populations *(Figure 1.)*.

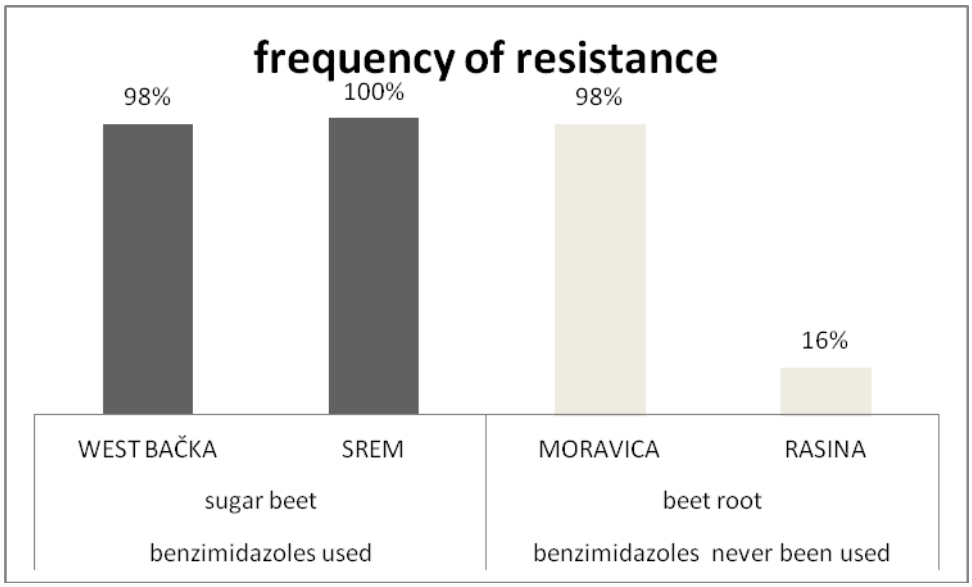


Figure 1. Frequency of resistant isolates of *C. beticola* to benzimidazole fungicides in different regions and history of fungicides applications

CONCLUSIONS

During this study, very high frequency (98 – 100%) of resistance of *C. beticola* isolates to benzimidazole fungicides was determined in two different districts in Serbia (West Bačka and Srem) both with similar history of fungicide applications, which suggested that pressure of fungicides is necessary condition to evolution of fungicides in the field. Due to that, implementation of measures of anti-resistance strategies is essential to stop further development of resistance of *C. beticola* to benzimidazole fungicides, in all regions where significant appearance of resistant populations was detected. Recent studies revealed very high frequency of isolates of *C. beticola* resistant to benzimidazole fungicides in region of the Central, Eastern and Western Serbia where sugar beet production was never established and fungicides to control of *C. beticola* were not used (TRKULJA ET AL., 2011; TRKULJA ET AL., 2012). This study determined very high frequency of resistant isolates of *C. beticola* to benzimidazoles (98%) in the district of Moravica, while in the district of Rasina, which is only 50 – 100 km away from the Moravica, frequency of resistance was dropped to 16%. Discovery of resistance on the locality without presence of selection pressure of fungicides, raise the question of origin of resistant populations in that regions. Based on these studies we can conclude that the usage of benzimidazole fungicides provided ideal conditions for resistant populations of *C. beticola* for their development. However, we can only discuss, that the long time selection pressure of benzimidazoles led to the spread of resistant populations to a regions that surrounds them, or in those regions, environmental conditions were more appropriate for the resistant then for sensitive populations of *C. beticola*, due to which its expansion has occurred. Further research, in terms of genetics of *C. beticola* population could provide an answer to this phenomenon.

ACKNOWLEDGEMENTS

This research was supported by grants of the Ministry of Education, Science and Technological Development of the Republic of Serbia TR-31018.

REFERENCES

D'AMBRA, V., MUTTO, S., CARULA, G. (1974): Sensibilita e toleranza di isolati di *Cercospora beticola* sensibili e toleranti al benomyl. L`Industria Saccarifera Italiana. 1, 11-13.

DAVIDSE, L. C. (1986): Benzimidazole fungicides: mechanism of action and biological impact. Annual Review of Phytopathology. 24, 43–65.

DAVIDSON, R. M., HANSON, L. E., FRANC, G. D., PANELLA, L. (2006): Analysis of ß-tubulin gene fragments from benzimidazole sensitive and tolerant *Cercospora beticola*. Journal of Phytopathology. 154, 321–328.

GEORGOPOULOS, S. G., DOVAS, C. (1973): Occurence of *Cercospora beticola* strains resistant to benzimidazole fungicides in northern Greece. Plant Disease Reporter. 57, 321–324.

HOLTSHULTE, B. (2000): *Cercospora beticola*-worldwide distribution and incidence. In: ASHER, M. J. C., HOLTSHULTE B., RICHARD MOLARD, M., ROSSO F., SEINRUECKEN, G., BECKERS, R. (ed.) *Cercospora beticola* Sacc. Biology, Agronomic Influence and Control Measures in Sugar Beet, Vol. 2. International Institute for Beet Research, Brussels. pp. 5–16.

KARAOGLANDINIS, G. S., BARDAS, G. (2006): Control of benzimidazole and DMI-resistant strains of *Cercospora beticola* with strobilurin fungicides. Plant Disease. 90, 419-424.

MA, Z., MICHAILIDES, T. J. (2005): Advances in understanding molecular mechanisms of fungicide resistance and molecular detection of resistant genotypes in phytopathogenic fungi. Crop Protection. 24, 853–863.

MARIĆ, A., PETROV, M., MAŠIREVIĆ, S. (1976): Pojava tolerantnosti kod *Cercospora beticola* Sacc. prema benomilu u Jugoslaviji i mogućnosti suzbijanja ovog parazita. Zaštita bilja. 27, 227-236.

SHANE, W. W., TENG, P. S. (1992): Impact of Cercospora leaf spot on root weight, sugar yieldand purity of *Beta vulgaris*. Plant Disease. 76, 812–820.

TRKULJA, N., ALEKSIĆ, G., STAROVIĆ, M., DOLOVAC, N., IVANOVIĆ, Ž., ŽISKOVIÇ, S., (2009): Osetljivost izolata *Cercospora beticola* prema karbendazimu i flutriafolu u Srbiji. Zaštita bilja. 270, 237-245.

TRKULJA, N., DOLOVAC, N., PFAF DOLOVEC E., STAVANOVIĆ, M., IVANOVIÇ Ž., ŠTRABOVIÇ, R., ŽIVKOVIÇ, S. (2011): Učestaloct rezistentnosti *Cercospora beticola* (Sacc.) prema benzimidazolima i DMI fungicidima. Zaštita bilja. 62, 109-117.

TRKULJA, N., IVANOVIĆ, Ž., POPOVIĆ, T., ŽIZKOVIĆ, S., ORO, V., DOLOVAC, N., BOŠKOVIĆ, J. (2012): Existence of *Cercospora beticola* isolates resistant to benzimidazole and triazole fungicides in natural populations. International Symposium on current trends in Plant Protection, Belgrade 25-28th September. Proceedings. 367-372.

TRKOLJA, N., IVANOVIĆ, Ž., PFAF-DOLOVAC, E., DOLOVAC, N., MITROVIĆ, M., TOŠEVSKI, I., JOVIĆ, J. (2013): Characterisation of benzimidazole resistance of *Cercospora beticola* in Serbia using PCR-based detection of resistance-associated mutations of the β-tubulin gene. Eurropean Journal of Plant Pathology. 135, 889-902.

WEILAND, J. J., HALLOIN, J. M. (2001): Benzimidazole resistance in *Cercospora beticola* sampled from sugarbeet fields in Michigan, USA. Canadian Journal of Plant Pathology. 23, 78–82.

RUSSELL, P. E. (2004): Sensitivity baselines in fungicide resistance research and management. FRAC Monograph No. 3. Brussels: Crop Life International. 56. P.

Review on Agriculture and Rural Development 2014. vol. 3 (1) ISSN 2063-4803

EVALUATING PREY PREFERENCES OF AN INSECTIVOROUS BIRD SPECIES BASED ON DIFFERENT SAMPLING METHODS

ORSOLYA KISS

University of Szeged, Faculty of Agriculture
H-6800 Hódmezővásárhely, Andrássy út 15.
kiss.orsolya@mgk.u-szeged.hu

ABSTRACT
Decline in populations of farmland and grassland birds has been attributed to the recent changes of agricultural practice in Europe. These changes may affect the food resources, so the studies in prey preference may have an importance when try to protect these species. We studied prey preference in the European Roller (*Coracias garrulous*) in natural grassland and farmland mosaics by two different sampling methods. (i) Pitfall traps were used to determine prey availability in Rollers' territories and (ii) nestbox content, supplemented with video recordings, were used to estimate the contribution of main prey taxa to nestling diet. We found that Rollers did not select their prey items in proportion to their availability. We also found significant differences between Savage selectivity indices obtained by the different sampling methods. Nestbox content indicated high preference of coleopterans and avoidance of orthopterans, but video recording showed significant preference of both taxa. None of our sampling methods indicated difference in prey preference during the nestling period between the two study sites.

Keywords: nestbox content, nestling diet, *Coracias garrulus*, video records, Savage selectivity index

INTRODUCTION

Knowledge of prey preference may play an important role in the conservation of threatened species. Recent changes in populations of grassland birds have been attributed to the changes in food supply due to agricultural intensification, such as increased pesticide use or reduction of suitable feeding areas (DONALD ET AL., 2006; NEWTON, 2004; MORRIS ET AL., 2005). Identification of main prey types and preservation of their populations are important to maintain the suitable food supply for threatened bird species. Usually, several methods are used to identify prey composition of the species. Analysis of pellets or nestbox content is most frequently used in raptor species (STENFOFF ET AL., 1988; BAKALOUDIS ET AL., 2012). Direct observation can be performed where prey items are large enough to detect (MARGALIDA ET AL., 2009).Video recordings of feeding birds (BRITSCHGI ET AL., 2006) and collar samples (TRYJANOWSKI ET AL., 2003) are useful methods to identify smaller prey items and allow us to detect changes in prey composition during the nestling period. Our study species, the European Roller (*Coracias garrulus*) is a threatened bird species in Europe. It suffered from serious population decline during the 1970's and disappeared as a breeding species from Finland, Denmark, Germany and the Czech Republic (CRAMP ET AL., 1993). The reasons for the severe decline in Roller populations are still not correctly revealed. The main causes of recent widespread decline are considered the loss of suitable habitats due to changing agricultural practices and loss of nesting sites. KOVÁCS ET AL. (2008) mentioned that the critical threats for Rollers is the conversion of natural grasslands to any other land use, management of meadows and pastures, destruction of microhabitats of large insects serving for basic food supply. The European Roller typically feeds on terrestrial invertebrates and slowly flying arthropods (CRAMP ET AL., 1993; AVILÉS AND PAREJO, 2002). However, this species is also known as a polyphagous bird species, also foraging on vertebrates (CRAMP ET AL., 1993). In this study we aimed to investigate prey preference of Rollers during the nestling period based

on two sampling methods, in two study site. We predict that food samples collected in nestboxes may indicate the higher use of certain taxa, such as coleopterans and vertebrates, because the remains of these taxa are most durable. We predict that both sampling methods differ in diet composition between the two studied habitats.

MATERIAL AND METHOD

Study site

The study was conducted in southern Hungary, in two sites: (i) "Grassland" habitat at the village Baks (46°32'N; 20°03'E). It was an alcalic natural grassland, which was characterized by the mosaic of salt and dry grasslands; (ii) "Farmland mosaics" at the village Szatymaz (46°24'N; 19°57'E). The second site was an agricultural area, which is composed of the mosaics of salt grassland patches (23% of the whole area) and extensive cereal cultures (3%), arable fields (53%) and artificial forest monocultures (e.g. black locusts, Robinia pseudoacacia; 4 % of the whole area). The size of the grassland patches within this habitat was about 14 ha. Due to the lack of natural holes available for breeding, nestboxes were installed in the area in the previous years (MOLNÁR, 1998). The study was conducted in 2009 during the breeding season of Rollers (from late April to early August).

Nestling diet

We studied the availability of prey in 10 plots at each sites. In these sites each plots were established within the breeding territories of Rollers. We used pitfall traps to estimate arthropod abundance. In each study plots we randomly placed 5 pitfall traps of plastic bowls with the diameter of 65 mm in a line, 1 m apart from each other. Ethylene glycol (30-50%) was used as killing-preservative solution. Pitfall-traps were active for two weeks between 16 June and 20 July, which overlapped the feeding period of nestlings. This resulted in two samples from pitfall traps. Rollers usually feed on arthropods larger than 1 cm (CRAMP ET AL., 1993), hence we selected the food items larger than 1 cm from the collected samples for further analyses. We used video recording and nestboxes content to determine the diet of Roller nestlings. We documented prey composition delivered by Rollers with the help of video recordings (Sony DCR-HC53E camera with Sony Premium mini DV cassettes). We recorded Rollers between 6 and 12 hours (C.E.T. summer time) in the morning, because POOL (2006) reported that frequency of Roller's feeding activity did not change in this period. We recorded each nests twice, first during the first week of the nestling period and the second recordings during the third week, as Rollers nestling period is at least 3 weeks long (CRAMP ET AL., 1993). Previous studies on Rollers reported that prey remains in the nestbox were useful indicators of nestlings' diet in Rollers (AVILÉS ET AL., 2002; TIDMARSH, 2003; MOLNÁR, 1998; CRAMP ET AL., 1993). For this reason we collected the content of 10-10 nestboxes in each study sites. The number of individuals of taxa was calculated based on TIDMARSH (2003).

Statistical analysis

We used Savage electivity index to determined Roller prey preferences in insects groups. Savage selectivity index $w_i = Ui / D_i$, where U_i is the proportion of units used in one territory and D_i is the proportion of units available (SAVAGE, 1931). This index varies from 0 (maximum negative selection) to infinity (maximum positive selection), with 1 indicating no selection. The statistical significance of the selection for each of the taxonomic groups considered is obtained by comparing the statistic $(w_i - 1)^2 / se(w_i)^2$ with theoretical value of a χ^2 distribution with one degree of freedom, with w_i being the Savage index for the

taxonomic group and se(wi), the standard error of the index. [es(W_i)] is the standard error of the index approximately given by $\sqrt{[(1 - D_i) / (u + D_i)]}$. Non-parametric tests were used testing potential differences in prey composition collected by the different methods.

RESULTS

From video records we identified 245 prey items delivered to 20 Roller nests, but 63 additional items (20.5 %) remained unidentified. From nestbox contents we identified 2141 prey items. Both methods revealed similar prey types, although their frequencies in nestling diet were different (*Table 1*). These results suggested that orthopterans and coleopterans were the most important taxa in nestlings' diet, however, nestbox content indicated higher consumption of coleopteras, whereas video recordings showed the higher consumption of orthopteras.

Table 1. Percentage of prey types in Roller nestlings' diet obtained by different sampling methods

Sampling method	Orthoptera (except mole crickets)	Coleoptera	*Gyrllotalpa gyrllotalpa*	Amphibians and reptiles	Mammals
nestbox contents	8.2%	77.2%	13.4%	0.1%	1.3%
video recordings	40.75%	25 %	0.32 %	9.4 %	3.76%

The European mole cricket (*Gyrllotalpa gyrllotalpa*) was highly overrepresented in nestbox contents; however, we found higher frequency of vertebrates in video recordings than in nestbox samples. We analysed prey-selection in respect to availability by the Savage electivity index (*Figure 1*). We did not calculate Savage index for Mole Cricket in case of video recordings, because we only detected once this taxon with this sampling method.

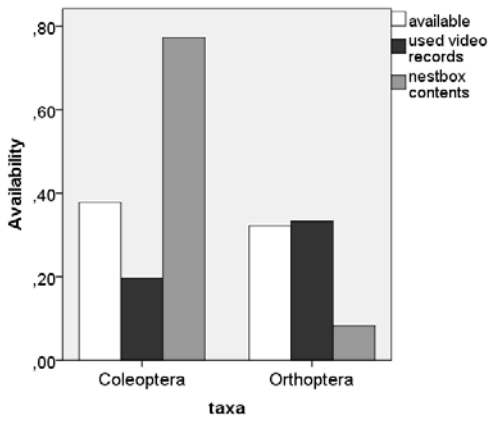


Figure 1. Relative frequency of Rollers' main prey types obtained by two sampling methods (video records and nestbox contents), and their availabilityin the territories during the breeding season. Availability was estimated by pitfall trap method.

Prey items were not selected in proportion to their availability both in case of nestbox content (orthopterans: $w_i = 0.34$, se = 0.19, p =0.001; coleopterans: $w_i = 4.8$, se. = 0.08, p

= 0.001; *Gyrllotalpa gyrllotalpa*: w_i = 2.8,se. = 0.1, p < 0.001); and video records (orthopterans: w_i = 1.9, se. 0.8, p = 0.03, coleopterans: w_i = 1.14, se. = 0.29, p = 0.001). We found differences in preference caused by the sampling methods. Preferences for main prey types differed significantly when we compared data obtained by the different sampling methods. The nextbox content indicated high preference of coleopterans (Mann-Whitney U = 5500, n_1 = 20, n_2 = 20, p = 0.001) and lower preference (avoidance) the orthopterans (Mann-Whitney U = 66000, n_1 = 20, n_2 = 18, p = 0.001) than video records.
We also investigated the differences of prey selection in different habitats. We found that the Savage index did not differ significantly between study sites neither in the case of nestbox contents (orthopterans: Mann-Whitney U = 32500, n_1 = 10, n_2 = 9, p = 0.315; coleopterans: Mann-Whitney U = 47000, n_1 = 10, n_2 = 10, p = 0.821; *Figure 2/a*) nor in video records (orthopterans: Mann-Whitney U = 26000, n_1 = 10, n_2 = 9, p = 0.133; coleopterans: Mann-Whitney U = 50000, n_1 = 10, n_2 = 10, p =0.1; *Figure 2/b*). The preference for mole cricket (*Gryllotalpa gryllotalpa*) was did not differ in the two habitats (Mann-Whitney U = 12000, n = 8, p = 0.23).

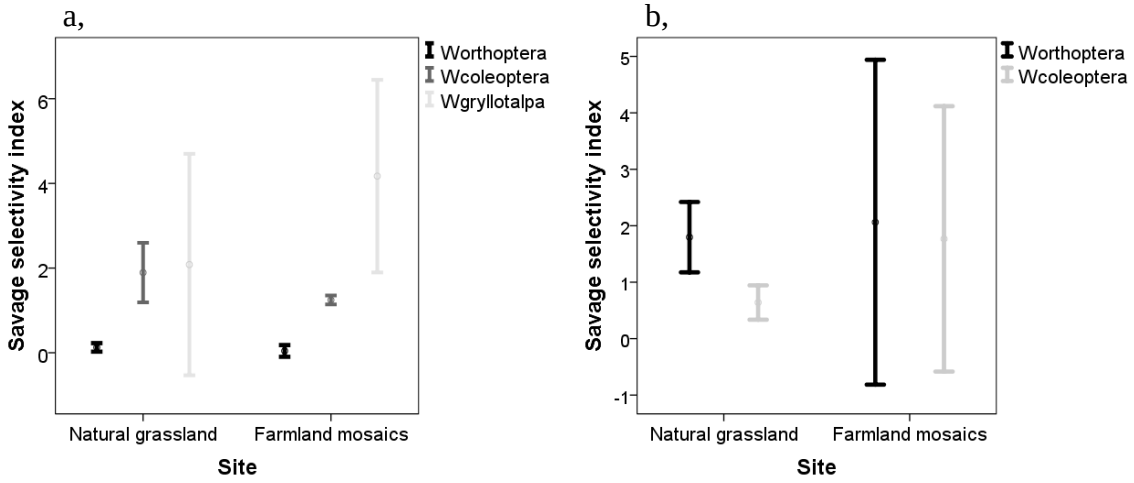


Figure 2. Savage electivity index in two different habitats by using nestbox contents (a) and video records (b) sampling methods.

CONCLUSIONS

According to the literature, Rollers' nestling diet was evaluated by a variety of methods, but none of them compared the results of the different techniques in the same territories. Most of the studies indicates polyphagia in this species (CRAMP ET AL., 1993) and highlighted the importance of vertebrates (AVILÉS ET AL., 2002). TIDMARSH (2003) found high frequencies of orthopterans by analysing nestbox content in France and AVILÉS ET AL. (2002) also found orthopterans as the most frequently consumed prey type. Our results, however, indicate much higher importance of coleopterans by using nestbox contents, but not in video records. We found that the sampling methods may indicate different preferences in same territories. Nestbox contents presumably overestimates the importance of coleopterans in nestlings' diet, although the analysis of pellets collected under perch sites and from nest-hole contents in East Germany found high frequency of coleopterans (77.6%) and less frequency of orthopterans (16.4%) (CRAMP ET AL., 1993). The analysis of nestbox contents proved to be useful to identify the important prey species, which was almost undetectable by video records. The latter method seems to be providing detailed informations about Rollers' diet. The results obtained by this method were similar to the

results of former studies (CRAMP ET AL., 1993). Biases in the methods of diet analysis were also found in other species. TRYJANOWSKI ET AL. (2003) found differences in orthopterans collected by different methods and TORBERG ET AL. (2007) reported that small prey items were underestimated in remains. In video records orthopterans were delivered to the nests the most frequently, this taxon consisted of 40% of nestling diet. According to the video records this taxon was probably the main prey type for Rollers during the nestling period in both habitats. Our results suggest that analyses of prey remains in nestbox contents should be used to find large preys, such as beetles, and data obtained by different methods is useful to perform an analysis of Rollers' diet.

ACKNOWLEDGEMENTS

We are grateful to the authority of the Kiskunság National Park for allowing us to work in the Pusztaszeri Landscape Protection area. We would like to thank Béla Tokody and the local group of BirdLife Hungary for their assistance in the field. We thank Róbert Gallé and Attila Torma for their help in insect collection and determination. Szilád Kovács helped me in nestbox contents analysis.

REFERENCES

Avilés, J.M., Pajero, D. (2004): Farming practices and roller *Coracias garrulus* conservation in south-west Spain. Bird Conservation International 14: 173–181.

AVILÉS, J.M., PAREJO, D. (2002): Diet and prey type selection by rollers (*Coracias garrulus*) during the breeding season in southwestern Iberian peninsula. Alauda 70: 227–230.

BAKALOUDISA, D.E., S. IEZEKIELC, S., VLACHOSD, C.G., BONTZORLOSD, V.A., M. PAPAKOSTAD, M., BIRRERB, S. (2012): Assessing bias in diet methods for the Long-legged Buzzard *Buteo rufinus*. Journal of Arid Environments Vol.77 59-65.

BRITSCHGI, A., SPAAR, R., ARLETTEZ, R. (2006): Impact of grassland farming intensification on the breeding ecology of an indicator insectivorous passerine, the whinchat *Saxicola rubetra*: lessons for overall Alpine meadowland management. Biological Conservation 130: 193–205.

CRAMP, S., PERRINS, C.M., BROOKS, D.J. (ed.) (1993): The Birds of the Western Palearctic. Vol. 7. Oxford University Press, Oxford.

DONALD, P.F., SANDERSON, F.J., BURFIEL, I. J., BOMMEL, F. P.J. (2006): Futher evidencie of continent-wide impacts of agricultural intensification on European farmland birds, 1990-2000. – Agriculture, Ecosystems and Environment 116: 189—196

KOVACS A., BAROV B., ORHUN C., GALLO-ORSI U. (2008): International Species Action Plan for the European Roller *Coracias garrulus garrulus*

MARGALIDA, A., BERTRAN, J., HEREDIA, R. (2009): Diet and food preferences of the endangered Bearded Vulture *Gypaetus barbatus*: a basis for their conservation. Ibis 151: 235–243

MOLNÁR, GY. (1998): Breeding biology and foraging of rollers (*Coracias garrulus*) nesting in nestboxes. (In Hungarian, Abstract in English). Ornis Hungarica 8. Suppl. 1: 119–124

MORRIS A.J., WILSON J.D., WHITTINGHAM, M.J., BRADBURY, R.B. (2005): Indirect effects of pesticides on breeding yellowhammer (*Emberiza citrinella*). Agriculture, Ecosystems and Environment 106:1–16.

NEWTON, I. (2004): The recent declines of farmland bird populations in Britain: an appraisal of causal factors and conservation actions. Ibis 146:579–600.
POOLE, T.F. (2006): An analysis of digital camera images as a mark of European roller feeding activity. Synthése des études et travaux de conservation. Pp. 11. A Rocha, France.
SAVAGE, R.E. (1931): The relation between the feeding of the herring off the east coast of England and the plankton of the sourrounding waters. Fishery Investigation, Ministry of Agriculture, Food and Fisheries, Series 2 12: 1–88.
STENFOFF, K., KOCHERT, M.N. (1988) Dietary reponses of three raptor species of the changing prey densities in natural environment. Journal of Animal Ecology 57:37-48.
TIDMARSH, R. (2003): Nest box contents as an indicator of nestling diet in the European Roller Coracias garrulous A Rocha, France. Synthèse des études et travaux de conservation A Rocha France pp. 1-13
TORNBERG, R., REIF, V. (2007): Assessing the diet of birds of prey: a comparsion of prey items found in nests and images. Ornis Fennica 84:21-31.
TRYJANOWSKI, P., KARG, M.K., KARG, J. (2003): Diet composition and prey choice by the red-backed Lanius collurio in western. Belgian Journal of Zoology 133 (2): 157-162
TRYJANOWSKI, P., KARG, M.K., KARG, J. (2003): Food of the Red-backed Shrike *Lanius collurio*: a comparison of three methods of diet analysis. Acta Ornithologia Vol. 38. No1 59-64

Review on Agriculture and Rural Development 2014. vol. 3 (1) ISSN 2063-4803

THE EFFECTS OF THYME OIL AND CHLORINE DIOXIDE ON THE GERMINATION AND PRODUCTION OF CONIDIA AND MYCELIAL GROWTH OF *MONILINIA FRUCTICOLA* (G. WINTER) HONEY

ÖZGE KARA, ISMET YILDIRIM

Çanakkale Onsekiz Mart University, Agricultural Faculty, Department of Plant Protection. 17000 Çanakkale, Turkey
yismet96@gmail.com

ABSTRACT
This study aims to research the *in vitro* effectiveness of thyme oil and chlorine dioxide (ClO_2) on mycelial growth, conidia production and conidia germination of *Monilinia fructicola* (G. Wint.) Honey which causes brown rot in plums.While a 300 ppm dose of chlorine dioxide inhibits mycelial growth by 77.2%, thyme oil at 30 ppm inhibits by 100%. The MIC value of chlorine dioxide is above 300 ppm. The ED_{50} values of thyme oil and chlorine dioxide have been determined as <3 and 15.3 ppm, respectively. While the spore germination of the pathogen is suppressed at high rates by 100 and 300 ppm chlorine dioxide (70 and 90%, respectively), the same doses of thyme oil suppress by 47 and 75%. Parallel to the effectiveness on germination the ED_{50} values of chlorine dioxide and thyme oil are 18 and 112.2 ppm. The test chemicals affected the fruit yield of the fungus at varying rates. Doses of 30, 100 and 300 ppm of chlorine dioxide affected the spore production at rates of 23.75, 37.5 and 43.75%. Doses of 3 and 10 ppm thyme oil affected the spore production by 77.7 and 96.5% while doses 30 µl/ml and above inhibited fructification by 100%. The research results prove that thyme oil, especially, and chlorine dioxide inhibit mycelial growth, spore germination and fructification of *M. fructicola* by a significant amount, indicating that, after *in vivo* studies, both chemical compounds may be used against monilia disease for plums after harvest.

Keywords: antifungal activity, thyme oil, chlorine dioxide, *Monilinia fructicola*, postharvest diseases.

INTRODUCTION

Monilinia fructicola [(G. Wint.) Honey] takes first place among diseases causing economic loss of fruit beginning before harvest and continuing during storage after harvest. *Monilinia fructicola*, which causes brown rot, generally begins with inoculum produced by apothecia forming on overwintered mummified fruit which cause blossom blight in spring. In appropriate environmental conditions blossom blight may progress to twig blight and branch canker, forming the second inoculum source and causing latent infection in mature stone fruits before and after harvest and in unripened green fruit (BOEHM ET AL., 2001).

Apricot, cherry, morello cherry, plum, almond and peach are among the hosts for this disease. The first signs on fruit are brown stains during the ripening period. In the advanced period of the disease it develops within the fruit flesh and causes drying and shriveling of the fruit over time. Infection discovered near harvest or during harvest may cause growth of rotting after harvest. Rotting after harvest is an important factor limiting the storage life of the fruit (ESTI ET AL., 2002).

Due to problems with chemical residues after harvest it is not possible to use synthetic fungicides such as carbendazim, captan, cyprodinil, dodine, iprodion, thiram and tebuconazole to treat monilia disease in the period before harvest. As a result in recent years to control the disease after harvest applications of biocontrol agents, food additives, plant activators, saline solutions, heat and hot water, ultraviolet light, disinfectants, plant extracts and essential oils have been used

(PUSEY ET AL., 1988, MARGOSAN ET AL., 1997, HONG ET AL., 1998, EKINCI ET AL., 2006, AKBUDAK AND KARABULUT, 2002, MARI ET AL., 1999). WILSON ET AL. (1986) identified that benzaldehyde, benzyl acetate, benzyl alcohol, δ-decalactone, γ-caprolactone, γ-decalactone, γ-octalactone, methyl salicylate and γ-valerolactone, naturally found in fruit, inhibited the spore germination of *Monilinia fructicola* and *Botrytis cinerea* by a large amount. They found that ethyl benzoate had a fungicidal effect on *M. fructicola* and a fungistatic effect on *B. cinerea* while methyl salicylate and benzaldehyde had fungicidal effects on both fungi. HONG AND MICHAILIDES (1998) in a study on brown rot in plums after harvest found 3 isolates of *Trichoderma spp.* (New, Ta291 and 23-E-6) inhibited *M. fructicola* by a significant amount (67-100%) while the BI-54 isolate of *Rhodotorula sp* had an inhibition rate of 54%.

The aim of this study is to research the *in vitro* effect of chlorine dioxide and thyme oil on the mycelial growth, spore density and spore germination of an isolate of *M. fructicola* from an infected plum.

MATERIAL AND METHOD

Material

The fungal material for the study was isolated from *M. fructicola* from an infected plum. Some properties of the test chemicals used during the study are given in *Table 1*.

Table 1. Chemicals used during the experiment

Trade Name	Active Ingredient	Percentage Active Ingredient	Formulation	Company
Thymol (Thyme oil)	2-isopropyl-5-methylphenol, IPMP	≥99.5%	Liquid	Sigma-Aldrich
Chlorine dioxide	ClO_2	10%	WP	AgrOx

Method

Effect of test chemical on mycelial growth

To determine the effectiveness of the test chemicals, chlorine dioxide and thyme oil, on the isolates doses of 3, 10, 30, 100 and 300 ppm were used. Only 1 ml sterile pure water and 1% diluted acetone were added to control petris. During the study chlorine dioxide was diluted with sterile pure water, while thyme oil was diluted with 1% acetone. After sterilization of the test chemicals the PDA broth was cooled to 45 °C and the concentrations listed above were spread across the surface until it was covered. The medium treated with control and chemicals were later inoculated with 4 mm disks, made with the aid of a cork-borer, of 7 day *Monilinia fructicola* grown in PDA broth. After inoculation the petri dishes were left to incubate at 23±2 °C. Colony growth was measured at 24 hour periods over 5 days.

Experiments were completely randomized and repeated 3 times. The effectiveness of the test chemicals on mycelial growth was identified by using the Abbott formula to compare the radius of the colonies on the petri dish with colonies on the control petri dishes. The ED_{50} value was found by using a semilogarithmic graph.

Effect of the test chemicals on spore germination

To determine the effect of the test chemicals on the spore germination of the pathogen, 1 ml 10^5 spore/ml spore suspensions prepared from *M. fructicola* isolates were spread on PDA in petris with the test chemicals at the same concentrations as used to test the effect on mycelial growth. After inoculation the petris were incubated in the dark at 23±2 °C and spore germination was examined under a microscope at 21 and 48 hours, recorded as germinated, non-germinated and rudimentary spores. Forty-eight hours after the spore suspension was administered to stop germination the blotting paper on the lid of every petri was treated with 0.5 ml 9% formaldehyde. Spores with clear germ tubes ½ their length were accepted as germinated, while swollen germ tubes or broken-tipped ones were accepted as rudimentary; no germination or germ tube less than ½ the length were accepted as non-germinated. ED_{50} values were found by using a semilogarithmic graph.

Effect of the test chemicals on sporulation

The effectiveness of the test chemicals on sporulation was determined by measuring the sporulation yield of the fungus culture in petris used to determine effectiveness against mycelial growth. To identify sporulation 10 ml pure water and 50 µl Tween 20 were added to the petris and using a glass rod the spores were placed in the water. The solution including spore and mycelium pieces was filtered through a single layer of cheesecloth and sterile pure water was added to reach a volume of 20 ml. Evaluation was made with the aid of hemacytometer as spore density per ml.

RESULTS

Thyme oil and chlorine dioxide showed effectiveness against mycelial growth of *Monilinia fructicola* at different levels. The effectiveness of the chemicals on the mycelial growth of the fungus is shown in *Figure 1*.

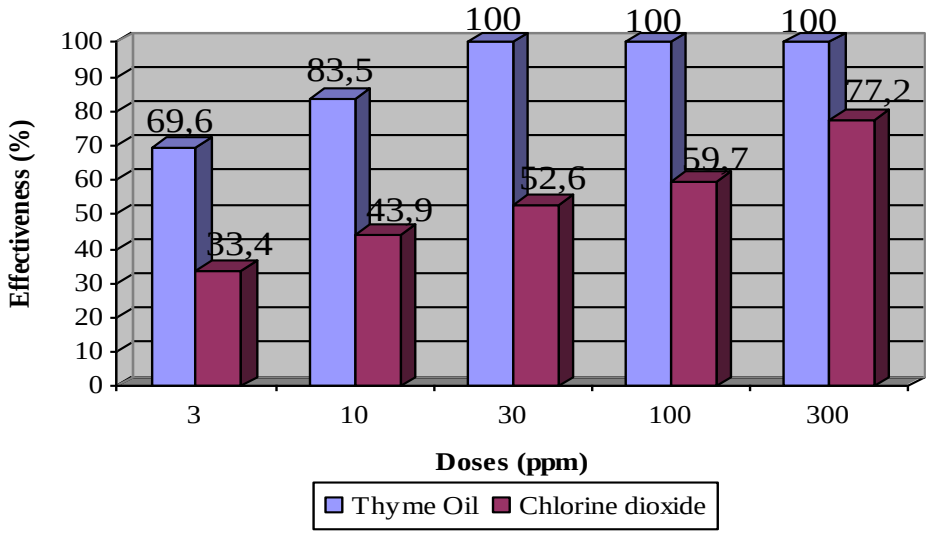


Figure 1. Effectiveness of the chemicals on the mycelia development of *Monilinia fructicola*

Thyme oil at doses of 30 ppm and above completely inhibited (100%) the mycelial growth while 3 and 10 mm doses caused a significant rate of inhibition (69.6 and

83.5%, respectively) (*Figure 1*). Different doses of chlorine dioxide affected mycelial growth at different rates. The lowest effectiveness was 3 ppm (33.4%) while the highest was with 300 ppm (77.2%). The minimum inhibition concentration (MIC) and ED_{50} values for the radial mycelial growth of *M. fructicola* are given in *Table 2*.

Table 2. MIC and ED_{50} of the test chemicals on the mycelial growth of *Monilinia fructicola*

Test chemical	MIC(ppm)	ED_{50}
Thyme oil	30	<3
Chlorine dioxide	>300	15.3

While thyme oil at 30 ppm completely inhibited the radial mycelial growth, the MIC value for chlorine dioxide was above 300 ppm. The ED_{50} value for thyme oil was less than 3 ppm, while it was 15.3 ppm for chlorine dioxide.
The effectiveness of the test chemicals on the germination of *M. fructicola* conidia are given in *Table 3*.

Table 3. Effectiveness of the chemicals on conidia germination of *Monilinia fructicola* (%)

Dose (ppm)	Chlorine dioxide	Thyme oil
3	0	0
10	44	4
30	55	5
100	70	47
300	90	75

The lowest concentrations of the chemicals did not inhibit germination of conidia (*Table 3*). While 30 ppm dose of thyme oil prevented 5% of conidia germination, chlorine dioxide at the same dose inhibited 55%. Chlorine dioxide and thyme oil at 300 µg/ml concentrations inhibited conidia germination by significant amounts (90 and 75%, respectively). Parallel to the effectiveness against germination, the ED_{50} values were 18 ppm for chlorine dioxide and 112.2 ppm for thyme oil.

Table 4. Effect of chemicals on conidia yield of *Monilinia fructicola* (spore count/ml)

Dose (ppm)	Chlorine dioxide	Thyme oil
3	$4.2x10^5$	$3.5x10^5$
10	$2.55x10^5$	$5.5x10^4$
30	$3.05x10^5$	0
100	$2.5x10^5$	0
300	$2.25x10^5$	0
Control	$4x10^5$	$1.57x10^6$

The spore density per ml of *M. fructicola* in sterile pure water was found to be $4x10^5$, while for acetone (1%) this value was $1.57x10^6$. At 3 and 10 ppm doses of

thyme oil the fructification yield of the fungus was significantly reduced while at 30, 100 and 300 ppm fructification yield was completely inhibited. A 3 ppm dose of chlorine dioxide did not affect conidia yield of the fungus but at 10, 30, 100 and 300 ppm doses the fructification reduced by 50% compared to control with a similarity between dose and spore production (*Table 4*).

CONCLUSIONS

This study investigated the *in vitro* effect of chlorine dioxide and thyme oil on the mycelial growth, conidia germination and fructification of *M. fructicola*. Thyme oil was found to be more effective against mycelial growth and fructification than chlorine dioxide. However chlorine dioxide prevented spore germination at a higher rate than thyme oil.

Only at 300 ppm doses did chlorine dioxide prevent the mycelial growth of the fungus at high rates, while thyme oil at doses ≥30 ppm totally inhibited growth. Increasing doses of chlorine dioxide prevented conidia germination more than thyme oil. At 300 ppm dose chlorine dioxide inhibited conidia germination by 90% while the same dose of thyme oil inhibited 75%. A study by LAZAR-BAKER ET AL. (2011) found doses of thyme oil ≥250 ppm completely inhibited mycelial growth of *M. fructicola* while 1000 ppm doses prevented 98% of spore germination. FATHI ET AL. (2012) reported that concentrations of thyme oil ≥400 ppm completely prevented the mycelial growth of *M. fructicola*. MARI ET AL. (1999) identified that a 100 ppm dose of chlorine dioxide completely inhibited the conidia germination of *M. laxa*. The highest effectiveness against fructification of *M. fructicola* was shown by thyme oil with doses ≥30 ppm completely inhibiting fructification. Chlorine dioxide at 300 ppm dose reduced conidia yield by 36.2%.

In conclusion, the test chemicals, especially thyme oil, were determined to have a large effect on the mycelial growth, conidia germination and fructification of *M. fructicola in vitro*. After *in vivo* studies, both chemicals may provide effect results in controlling brown rot in plums after harvest.

REFERENCES

AKBUDAK, B., KARABULUT, Ö.A. (2002). Üzüm muhafazasında gri küf'den (*Botrytis cinerea* Pers:Fr) kaynaklanan kalite kaybı ve çürümelerin ultraviolet-C (UV-C) ışık uygulamaları ile önlenmesi üzerine bir araştırma. Uludağ Univ. Zir. Fak. Derg. 16(2): 35-46.

BOEHM, E.W.A., MA, Z., MICHAILIDES, T.J. (2001). Species-specific detection of *Monilinia fructicola* from California stone fruits and flowers. Phytopathology 91: 428-439.

EKİNCİ, N., YILDIRIM, İ. VE ÖZDÜVEN, F.F. (2006). Sıcak su uygulamalarının 0900 Ziraat Kiraz Çeşidinin depolama kalitesi ve Monilya çürüklüğüne olan etkisi. Bahçe Ürünlerinde IV. Muhafaza ve Pazarlama Sempozyumu (08 - 11 Ekim 2008, Antalya), 180-188.

FATHİ, Z., HASSANİ A., GHOSTA Y., ABDOLLAHİ A., MOHAMMAD H., MESHKATALSADAT M.H. (2012). The potential of thyme, clove, cinnamon and ajowan essential oils in inhibiting the growth of *Botrytis cinerea* and *Monilinia fructicola.* Journal of Essential Oil Bearing Plants 15 (1): 38 – 47.

HONG, C., AND MICHAILIDES, T.J. (1998). Effects of wounding, inoculum density, and biological control agents on postharvest brown rot of stone fruits. Plant Dis. 82: 1210-1216.

LAZAR-BAKER E.E., HETHERINGTON, S.D., KU, V.V., NEWMAN, S.M. (2011). Evaluation of commercial essential oil samples on the growth of postharvest pathogen Monilinia fructicola (G. Winter) Honey. Letters in Applied Microbiology 52: 227–232.

MORGOSAN, D.A., SMILANICK, J.L., SIMMONS, G.F., AND HENSON, D.J. (1997). Combination of hot water and ethanol to control postharvest decay of peaches and nectarines. Plant Dis. 81: 1405-1409.

MARI, M., CEMBALI, T., BARALDI, E., AND CASALINI, L. (1999). Peracetic acid and chlorine dioxide for postharvest control of *Monilinia laxa* in stone fruits. Plant Dis. 83: 773-776.

Review on Agriculture and Rural Development 2014. vol. 3 (1) ISSN 2063-4803

PRODUCTION AND USE OF ANGELICA IN MEDICINE AND ENVIRONMENTAL PROTECTION

PÉTER JAKAB[1], JÚLIA HUPUCZI[1], YOSHITAKA WACHI[2], TÍMEA SÜLI-ZAKAR[1]

[1]Institute of Crop Production and Environmental Protection, University of Szeged
Andrássy út 15, 6800 Hódmezővásárhely, Hungary
[2]Nougakuken Center Ltd., Japan
sulizakartimea@mgk.u-szeged.hu; jakabpeter@mgk.u-szeged.hu

ABSTRACT
The concentration of greenhouse gases in the atmosphere, especially carbon dioxide is increasing apace on account of population's growing, human and industrial activities. These gases are not only unhealthy but also there has been growing interest in the global temperature of Earth.
The *Ashitaba* (*Angelica*) could be used as strong carbon offsetting and it is used as medicine raw material and the health food supplement. In Scandinavian countries the angelica has been known and used as a medicinal and culinary herb since the 12th century. It has been grown in England since the 16th century. Folk medicine recommends the scalded leaves for colds, and for the illnesses of the stomach, for carminative purposes or for respiratory illnesses. The spasmolytic and anti-inflammatory effects of the plant were confirmed in the *in vitro* experiment. The root furanocumarines inhibited the growth of certain cancer cells as specified in animal studies. In some *in vivo* studies the anti-ulcer, antioxidant, hepatoprotective, analgesic and sedative effects were demonstrated.

Keywords: *Ashitaba* (*Angelica*), carbon dioxide, environmental protection, herbal.

INTRODUCTION

In recent years environmental protection has been more and more widespread both in medical treatment and in using natural plant-based materials.
According to customers plant-based medicine (phytopharmacon) has biological and economical advantages. This kind of medicine is suitable to keep health, to prevent illnesses and it can also be used as corroborative material to cure not too serious illnesses' if using of synthetic materials in unsubstantiated 60-70% of the civilization diseases come from psychomatic origin. They can mostly be treated by plant-based materials (GANONG, 1990).
In the atmosphere the concentration of carbon dioxide is higher today than it was any time in the last 650,000 years. More than 80% of the greenhouse gases are carbon dioxide in the industrially developed countries. Plants can bind the carbon dioxide of the atmosphere through photosynthesis.

MATERIAL AND METHOD

According to the 8th Hungarian Pharmacopoeia the drugs of angelica are from the root and the *Angelica radix*. The essential oil content minimum is 2.2 ml/kg. Rarely used parts are the leaf and the crop (Angelica folium et fructus). The essential oil of angelica root is made of angelica root with steam distillation. The alcoholic extract of angelica (*Angelicae* tinctura) is used also in medicine (BERNÁTH AND NÉMETH, 2007; GOSZTOLA AND LENCHÉS, 2013).
The root of *Angelica* contains 0.2-1.9% essential oil, there is 0.2-0.4%, in the dry leaf, while 0.6-1.5% in the mature crop. The principal component of essential oil are alpha-and

beta-pinen, alpha- and beta-fellandren, mircen, limonen, szabinen, germakren-D, beta-bizabolen, kariofillen. The root contains kumarins, furanokumarins (ex. bergapten, angelicin), and also angelica acid (0.3%), 6% resin, sterols, fenol acids (caffeic acid, chlorogen acid), bitter substances and exchange material. The crop contains 25% fatty oil (TAKÁCSNÉ, 2004, GOSZTOLA, LENCHÉS, 2013).

The *Ashitaba* is dried and it is used for the medicine raw material, the health food supplement, and the juice, tea, pasta, the seasoning, soup, the ice cream, jam, bread, and the cookie, etc. as a powder.

RESULTS

Botanical description

The *Angelicae* is a strong growing, biennial, herbaceous plant. In the first year the root is carrot-like, 20-30 cm long, 5-6 cm thick, less branched, while in the second year it develops finger-sized accessory roots. It is also in the second year that it grows a 1.5-2 m high stem. Umbellate florescence is globular; its diameter is 20-30 cm. Its perfect yellow flower comes out in June. The schizocarp crops are light yellowish brown. Its thousand seed weight is 2.5-3 g (GOSZTOLA, LENCHÉS, 2013).

Environmental needs

It prefers cool climate. It is not sensitive to frost even in the vegetation period. It grows best on lower areas, humid (not aqueous) with fertile layer rich in nutrients, on sandy loam, or adobe-like, medium-cohesive soil. It can be grown successfully under drier conditions as well, when its high water need can be satisfied by irrigation (GOSZTOLA, LENCHÉS, 2013).

Production

Crop life is 1-4 years, depending on what drug is desired to be produced. We must choose a preceding crop for angelica, which makes it possible that soil tillage can be done in autumn, and sowing in November. After itself or other umbelliferous plants it can be sown again in 3-4 years.

Angelica well utilized the organic fertilizer which was applied for the preceding crop. It had particularly high potassium and phosphorus requirement, nitrogen, especially for root-cultivation should be dosed with caution. For base fertilization 50-70 kg/ha nitrogen, 80-100 kg phosphorus, and 120-180 kg potassium were applied in deep ploughing. In the second year 50 kg/ha nitrogen can be applied as starter fertilizer. The soil for *Angelica* should be loose.

The seedbed should be prepared as in a garden. Frost effect is necessary for the germination of the angelica seed. Therefore, the ideal sowing time is November. The seeds are sown *in situ*, they germinate and emerge in spring. The seeds may be sown early in the spring as well (in March), but in this case the seeds should be frozen 2-3 weeks before sowing. The sowing depth is 1.0-1.5 cm, the row width is 60 cm. 8 kg / ha of seeds is needed for autumn sowing, while 10 kg / ha for spring sowing. The increased dose for spring sowing is necessary because of the reduced germination ability of the plant. *Angelica* used to be propagated by seedlings but it was stopped because of the high costs. After the young plants have appeared thinning is required, with 8-10 plants per linear meter spacing. Mechanical weed control should be carried out throughout the *Angelica* cultivation. Chemical weed control can be used only as pre-emergence (ANTAL, 1992; GOSZTOLA, LENCHÉS, 2013).

Some agrotechnical elements are shown in *Figure 1.*

Figure 1. Some agrotechnical elements of angelica production (Hitachinaka, Japan)

After the young plants have appeared thinning is required, with 8-10 plants per running meter. Mechanical weed control should be carried out throughout the angelica cultivation. Chemical weed control can be used only as pre-emergent.
In dry periods irrigation is necessary for the plants. Depending on the weather it can vary from 150 to 200 mm of water. Its disease is gall *(Passalora depressa),* and its frequent pests are aphids. Crop rotation and chemical protection are two ways of prevention against them.

Harvest
The harvest of the drug leaves takes place in the second year. The fully developed leaves are cut off by a harvester loader. The best quality leaves are cut by hand. The angelica root is harvested by a plough without mouldboard, or in smaller areas they dig it out with a spade, at the beginning of October in the first or second year. In the second year essential oil can be produced from the green seed-bearing plant. In this case the time of the harvest is at the time of wax-ripeness. The harvest is done by a harvester loader or silo filler. During the harvest and the processing of the angelica plant there can be yellow cell sap leaking from the fresh parts. This can cause the inflammation of the skin, so protection is necessary (hand wash, gloves) while doing the job.
The expected yield of dry leaves is 0.6-0.8 t/ha. The dry root yield is 1.6-1.8 t/ha, 6-10 kg/ha essential oil can be obtained from roots, and 6-8 kg/ha from seeds.

Primary processing
The soil and other plant materials are cleaned off the roots and then they are washed with running water. The thick roots are cut into halves or into quarters and dried at 40-50 °C. The fresh leaves are dried at a low temperature (30-40 °C) immediately after they have been cut. Essential oil is gained from the washed and chopped roots by fractional distillation in intermittent periodic duty equipment. The distillation takes about 8-10 hours.

Traditional use
In Scandinavian countries the angelica has been known and used as a medicinal and culinary herb since the 12th century. It has been grown in England since the 16th century. Folk medicine recommends the scalded leaves for colds, and for the illnesses of the stomach, for carminative purposes or for respiratory illnesses. It has mild analgesic and spasmolytic effects as well. In case of rheumatic diseases and muscle inflammation it is used externally as a rubbing agent. The angelica root is sweet, spicy and it has a slightly bitter aroma that is the reason why it is used for seasoning liqueurs, wines and vermouth.
The fruit of the plant is an important component of spirits production (e.g. Cognac). It is a spice of various meals, soups, sauces, salads and compotes. The fresh young leaves are

used for making vegetable sauce in the Nordic countries. The essential oil of the angelica is utilised in cosmetics and perfume industry.

Therapeutic indications

The spasmolytic and anti-inflammatory effects of the plant were confirmed in *in vitro* experiment. The root furanocumarines inhibited the growth of certain cancer cells as specified in animal studies. In some *in vivo* studies the anti-ulcer, antioxidant, hepatoprotective, analgesic and sedative effects were demonstrated.

The *Ashitaba* has very big carbon dioxide absorptivity power. The CO_2 absorptivity power is very large compared with other plants *(Figure 2.)*. The method by which it tries to counterbalance CO_2 is that it absorbs carbon dioxide that the enterprise put out with exhausted CO_2 by growing. The *Ashitaba* by using this thing starts and it is vegetable that contributes to the global environment.

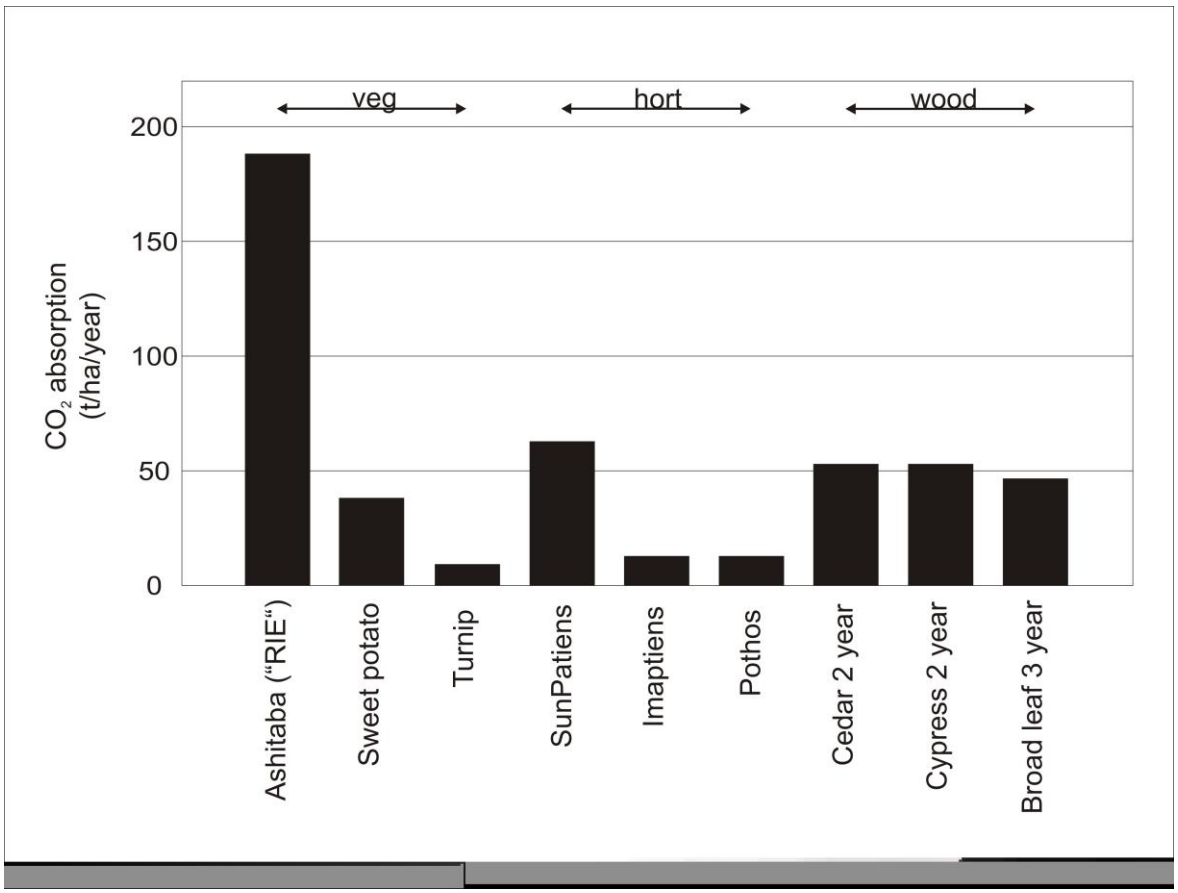


Figure 2. Confirmed *Ashitaba* could absorb 1460 tons (max) of CO_2/ha/year in verification test done (Dr. Yutaka Urano, Tokyo University)

CONCLUSIONS

The concentration of greenhouse gases in the atmosphere, especially carbon dioxide is increasing apace on account of population's growing, human and industrial activities. These gases are not only unhealthy but also there has been growing interest in the global temperature of Earth. The *Ashitaba* (*Angelica*) could be used as strong carbon offsetting and it is used as medicine raw material, the health food supplement. Folk medicine recommends the scalded leaves for colds, and for the illnesses of the stomach, for carminative purposes or for respiratory illnesses. The spasmolytic and anti-inflammatory effects of the plant were confirmed in the *in vitro* experiment. The root furanocumarines inhibited the growth of certain cancer cells as specified in animal studies. In some *in vivo* studies the anti-ulcer, antioxidant, hepatoprotective, analgesic and sedative effects were demonstrated.

REFERENCES

GANONG, W.F. (1990): Az orvosi élettan alapjai. Medicina Könyvkiadó, Budapest. 804 p.
ANTAL J. (1992): Angelika. In: Szántóföldi növénytermesztés. Ed.: Bocz E. Mezőgazda Kiadó, Budapest. 858-860 p.
GOSZTOLA B.- LENCHÉS O. (2013): Angelica archangelica L.- orvosi angyalgyökér. In: Vadon termő és termesztett gyógynövények. Ed.: Bernáth J. Mezőgazda Kiadó, Budapest. 174-177 p.
BERNÁTH J.-NÉMETH É. (2007): Gyógy- és fűszernövények gyűjtése, termesztése és felhasználása. Mezőgazda Kiadó, Budapest. 35 p.
TAKÁCSNÉ HÁJOS M. (2004): Gyógynövények termesztése. Szaktudás Kiadó Ház, Budapest. 61-64 p.

Review on Agriculture and Rural Development 2014. vol. 3 (1) ISSN 2063-4803

ENVIRONMENTALLY FRIENDLY NUTRIENT SUPPLY OF MAIZE

PÉTER JAKAB[1], PIROSKA NAGY[2], ISTVÁN KRISTÓ[3]

[1] University of Szeged, Faculty of Agriculture
Institute of Plant Sciences and Environmental Protection
Andrássy út 15, 6800 Hódmezővásárhely, Hungary
[2] College of Szolnok, Department of Technical and Agricultural Management
Tiszaligeti sétány 14, 5000 Szolnok, Hungary
[3] Hungarian Chamber of Agriculture, Food and Rural Developement, Csongrad County Directorate
Kossuth L. sgt. 17, 6722 Szeged, Hungary
jakabpeter@mgk.u-szeged.hu

ABSTRACT
We examined the effect of foliar fertilization on the yield of maize hybrids in 2013. The experiment was set in three repetitions, random blocks on an ecological farm. The soil of the experiment was chernozem. Soil analysis data showed that it had proper nitrogen, plenty phosphor and very good potassium content. During the experiment we applied two times foliar fertilization in 5-5 l/ha dosage. The year 2013 was unfavourable for maize production. In 2013 the amount of precipitation in the graining phase of maize was lower by 59 mm than the average. The yield of the control plots ranged between 9.9-11.8 t/ha, the yields of the foliar fertilization plots ranged between 10.3-11.47 t/ha. There were not significant differences between the average yields of control and foliar fertilization plots. By the application of foliar fertilization the yield fluctuation decreased. Factual conclusion can be drawn only after the results of several years, we wish to continue our examinations.

Keywords: maize, nutrient supply, yield, foliar fertilization,

INTRODUCTION

Nutrient supply is one of the most important agrotechnical elements of maize production. Numerous researchers have been involved in determining the optimum NPK fertilizer doses for the different maize hybrids.

Considering the aspects of efficiency and environment protection, maize needs only $N_{60\text{-}120}$, $P_2O_{5\ 45\text{-}90}$, $K_2O_{53\text{-}106}$ kg ha^{-1} active agent. With N doses larger than $N_{60\text{-}120}$ kg ha^{-1} the quantity of NO_3-N reaches 150-200 mg kg^{-1} in the 100-120 cm soil profile which can result in marked environment pollution (SÁRVÁRI, 1995).

In the N_0 treatment, the yield decreased gradually and the cumulated yield difference was 74.0 t ha^{-1} as compared to the basis treatment (N_{80}). In the average of 1970-1991, the grain yield of maize (t ha^{-1}) was the following as per N-treatments: N_0: 3.56, N_{80}: 6.93, N_{160}: 8.12 and N_{240}: 8.00. In the N_{160} treatment the yield surpassed that of N_{240} treatment after the 13th year of the trial, and the cumulated extra yield was 26.3 t ha^{-1} in comparison with the basis treatment. In wet years, the grain yield of maize was higher depending on the N-treatment by 1.13-2.28 t ha^{-1} than in the dry years (BERZSENYI, 1993).

DOBOS AND NAGY (1998) examined the effect of year and fertilisation on the dry matter production of the maize hybrid Volga SC on a 5-year series of data in four replications, including two favourable and three unfavourable years, without fertilisation and with a fertiliser treatment involving 120 kg ha^{-1} N+ 90 kg ha^{-1} P_2O_5 + 106 kg ha^{-1} K_2O.

In the unfertilised treatment there was a significant difference in the dry matter content of the maximum vegetative mass in the years examined. In the fertilised treatment higher

values were recorded each year than in the control plots, the fertiliser effect being 17-19 % in 1991, 1993 and 1994 and 22-28 % in 1992 and 1995.

NAGY (1995) determined the profitable fertilizer rate in production practice, based on the experimental data, the fertilizer active agent quantities belonging to 10 kg grain yield were fixed, and these values can be converted to different economic circumstances, as well. The fertilizer rate belonging to 10 kg marginal efficiency in the non-irrigated treatment, during four years, was 111 kg ha^{-1} N (its extreme values being 89-125 kg). In the irrigated treatment, on average a rate of 158 kg ha^{-1} N met the condition of 10 kg marginal efficiency, which varied between 147 kg and 170 kg. It was stated, that based on the experimental data - on similar production site - without irrigation a rate of 90-120 kg ha^{-1} N and in irrigated production a rate of 150-170 kg ha^{-1} N may be a normal dose.

PEPÓ (2001) found that crop rotation strongly modified the optimum N doses (+PK) of maize. The optimum N doses were N_{113}+PK in triculture, N_{147}+PK in biculture and N_{187}+PK in monoculture. The efficiency of fertilization was modified by crop rotation and the water supply of the crop year. The yield surpluses resulting from fertilization were 1378 kg ha^{-1} in triculture (peas-winter wheat-maize), 2477 kg ha^{-1} in biculture (winter wheat-maize) and 2325 kg ha^{-1} in monoculture. There were hybrid-specific differences between the maize genotypes in optimum N doses (+PK) in the long-term experiments (in triculture N-opt+PK 60-180 kg ha^{-1}, in biculture N-opt+PK 120-180 kg ha^{-1}, in monoculture N-opt+PK 120-240 kg ha^{-1} depending on genotypes). In practice, the best hibrids are those that can produce high yields with the application of moderate (low) N doses (+PK).

KÁDÁR (2008) says that the macro and micro element requirements of most arable crops can be satisfied through soil. The future spread of foliar fertilisation must be grounded by comprehensive experimental research. Accurate, repeated small plot trials are necessary to clarify the factors influencing the effectiveness of foliar fertilizers and recommendations must be developed for consultation.

MATERIAL AND METHOD

Soil properties of the experimental field

We set the experiment on the area of an ecological farm in Kútvölgy. The soil was chernozem, the reaction of which was nearly neutral (pH_{KCL} 6.86). Before setting the experiment the soil analysis data showed that it had proper nitrogen, plenty phosphor and very good potassium contents (*Table 1*).

Table 1. Main properties of the experimental field area

pH (H_2O)	P_2O_5 (mg/kg)	K_2O (mg/kg)	Humus (%)	Soil plasticity value (K_A)
6.86	604	653	2.8	42

Weather in the experimental years

The year 2013 was unfavourable for maize production. In 2013 the amount of precipitation in the graining phase of maize (July and August) was lower by 59 mm than the average. Totally, we can say that low precipitation had a negative effect on the development of maize (*Table 2*).

Table 2. The distribution of precipitation in the vegetative period of maize in 2013

Month	Rainfall (mm)	Average rainfall (mm)	Difference (mm)
April	41	42	-1
May	91	47	+44
June	79	72	+7
July	11	60	-49
August	44	54	-10
September	42	32	+10
Total amount of rainfall (mm)	**308**	**307**	**+1**

Main features of the agro-technology applied

Our small-scaled plough experiment was set in three replications, organised as a random block in 2013. We applied foliar fertilization treatments, which we supplemented with a control plot. The amount of nitrogen was applied in autumn and spring in 50-50%; the total amount of phosphorus and potassium was applied in autumn in one dosage. The foliar fertilization was applied twice (15 of May, 6 of June) in a dosage of 5-5 l/ha. The fore-crop was winter wheat. Fall tillage involved deep ploughing at 32 cm depth in the experimental years. The maize hybrid in the experiment was Finkass. We processed the obtained data by single factor variant analysis (SVÁB, 1981).

RESULTS

Without foliar fertilization the yield of the examined hybrid was ranging between 9.9-11.8 t/ha. In control plots the yield fluctuation was 1.9 t/ha. With foliar fertilization the yield was 10.3-11.47 t/ha. Under the influence of foliar fertilization treatments the yield fluctuation was lower 1.17 t/ha (*Table 2*).

Table 2. The effect of foliar fertilization on the yield of maize hybrid (t/ha)

	1. repl.	2. repl.	3. repl.	yield (average repl.)	yield fluctuation
control	11.80	11.07	9.9	10.92	1.90
foliar fertilization	11.47	10.45	10.3	10.74	1.17

The yield of the control plots/treatments in the average of three replications was 10.92 t/ha. Under the influence of foliar fertilization the yield was 10.74 t/ha. There is no significant difference between the yields (*Figure 1*). The foliar fertilization does not decrease the yield of maize. It is necessary to continue the experiment to explore the exact reasons because the results of at least three years are needed to draw the correct conclusions about the continuation of the experiment.

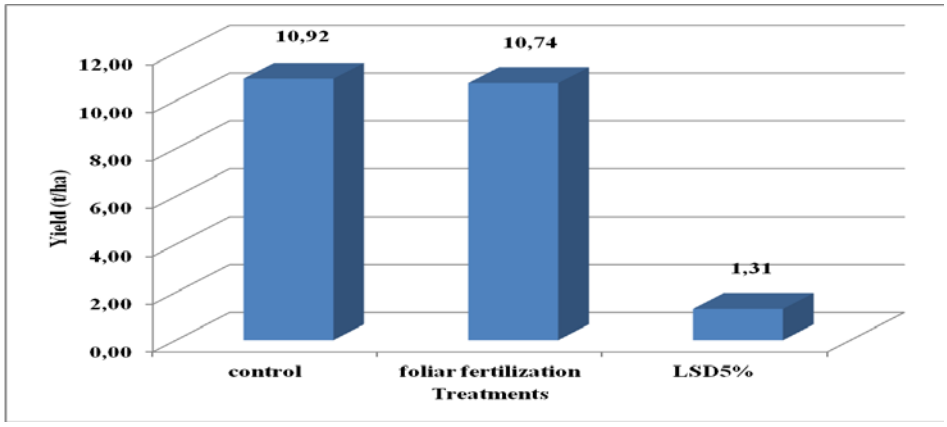


Figure 1. The yield of the maize hybrid in control and foliar fertilization treatment

CONCLUSIONS

The foliar fertilisation of corn is currently not part of the production technology. As KÁDÁR (2008) emphasized, the future spread of foliar fertilization should be grounded by a comprehensive experimental research. Accurate, repeat small plot trials are necessary to clarify the factors influencing the effectiveness of foliar fertilizers and to develop proposals for consultancy. The present experiment and its continuation also serve this purpose.

REFERENCES

BERZSENYI Z. (1993): Effect of N-fertilization and year on the grain-yield and N-fertilizer-reaction in maize hybrids (*Zea mays* L.) in long-term trial in 1970-1991. Növénytermelés. Tom. 42. No. 1. 49-62.p.

DOBOS A., NAGY J. (1998): Effect of year and fertilisation on the dry matter production of maize (*Zea mays* L.). Növénytermelés. Tom 47. No.5. 513-524.p.

KÁDÁR I. (2008): A levéltrágyázás jelentősége és szerepe a növénytáplálásban. Acta Agronomica Óváriensis. Vol. 50. No.1. 19-27.p.

NAGY J. (1995): Evaluation of fertilization effect on the yield of maize (*Zea mays* L) in different years. Növénytermelés. Tom. 44. No. 5-6. 493-506.p.

PEPÓ P. (2001): Role of genotype and crop rotation in the nutrient supply of maize on chernozem soil. Növénytermelés. Tom. 50. No. 2-3. 189-202.p.

SÁRVÁRI M. (1995): The productivity and fertilizer reaction of maize hybrids on meadow soil. Növénytermelés. Tom. 44. No.2. 179-191.p.

SVÁB, J. (1981): Biometriai módszerek a kutatásban. Mezőgazdasági Kiadó. Budapest. 557.p.

Review on Agriculture and Rural Development 2014. vol. 3 (1) ISSN 2063-4803

TRICHODERMA ISOLATES FROM VEGETABLE RHIZOSPHERE SAMPLES: POTENTIAL FOR THE BIOLOGICAL CONTROL OF *BOTRYTIS* SPECIES

PÉTER KÖRMÖCZI, TAMÁS MARIK, LÁSZLÓ MANCZINGER, ENIKŐ SAJBEN-NAGY, CSABA VÁGVÖLGYI, LÁSZLÓ KREDICS

University of Szeged, Faculty of Science and Informatics
Department of Microbiology
Közép fasor 52, H-6726 Szeged, Hungary
kormoczipeti@gmail.com

ABSTRACT
Members of the genus *Trichoderma* are wide-spread saprophytic fungi living in the soil and the rhizosphere of different plants. Due to their enzyme production abilities they are able to use complex biomolecules as carbon and nitrogen source. Many strains with very good biocontrol abilities against plant pathogenic fungi could be isolated from soils of agricultural areas. In this study we isolated *Trichoderma* strains from the rhizosphere of vegetables (pepper and lettuce) derived from gardens of different Hungarian cities (Szolnok, Kalocsa, Újszilvás, Kelebia). The isolates were identified by the sequence analysis of the ITS (internal transcribed spacer) region. The strains belonging to species that are not pathogenic to humans or cultivated mushrooms and possessing promising bicontrol potential were further investigated. The antagonistic abilities of the strains were studied against *Botrytis* species (*B. cinerea*, *B. pseudocinerea*) in *in vitro* confrontation tests and the extracellular enzyme systems of the strains were investigated in different liquid media. The knowledge of the correlation between the *in vitro* antagonistic abilities and enzyme production may contribute to our understanding of the biocontrol mechanism.

Keywords: *in vitro* antagonism, *Trichoderma*, *Botrytis*, extracellular enzymes

INTRODUCTION

The filamentous fungal genus *Trichoderma* (*Ascomycota*, *Hypocreales*, *Hypocreaceae*) was firstly divided into 9 species aggregates (*T. piluliferum*, *T. polysporum*, *T. hamatum*, *T. koningii*, *T. aureoviride*, *T. harzianum*, *T. longibrachiatum*, *T. pseudokoningii* and *T. viride*) which was later revised with the introduction of 5 sections: *Trichoderma*, *Longibrachiatum*, *Saturnisporum*, *Pachybasium* and *Hypocreanum* (DRUZHININA AND KUBICEK, 2005). Today, more than 200 species are known within the genus. They are mostly soil-borne, saprophytic fungi, living on the roots and in the rhizosphere of plants. *Trichoderma* species play key roles in biodegradation due to their abilities to produce extracellular enzymes: they can degrade different macromolecules including proteins, cellulose and chitin. Moreover, certain species of the genus include excellent biocontrol agents which are producing antifungal metabolites and having mycoparasitic abilities. Certain strains are also able to stimulate the plant growth, mainly in the root region, and they can induce drought tolerance and systemic resistance in plants. Because of these previously described phenomena, *Trichoderma* strains are applicable for biocontrol purposes against plant pathogenic fungi, e.g. species from the genus *Botrytis*.
Many previous studies focused on diversity of *Trichoderma* in natural soil ecosystems, e.g. in a mid-European, primeval floodplain-forest (WUCZKOWSKI, 2003), in the Danube floodplains (FRIEDL and DRUZHININA 2012), and habitats in Russia, Nepal, North-India (KULLNIG et al., 2000), Southeast Asia (KUBICEK et al., 2003), China (SUN et al., 2012), North Africa (SADFI-ZOUAOUI, 2009) and South-America (HOYOS-CARVAJAL, 2009). During these studies, many *Trichoderma* species and genotypes were identified and characterized, increasing our knowledge about the biodiversity of the genus. Unfortunately

only a few investigations were carried out in agricultural fields, monitoring the diversity of *Trichoderma* community in the plant rhizosphere (GHERBAWY, 2004; SADFI-ZOUAOUI et al., 2009; MULAW et al., 2010; NAEIMI et al., 2011). These community analyses could help us to find fungicide-resistant biocontrol strains with good antagonistic abilities, which could be applied for biocontrol purposes.

The genus *Botrytis* is belonging to the *Sclerotiniaceae* family (*Ascomycota, Helotiales*) counting more than 22 species including *B. cinerea, B. pseudocinerea, B. elliptica, B. tulipae* and *B. gladiolorum* which are able to cause serious infections in different plants, leading to significant production losses, e.g. the opportunistic pathogen *B. cinerea* can attack different parts of plants including roots, crops, bulbs or aging plant parts (ELAD et al., 2004). They are very widespread organisms; they could be found almost everywhere near their host plants. They can be identified easily, because of their numerous transparent conidia, grey, branching, tree-like conidiophores and sclerotia in the older cultures. *B. cinerea* is capable of attacking more than 230 different plants before and after harvesting as well. There are economically significant species among the host plants, like vegetables (tomato, pepper, lettuce and cucumber), fruits (strawberry, raspberry, grape and kiwi), onions or ornamentals. The most common disease caused by *B. cinerea* is grey mould. Infections are mostly developing through different lesions. The basis of plant protection is mostly the chemical control, however the emergence and spreading of fungicide resistant pathogenic strains is an increasing challenge. Moreover, in numerous countries there are strong limitations in the application of pesticides. These reasons highlight the significance of biological control as an environment-friendly alternative in plant protection.

Numerous studies are available in the literature about the opportunities of biocontrol application of *Trichoderma* species against *Botrytis* strains. The mycoparasitic process is well known in case of *T. harzianum* (BELANGER et al., 1995). It was concluded that the antibiotic agents produced are more important for biocontrol of *Botrytis* than the chitinase enzymes. The biocontrol agent (BCA) registered as TRICHODEX (strain T-39 of *T. harzianum*) could be applied in greenhouses and vineyards (ELAD, 1994; 2000ab), moreover TRONSMO and DENNIS (1977) reported that it could control grey mould of strawberry caused by *B. cinerea*. In this study we isolated and identified *Trichoderma* strains from the rhizosphere of different vegetables. We investigated the antagonistic abilities of the isolates against plant pathogenic *Botrytis* strains and the production of extracellular enzymes under different cultivation conditions.

MATERIAL AND METHOD

Isolation of *Trichoderma* strains from vegetable rhizosphere samples

Soil samples were collected at different locations in Hungary (Szolnok, Kalocsa, Újszilvás and Kelebia) from the root region of distinct vegetables (pepper and lettuce). Isolations were carried out on dichloran-Rose Bengal medium, which contained 5g peptone, 1g KH_2PO_4, 10g glucose, 0.5g $MgSO_4.7H_2O$, 0.5 ml dichloran-ethanol solution (0.2%), 0.25ml Rose Bengal from suspension (5%) and 20g agar per liter according to KING et al. (1979). After sterilization, 0.1g oxytetracyclin, 0.1g streptomycin and 0.1g chloramphenicol were added per liter to inhibit bacterial growth. The isolated strains were deposited at the Szeged Microbiological Collection (SZMC).

Molecular identification of the isolats

DNA extractions were carried with E.Z.N.A.® Fungal DNA Mini Kit-Omega Bio-Tek (VWR International, Radnor, USA) according to the instructions of the manufacturer. ITS

sequences (ITS1-5.8 rDNA-ITS2) were amplified and analysed as described previously by NAEIMI et al. (2011). *Trichoderma* isolates were identified by the barcoding program TrichOKEY 2.0 (DRUZHININA et al., 2005) available online at the home page of the International Subcommission on *Trichoderma* and *Hypocrea* Taxonomy (www.isth.info).

In vitro confrontation tests in dual cultures of *Trichoderma* and *Botrytis* strains

In vitro antagonism was investigated in dual cultures tests in confrontation with 6 plant pathogenic *Botrytis* strains (*Table 1*.).

Table 1. Plant pathogenic *Botrytis* strains applied in the confrontation tests

Strain numbers	Species	Host plant
SZMC 21470	*Botrytis pseudocinerea* (*B. cinerea* group I)	Colza
SZMC 21471		Colza
SZMC 21472	*Botrytis cinerea* (*B. cinerea* group II)	Raspberry
SZMC 21473		Raspberry
SZMC 21474	*Botrytis pseudocinerea* (*B. pseudocinerea* group I)	Strawberry
SZMC 21475	*Botrytis cinerea* (*B. cinerea* group II)	Strawberry

Biocontrol Index Values (BCI) were determined by the image analysis-based method developed by SZEKERES et al. (2006).

Enzyme activity measurements

For enzyme production, 3 different liquid media were used: YEG (containing 5g glucose, 5g KH_2PO_4 and 1g yeast extract per liter), MIN (containing 5g mannitol, 5g KH_2PO_4, 2g $NaNO_3$ and $MgSO_4$ per liter) and BOT (containing 1g $NaNO_3$ and 2g dried mycelia of *B. cinerea* per liter). The strains were inoculated into these liquid media and after incubation for 5 days at 25°C in a rotary shaker (150 rpm), the cell free filtrates were used in the further experiments. We measured the activities of aminopeptidase, chymoelastase-like protease, chymotrypsin-like protease, β-1,4-*N*-acetyl-glucosaminidase, cellobiohydrolase and β-glucosidase with chromogenic substrates (*Table 2*.).

Table 2. Substrates used for the detection of extracellular enzyme activities

Extracellular enzyme activity	Substrates
Chymotrypsin-like protease	*N*-succinyl-Ala-Ala-Pro-Phe-pNA
Chymoelastase-like protease	*N*-succinyl-Ala-Ala-Pro-Pro-Leu-pNA
Aminopeptidase	*N*-benzoyl-L-Tyr-pNA
β-glucosidase	p-nitrophenyl-β-D-glucopyranoside
Cellobiohydrolase	p-nitrophenyl-β-D-cellobioside
β-1,4-*N*-acetyl-glucosaminidase	p-nitrophenyl-β-D-*N*-acetyl-glucosaminide

We measured the optical densities after one hour of incubation at 25°C with a Jupiter HD microtiter plate reader (ASYS Hitech GmbH, Austria) at a wavelength of 405 nm.

RESULTS

Isolation and identification

A total of 25 *Trichoderma* strains were isolated from the rhizospere of lettuce and pepper. The identification process revealed the presence of 4 different species: *Trichoderma atroviride, T. harzianum, T. longibrachiatum* and *T. koningiopsis* in the samples. The most frequently isolated species was *T. atroviride* with 16 isolates, followed by *T. koningiopsis* (4), *T. harzianum* (3) and *T. longibrachiatum* (2).

In vitro confrontation tests

For the antagonism assays, 5 *Trichoderma* strains: 3 *T. atroviride* (SZMC 22215, SZMC 22216, SZMC 22217), 1 *T. koningiopsis* (SZMC 22218) and 1 *T. harzianum* (SZMC 22219) were selected. *T. longibrachiatum* isolates were excluded from the experiments because of their potential to act as opportunistic human pathogens (HATVANI et al., 2013). In the case of *T. atroviride* (3 isolates) and *T. koningiopsis* (1 isolate), a BCI value of 100 could be measured against the 3 examined *B. cinerea* isolates (SZMC 21472, SZMC 21473, SZMC 21475) as well as against *B. pesudocinerea* SZMC 21474 (*Table. 3*).

Table 3. Biocontrol Index (BCI) values of the examined *Trichoderma* isolates against plant pathogenic *Botrytis* strains

Strain number	*TrichOkey* 2.0 diagnosis	Plant pathogenic *Botrytis* strains					
		SZMC 21470	SZMC 21471	SZMC 21472	SZMC 21473	SZMC 21474	SZMC 21475
SZMC 22215	*T. atroviride*	91.05	100	100	100	100	100
SZMC 22216	*T. atroviride*	89.46	84.2	100	100	100	100
SZMC 22217	*T. atroviride*	89.68	91.73	100	100	100	100
SZMC 22218	*T. koningiopsis*	100	100	100	100	100	100
SZMC 22219	*T. harzianum*	38.57	42.93	92.18	77.34	100	62.42

We also found the highest BCI values (100) in the case of the *T. koningiopsis* isolate SZMC 22218 (*Figure 1.*) against the *B. pseudocinerea* strains SZMC 21470 and SZMC 21471, while the *T. atroviride* isolates could not overgrow these two plant pathogenic fungi except from *T. atroviride* SZMC 22215 against *B. pseudocinerea* SZMC 21470.

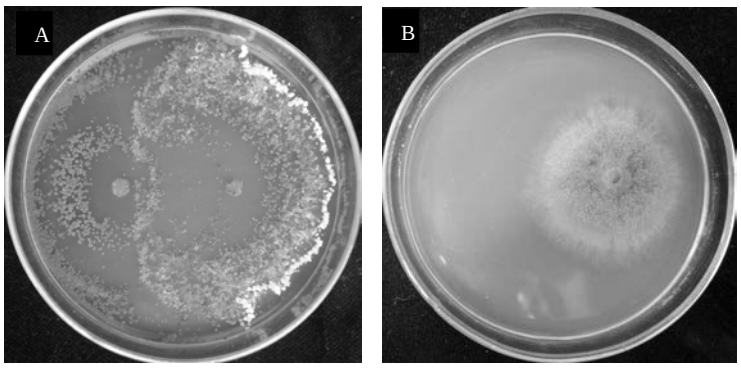


Figure 1. A: *In vitro* antagonism of *T. koningiopsis* SZMC 22218 (left) against *B. pseudocinerea* SZMC 21471 (right); B: *Botrytis pseudocinerea* colony of the same age without the presence of *Trichoderma*

We detected the lowest BCI values in the case of the *T. harzianum* isolate SZMC 22219. All of the examined *Trichoderma* strains could completely overgrow the colony of *B.*

pseudocinerea strain SZMC 21474, while *T. koningiopsis* strain SZMC 22218 could completely overgrow all of the examined *Botrytis* strains.

Enzyme activities

Measurement of cellobiohydrolase and β-glucosidase enzymes revealed low activities in liquid YEG and MIN media. In the case of the addition of powderized *Botrytis* mycelia (BOT) we could observe significant, 5× and 5.8 × increase in the cellobiohydrolase and β-glucosidase activities, respectively. For β-1,4-*N*-acetyl-glucosaminidase, higher activities could be detected in the case of almost all strains. We could detect 27× and 6× higher enzyme activities in BOT liquid media in the case of *T. atroviride* (SZMC 22216) and *T. harzianum* (SZMC 22219). Regarding the chymotrypsin-like protease and chymoelastase-like activities, low enzyme activities were measured, except from strains *T. atroviride* SZMC 22216 and *T. harzianum* SZMC 22219, where the production of these enzymes proved also higher in BOT liquid media. For aminopeptidase we also detected low enzymes activities, but in this case the liquid MIN and YEG media proved to be better than the liquid BOT medium.

CONCLUSIONS

In this study we isolated different *Trichoderma* strains from the rhizosphere of pepper and lettuce. We detected the presence of 4 *Trichoderma* species (*T. atroviride*, *T. harzianum*, *T. koningiopsis* and *T. longibrachiatum*). After the *in vitro* antagonism tests it can be concluded that *T. harzianum* has a lower capability to overgrow the tested plant pathogenic *Botrytis* strains. In contrast to that we detected high BCI values in the case of *T. atroviride* strains and we could observe complete overgrowth in the case of *T. koningiopsis*. We examined the production of extracellular enzymes in the case of these *Trichoderma* strains and the results showed that the β-glucosidase, cellobiohydrolase and β-1,4-*N*-acetyl-glucosaminidase enzyme activities were higher in liquid BOT media. Also in the case of *T. atroviride* SZMC 22216 and *T. harzianum* SZMC 22219 we measured higher enzymes activities in BOT liquid media. The results of this study (biodiversity data, antagonistic abilities and enzyme production data) could be useful for the selection of potential biocontrol agents, which could be used in the agriculture against plant pathogenic *Botrytis* strains.

ACKNOWLEDGEMENTS

The authors thank Dr. Erzsébet Karaffa (University of Debrecen) for kindly providing the *Botrytis* strains. Péter Körmöczi was supported by the European Union and the State of Hungary, co-financed by the European Social Fund in the framework of TÁMOP-4.2.4.A/ 2-11/1-2012-0001 ‘National Excellence Program’. The related research group was also supported by project TÁMOP-4.1.1.C-12/1/KONV-2012-0012 and the Hungary-Serbia IPA Cross-border Co-operation Programme (PHANETRI, HUSRB/1002/214/068).

REFERENCES

BELANGER, R.R., DUFOUR, N., CARON J., BENHAMOU N. (1995): Chronological events associated with the antagonistic properties of *Trichoderma harzianum* against *Botrytis cinerea*: indirect evidence for sequential role of antibiosis and parasitism. Biocontrol Science and Technology 5: pp. 41-53.

DRUZHININA, I.S., KUBICEK, C.P. (2005): Species concepts and biodiversity in *Trichoderma* and *Hypocrea*: from aggregate species to species clusters? Journal of Zhejiang University Science 6B: pp. 100-112.

ELAD, Y. (1994): Biological control of grape grey mould by *Trichoderma harzianum*. Crop Protection 13: pp. 35–38.

ELAD, Y. (2000A): *Trichodema harzianum* T39 preparation for biocontrol of plant diseases - control of *Botrytis cinerea*, *Sclerotinia sclerotiorum* and *Cladosporium fulvum*. Biocontrol Science and Technology 10: pp. 499-507.

ELAD, Y. (2000b): Biological control of foliar pathogens by means of *Trichoderma harzianum* and potential modes of action. Crop Protection 19: pp. 709–714.

ELAD, Y., WILLIAMSON, B., TUDZYNSKI, P., DELEN, N. (2004): *Botrytis*: Biology, Pathology and Controls. Kluwer Academic Publisher. The Netherlands.

FRIEDL, M.A., DRUZHININA, I.S. (2012): Taxon-specific metagenomics of *Trichoderma* reveals a narrow community of opportunistic species that regulate each other's development. Microbiology (UK) 158: pp. 69-83.

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: pp. 211-218.

HATVANI, L., MANCZINGER, L., VÁGVÖLGYI, C., KREDICS, L. (2013) *Trichoderma* as a human pathogen. In: Mukherjee, P.K., Horwitz, B.A., Singh, U.S., Mukherjee, M., Schmoll, M. (eds.) *Trichoderma* - Biology and Applications. Wallingford: CABI, 2013. pp. 292-313.

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: pp. 615-631.

KING, A.D. JR., HOCKING, A.D., PITT, A.J. (1979): Dichloran-Rose Bengal medium for enumeration and isolation of molds from foods. Applied and Environmental Microbiology 37: pp. 959-964.

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: pp. 310-319.

KULLNIG, C.M., SZAKACS, G., KUBICEK, C.P. (2000): Molecular identification of *Trichoderma* species from Russia, Siberia and the Himalaya. Mycological Research 104: pp. 1117-1125.

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: pp. 527-549.

NAEIMI, S. KHODAPARAST, S.A., JAVAN-NIKKHAH, M. VÁGVÖLGYI, C., KREDICS, L. (2011): Species patterns and phylogenetic relationship of *Trichoderma* strains in rice fields of Southern Caspian Sea, Iran. Cereal Research Communications 39: pp. 560-568.

SADFI-ZOUAOUI, N., HANNACHI, I., ROUAISSI, M., HAJLAOUI, M.R., RUBIO, M.B., MONTE, E., BOUDABOUS, A., HERMOSA, M.R. (2009): Biodiversity of *Trichoderma* strains in Tunisia. Canadian Journal of Microbiology 55: pp. 154-162.

SUN, R.Y., LIU, Z.C., FU K., FAN, L. CHEN, J. (2012): *Trichoderma* biodiversity in China. Journal of Applied Genetics 53: pp. 343-354.

SZEKERES, A., LEITGEB, B., KREDICS, L., MANCZINGER, L., VÁGVÖLGYI, C. (2006): A novel, image analysis-based method for the evaluation of *in vitro* antagonism. Journal of Microbiological Methods 65, pp. 619-622.

TRONSMO, A. AND DENNIS, C. (1977): The use of *Trichoderma* species to control strawberry fruit rots. Netherlands Journal of Plant Pathology 83: pp. 449–455.

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 foodplain-forest. Microbiological Research 185: pp. 125-133.

Review on Agriculture and Rural Development 2014. vol. 3 (1) ISSN 2063-4803

ENHANCEMENT OF A NEW METHOD IN CEREAL BREEDING PROGRAMMES

ROBERT MIHALY, PETER FONAD, ANDRAS PALAGYI, LAJOS BONA, CSABA LANTOS, JANOS PAUK

Cereal Research Non-Profit LtD. Co., Department of Minor Cereals 6701, Szeged, Pf. 391, Hungary
robert.mihaly@gabonakutato.hu

ABSTRACT
Homozygous doubled haploid (DH) plants and lines can be used in cereal breeding programmes. Methods based on androgenesis induction are a common way to produce homogenous basic material for variety development and genetic research purposes. Anther culture is a simple and rapid method for DH production in case of major cereal crops like barley and wheat. Oat is known as recalcitrant species for tissue culture response specially anther and microspore culture. Its low frequency DH production limits extensive application in breeding. Our aim was to start developing an improved protocol to generate acceptable number of DH lines for breeding. Many factors (low induction rate, essential manpower needed, plant regeneration problems and genotype dependence) hinder the development and application of the methods of *in vitro* androgenesis. Understanding of topic "*in vitro* response" and "plantlet regeneration frequency" are crucial factors in cereal science, too. Our aimed results of oat (*Avena sativa* L.) will open new genetic solutions in plant science, plant physiology and cell- and tissue culture of cereals and in the development of new varieties.

Keywords: plant breeding, anther culture, oats

INTRODUCTION

The production of doubled haploid (DH) plants from microspores is an important technique used also in plant science research and breeding programs. Although doubled haploid efficiencies in wheat and barley are sufficient for breeding purposes, oat (Avena sativa L.) is considered recalcitrant (Kiviharju et al., 2005, Ferrie et al., 2014). In oat (Avena sativa L.) low doubled haploid production rates have limited the use of DHs in different research areas. New varieties can only be state registered or included in the EU variety list if they possess distinctness, uniformity and stability (DUS) in their phenotypic traits. The market also expects varieties and products to have homogenous qualitative and quantitative traits. The main goal of this research is the improvement of anther culture of oat, which is new method in doubled haploid oat plant production. Application of effective in vitro haploid techniques offers many opportunities for breeding and applied research. Using in vitro haploid techniques, genetic combinations (meiotic recombination) can be fixed within a single generation, producing homozygous breeding material. Haploid or doubled haploid plants (DH) developed provide valuable basic material for molecular experiments for example functional genetic analysis on allele interactions, combining ability of alleles, genetic mapping of individual species, molecular breeding using genetic markers. The "homogeneity of a released and/or protected genotype" is an outstanding character in plant improvement. The homogenous lines become released or patented varieties or a pure line (homogenous) line can be good parental lines in different crossing programmes (in traditional or hybrid seed production). The in vitro methods - based on androgenesis - can give an alternative approach (anther and microspore cultures) to reach these goals.

Scientific background of the topic and historical review of oat haploid induction

The spontaneous occurrence of haploids is rare in nature. Haploid plants were first reported by BLAKESLEE ET AL. (1922) in *Datura stramonium*. Since then, several *in vitro* haploid induction methods have been improved: marker method, twin-embryo method, *Bulbosum* method, *Phureja* method, ovary culture, ovulum culture, anther culture, microspore culture.

Our laboratory focuses on *in vitro* haploid plant production based on anther culture (wheat, pepper) and isolated microspore culture (wheat, rice, triticale, barley and pepper). In case of these methods, stress effects (e.g. heat shock, chemical or physical treatment) are applied to influence the natural processes of development and differentiation in the male gametes. Stress may divert gamete development from the gametophytic developmental pathway to sporophytic one, resulting in the development of androgenetic embryos or morphogenic callus. Plants arising from gametes carry the genetic material of a single parent, so they can be regarded as genetically identical, or homozygous. The first anther culture-derived plants were published by GUHA AND MAHESWARY (1964). Induction of androgenesis has been published in case of more than three hundred species. Over the last twenty years, research of the haploid plant production focused on the induction of gametes, has become a major research field in plant biotechnology.

New varieties developed through DH protocols have been reported for many crops, such as wheat (*Triticum aestivum* L.), barley (*Hordeum vulgare* L.), triticale (*x Triticosecale* Wittm.), rice (*Oryza sativa* L.), *Brassica* spp., eggplant (*Solanum melongena* L.), pepper (*Capsicum annuum* L.), asparagus (*Asparagus officinalis* L.) and tobacco (*Nicotiana tabacum* L.) (THOMAS ET AL., 2003).

While most of the early DH work relied on anther culture, isolated microspore culture is usually the preferred method. Microspore culture is defined as isolating the microspores from the anther prior to culture, whereas anther culture involves culturing the whole anther. Microspore culture has a number of advantages over anther culture: in anther cultures, the anther wall may negatively impact the microspores, or may produce diploid, somatic callus and subsequently embryos; anther culture is extremely time-consuming, and depending on the species, may require micro-surgical skills; the isolated microspore culture system allows for better nutrient availability to the developing microspores; and isolated microspore culture provides a superior method for tracking and studying microspore maturation and embryo development. For some species, isolated microspore culture protocols are well established and are routinely used in laboratories around the world for developing new varieties, as well as for basic research in areas such as genomics, gene expression, and genetic mapping. In 1974, NITSCH (1974) cultured *Nicotiana* microspores that were free from anther tissue. These early studies used microspores shed naturally from cultured anthers. Eight years later, LICHTER (1982) mechanically isolated microspores from *Brassica* buds prior to culturing them, which launched the field of isolated microspore culture research. Since then studies have focused on increasing the frequency of embryogenesis with responsive species and on developing protocols for recalcitrant species. Despite the progress that has been made, many species are still considered recalcitrant: beside oat, for example, even though there is abundant information available describing the Arabidopsis genome, there is currently no microspore culture protocol for this species (FERRIE AND CASWELL, 2011).

For barley (*Hordeum vulgare* L.) and wheat (*Triticum aestivum* L.), improved anther culture results from recalcitrant genotypes has been obtained by stimulating pollen embryogenesis with ethylene (CHO AND KASHA, 1989; SE´VENIER AND COUMANS, 1996). In some experiments, amino acid and vitamin supplements have been used to increase the green plant regeneration rates (TROTTIER ET AL., 1993; HU, 1997; OUEDRAOGO ET AL., 1998). Moreover, weak light instead of darkness during the induction phase lifted the

anther culture response rates in the poorly responding genotypes of barley (BJORNSTAD ET AL., 1989). Gametoclonal variation may affect the quality of microspore-derived DH-plants (HUANG, 1996).

RINES ET AL. (1997) reviewed initial progress in the improvement of an anther culture method for oat. Three green plants were regenerated from anther cultures of oat cv. 'Stout' (RINES, 1983) and 12 green plants from cultivated naked oat (*Avena nuda* L.) (SUN ET AL., 1991) anther cultures. In recent years the induction of embryo-like structures (ELS) has been improved by several adjustments to the protocol: 5 days of heat stress at +32 ^{o}C for isolated anthers, 2,4-D up to 5 mg/l together with a low level of kinetin, 10% maltose instead of sucrose, and W_{14} induction medium containing both a solid phase and a liquid phase, the latter including Ficoll (KIVIHARJU AND PEHU, 1998; KIVIHARJU AND TAURIAINEN, 1999; KIVIHARJU ET AL., 2000). Together, 14 green plants, mostly haploids, regenerated to the greenhouse from cvs. 'Kolbu', 'Stout', 'Katri' and from the hexaploid naked oat 'Lisbeth'. Also a number of more easily regenerating wild red oat (*Avena sterilis* L.) plants were produced in these experiments.

Oat (*Avena sativa* L.) is considered one of the more recalcitrant cereal crops with respect to doubled haploidy. Wide hybridization with maize pollen (RINES, 2003; RINES AND DAHEEN, 1990; SIDHU ET AL., 2006) generates DHs as has anther culture (DE CESARO ET AL., 2009; KIVIHARJU ET AL., 2000, 2005; PONITKA AND SLUSARKIEWICZ-JARZINA, 2009), but methods are inefficient. Haploid embryo production using wide crosses has an efficiency of 0.8–6.7% (SIDHU ET AL., 2006) and for anther culture up to 30 green plants/100 anthers has been reported (KIVIHARJU ET AL., 2005). Haploid and DH plants have been regenerated from isolated microspore culture, but at very low frequency; two green plants and 15 albino plants were regenerated (SIDHU AND DAVIES, 2009).

Agronomic performance of DH lines has been tested in field experiments in other cereals. For wheat, lower yield, kernel weight and plant height has been reported for DH lines compared to lines of single seed descent (SSD), while test weight, grain protein and heading dates were not different (MA ET AL., 1999). Also for barley, lower performance, particularly in yield and its components has been found (ROSSNAGEL ET AL., 1987). However, agronomic performance of microspore-derived wheat and barley DH lines is generally thought to be acceptable (BAENZIGER ET AL., 1989; POWELL ET AL., 1992; MA ET AL., 1999). The agronomic performance of some DH oat lines was compared with that of the plants derived from commercial seeds of the same cultivars in the field experiment. A few differences were found, but generally DH lines yielded the same or more as the commercial cultivars (KIVIHARJU ET AL., 2005).

Opportunity of application of haploid and dihaploid lines in oat molecular biology

The potential to establish totally homozygous lines in a single generation provides advantages to both breeding and research (FOSTER AND THOMAS, 2005) The efficiency of genetic mapping is increased by using a totally homozygous (genetically) mapping population, because dominant markers function as if they were co-dominant (KIVIHARJU, 2005). Oat anther and microspore culture can be used for the production of DH mapping populations.

In our laboratory, the methods of the isolated microspore culture and anther culture techniques are successfully used in case of different crop species, i.e. wheat, rice, corn, pepper and triticale. Microspore culture-derived triticale plants were first published by our laboratory (PAUK ET AL., 2000). In case of wheat, several published media were compared (PUOLIMATKA ET AL., 1996) and some co-culture methods were tested (PUOLIMATKA AND PAUK, 1999). The responses of some Hungarian wheat varieties were observed in isolated microspore culture (Lantos et al 2006). The role of growth regulators was tested in barley

(MONOSTORI ET AL., 2003) and rice microspore culture (LANTOS ET AL., 2005), and the response of some Hungarian rice varieties were checked in isolated microspore culture (LANTOS ET AL., 2005). Several efforts were made in improving DH pepper plants production, and the isolated microspore culture developed by us is a new technique in this area (LANTOS ET AL., 2009).
Developing an efficient doubled haploid production protocol contains evaluating factors which influence induction of embryogenesis and the regeneration of those embryos to plants (FERRIE AND CASWELL, 2011).

In our targeted scientific work various factors will be tested to increase *in vitro* response and plantlet regeneration frequency such as:

- Testing the responses of oat genotypes from our gene bank collection
- Adaptation and improvement of published anther and microspore culture protocols
- Effect and test of heat- and cold pre-treatments of basic material for anther and microspore culture
- Effect of microspore density in isolated microspore cultures
- Cold pre-treatment of panicles and/or anthers in different carbohydrate solutions
- Effect of the induction medium's components with special attention to basal media, effect of plant growth regulators (auxines, cytokinins, ethylene), carbohydrates, L-cysteine, myo-inositol and pH
- Study various conditions on plant regeneration (basal media, activated charcoal, increased $CuSO_4$ content, etc.)
- Study the chromosome doubling procedure (spontaneous- or induced method, using by colchicine)
- Agronomic performance of some DH lines will be compared with populations from commercial seeds.

CONCLUSIONS

The development of the homozygous DH stocks has a great significance in basic plant research and crop breeding. The technique enables the development of the homogenous, uniform populations already in the early generations and therefore it is an important tool to save time and material costs for the plant breeders. The main deliverable of the present research will be the creation of a well-functioning DH development system for a plant species, the response of which is known to be low to date. The development of the technique needs the optimization of the physical, chemical and biological conditions, which will generate notable results in basic researches. Identifying the genetic and physiological differences from other cereal species will clarify essential plant physiological relationships. This research work will trigger novel scientific results by the analysis of the culture densities, the impact of growth regulators and the stress caused by the pre-treatment of donor tillers and cultures.

ACKNOWLEDGEMENTS

This research was supported by the European Union and the State of Hungary, co-financed by the European Social Fund in the framework of TÁMOP 4.2.4. A/2-11-1-2012-0001 'National Excellence Program'.

REFERENCES

BAENZIGER, P.S, WESENBERG, D.M, SMAIL, V.M., ALEXANDER, W.L., SCHAEFFER, G.W. (1989): Agronomic performance of wheat doubled-haploid lines derived from cultivars by anther culture. Plant Breed. 103: 101–109

BJØRNSTAD, A.,OPSAHL, H.G., AASMO, M. (1989): Effects of donor plant environment and light during incubation on anther cultures of some spring wheat (*Triticum aestivum* L.) cultivars. Plant Cell Tissue Organ Cult. 17: 27–37

BLAKESLEE, A., BELLING, J., FARNMAN, M.E., BERGNER, A.D. (1922): A haploid mutant in *Datura stramonium*. Science 55: 646-647

CHO, U.H., KASHA, K.J. (1989): Ethylene production and embryogenesis from anther cultures of barley (*Hordeum vulgare*). Plant Cell Rep. 8: 415–417

DE CESARO, T., BAGGIO, M.I., ZANETTI, A., SUZIN, M., AUGUSTIN, L., BRAMMER, S.P., LORCZESKI, E.J., MILACH, S.C.K., (2009): Haplodiploid androgenetic breeding in oat: genotypic variation in anther size and microspore development stage. SciAgri (Piracicaba, Braz) 66:118–122

FERRIE, A.M.R., CASWELL, K.L. (2011): Isolated microspore culture techniques and recent progress for haploid and doubled haploid plant production. Plant Cell Tissue Organ Cult 104:301–309

FERRIE, A.M.R., IRMEN, K.I., BEATTIE, A.D., ROSSNAGEL, B.G. (2014): Isolated microspore of oat (*Avena sativa* L.) for production of doubled haploids: effect of pre-culture and post culture conditions Plant Cell Tiss Organ Cult 116: 89–96

FOSTER, B.P., THOMAS, W.T.B. (2005): Doubled haploids in genetics and plant breeding. Plant Breed Rev 25: 57-88

GUHA, S., MAHESWARY, S.C. (1964): *In vitro* production of embryos from anthers of *Datura*. Nature 204: 497.

HU, H. (1997): *In vitro* induced haploids in wheat. In: Jain S. M, Sopory S. K, Veilleux RE (eds) In vitro Haploid Production in Higher Plants, Vol. 4: Cereals (pp. 73–97). Kluwer, Dordrecht

HUANG, B. (1996): Gametoclonal variation in crop improvement. In: Jain S. M, Sopory S. K, Veilleux R. E (eds) In vitro Haploid Production in Higher Plants, Vol. 2: Applications (pp. 73– 91). Kluwer, Dordrecht

KIVIHARJU, E., PEHU, E. (1998): The effect of cold and heat pretreatment on anther culture response of *Avena sativa* and *A. sterilis*. Plant Cell Tissue Organ Cult. 54: 97–104

KIVIHARJU, E., TAURIAINEN, A. (1999): 2,4-dichlorophenoxyacetic acid and kinetin in anther culture of cultivated and wild oats and their interspecific crosses: plant regeneration from *Avena sativa* L. Plant Cell Rep. 18: 582–588

KIVIHARJU, E., PUOLIMATKA, M., SAASTAMOINEN, M., PEHU, E. (2000): Extension of anther culture to several genotypes of cultivated oats. Plant Cell Rep. 19: 674–679

KIVIHARJU, E., MOISANDER, S., LAURILA, J. (2005): Improved green plant regeneration rates from oat anther culture and the agronomic performance of some DH lines. Plant Cell Tiss Organ Cult 81: 1–9

KIVIHARJU, E., PUOLIMATKA, M., SAASTAMOINEN, M. (2000): Extension of anther culture to several genotypes of cultivated oats. Plant Cell Rep 19:674–679

LANTOS, C., JANCSÓ, M., PAUK, J. (2005): Microspore culture of small grain cereals. Acta Physiologiae Plantarum 27 (4B):631-639.

LANTOS, C., JUHASZ, A.G., SOMOGYI, G., OTVOS, K., VAGI, P., MIHALY, R., KRISTOF, Z., SOMOGYI, N., PAUK, J. (2009): Improvement of isolated microspore culture of pepper (Capsicum annuum L.) via coculture with ovary tissues of pepper or wheat. Plant Cell Tiss Organ Cult 97:285–293

LANTOS, C., PÁRICSI, S., ZOFAJOVA, A., WEYEN, J. (2006): Isolated microspore culture of wheat with Hungarian cultivars. Acta Biologica Szegediensis 50 (1-2): 31-35.

LICHTER, R. (1982): Induction of haploid plants from isolated pollen of *Brassica napus*. Z. Pflanzenphysiol 105:427–434

MA, H., BUSCH, R.H., RIERA-LIZARAZU, O., RINES, H.W., DILMACKY, R. (1999): Agronomic performance of lines derived from anther culture, maize pollination and single-seed descent in a spring wheat cross. Theor. Appl. Genet. 99: 432–436

MONOSTORI, T., LANTOS, C., MIHÁLY, R., PAUK, J. (2003): Induction of embryogenesis without exougenous hormone supplement in barley microspore culture. Cereal Research Communications 31: 297-300.

NITSCH, C. (1974): La culture de pollen isole´ surmileusynthe´tique. C R AcadSci Paris 278:1031–1034

OUE´DRAOGO, J.T., ST-PIERRE, C.A., COLLIN, J., RIOUX, S., COMEAU, A. (1998): Effect of amino acids, growth regulators and genotype on androgenesis in barley. Plant Cell Tissue Organ Cult. 53: 59–66

PAUK, J., PUOLIMATKA, M., TÓTH, K.L., MONOSTORI, T. (2000): *In vitro* androgenesis of triticale in isolated microspore culture. Plant Cell Tissue and Organ Culture 61 (3):221-229.

PONITKA, A., SLUSARKIEWICZ-JARZINA, A. (2009): Regeneration of oat androgenic plants in relation to induction media and culture conditions of embryo-like structures. Acta Soc Bot Pol 78:209–213

POWELL, W., THOMAS, W.T.B., THOMPSON, D.M. (1992): The agronomic performance of anther culture derived plants of barley produced via pollen embryogenesis. Ann. Appl. Biol. 120: 137–150

PUOLIMATKA, M., LAINE, S., PAUK, J., (1996): Effect of ovary co-cultivation and culture medium on embryogenesis of directly isolated microspores of wheat. Cereal Research Communications 24 **(**4**):** 393-400.

PUOLIMATKA, M., PAUK, J. (1999): Impact of explant type, duration and initiation time on the coculture effect in isolated microspore culture of wheat (*Triticum aestivum* L.). Journal of Plant Physiology 154 **(**3): 367-373**.**

RINES, H.W. (1983): Oat anther culture: genotype effect on callus initiation and the production of a haploid plant. Crop Sci. 30: 1073–1078

RINES, H.W. (2003): Oat haploids from wide hybridization. In: Maluszynski M, Kasha KJ, Forster BP, Szarejko I (eds) Doubled haploid production in crop plants. Kluwer, Dordrecht, pp 155–159

RINES, H.W., RIERA-LIZARAZU, O., NUNEZ, V.M., DAVIS, D.W., PHILLIPS, R.L. (1997): Oat haploids from anther culture and from wide hybridisations. In: Jain S. M, Sopory S. K, Veilleux R. E (eds) In vitro Haploid Production in Higher Plants, Vol. 4 (pp. 205–221). Kluwer, Dordrecht

RINES, H.W., DAHEEN, L.S. (1990): Haploid oat plants produced by application of maize pollen to emasculated oat florets. Crop Sci 30:1073–1078

ROSSNAGEL, B.G., SARIAH, M.A., KAO, K.N. (1987): Field evaluation of anther culture derived breeding materials compared to materials developed by the pedigree and single seed descent methods in barley (*Hordeum vulgare* L.). Barley Genet. V 997–1004

SE´VENIER, R., COUMANS, M. (1996): Ethylene production and involvement during the first steps of durum wheat (*Triticum durum*) anther culture. Physiol. Plant. 96: 146–151

SIDHU, P., DAVIES, P.A. (2009): Regeneration of fertile green plants from oat isolated microspore culture. Plant Cell Rep 28:571–577

SIDHU, P.K.,, HOWES, N.K., AUNG, T., ZWER, P.K., DAVIES, P.A. (2006): Factors affecting oat haploid production following oat x maize hybridization. Plant Breed 125:243–247

SUN, C.S., LU, T.G., SÖNDAHL, M.R. (1991): Anther culture of naked oat and the establishment of its haploid suspension cell. Acta Bot. Sin. 33: 417–420
THOMAS, W.T.B., FORSTER, B.P., GERTSSON, B. (2003): Doubled haploids in breeding. In: Maluszynski M, Kasha K. J, Forster B. P, Szarejko I. (eds) Doubled haploid production in crop plants: a manual. Kluwer, Dordrecht, pp 337–349
TROTTIER, M.C., COLLIN, J., COMEAU, A. (1993): Comparison of media for their aptitude in wheat anther culture. Plant Cell Tissue Organ Cult. 35: 59–67

Review on Agriculture and Rural Development 2014. vol. 3 (1) ISSN 2063-4803

ECOLOGIC AND BIOLOGIC AGRICULTURAL SYSTEMS

SIMONA NIȚĂ[1], LUCIAN DUMITRU NIȚĂ[1], CASIANA MIHUȚ[1], ELISABETA KOCIS[1], LILIANA PANAITESCU[2], MARIUS LUNGU[2]

[1]Banat University of Agricultural Sciences and Veterinary Medicine „King Mihai I" from Timisoara
Faculty of Food Products Technology
Calea Aradului No.119 Timisoara, Romania
[2]Universitatea Ovidius Constanţa
suveti_s@yahoo.com

ABSTRACT
Ecologic agriculture has a large contribution to long lasting economic development and plays an important role in improving the environment conditions, preserving the soil, improving water quality, biodiversification and nature protection.
Ecologic agriculture may move forward in rural economy and may make it viable by extending economic activities with great added value and by generating working places in rural areas.
The aim of this paper is to present biological and ecological farming systems in Europe, and Romania. The objectives of this study were presenting ecological agriculture and biological systems and their evolution, the benefits and drawbacks to extensive and intensive agriculture.
We also briefly present a new agricultural and permacultural system - an approach to agriculture in terms of harmony with nature.

Keywords: soil, agriculture, farming systems, environmental, biological

INTRODUCTION

Ecologic agriculture is an agricultural production management system which sustains renewable resources and recycling and does not harm the environment. Organic agriculture avoids pesticide, herbicide, synthetic fertilizer usage and the practice of genetic manipulation. Regarding animal breeding, people avoid prophylactic antibiotics and growth hormone usage and there is great interest in animal welfare and the insurance of natural product feed.
The necessity of a healthy alimentation led to the increase of the local ecologic food production growth, up to million euro businesses, representing significant investments in farms, supermarkets, special restaurants and factories from Romania.
Research in ecologic agriculture is organized differently in various European countries. Up to 1980 it was mainly conducted by private research institutes, which meant a starting point for the development of ecologic farm research from 1920. In 1980 the first university added ecologic agriculture to their curricula, and in 1990 the first EU ecologic agriculture project led to a better cooperation in ecologic agriculture at a European level and the first research institute became active.

MATERIAL AND METHOD

The study was made based on field research and documentation. Regulations and norms regarding biodynamic, biologic or organic agriculture do not contradict the classic ecologic agriculture principles. On the contrary, they complement them, enlarge their span, taking

into account the state of the natural biogeographic environment and the agricultural system state, but also the insurance of population food security from one country to another.
For a better clarification, in the following we bring the main objectives and activities regarding „ecologic agriculture" (ecologic production):

- Ecologic production means obtaining agrifood products without the use of chemical synthesis products.
- The purpose of ecologic agrifood production is to create sustainable, diversified and balanced agricultural systems, which insure the protection of natural resources and the consumers' health.

Basic ecologic agrifood production principles refer to:

- the creation of production structures and crop rotation, where the main part is maintained by breeds, species and classes with high adaptability;
- continuous sustaining and natural fertilization amelioration of the soil;
- animal breeding integration in the agricultural plant production system and plant products;
- economic usage of conventional energy resources and their larger replacement with a rational usage of reusable secondary products;
- technology application to plant cultivation as well as animal breeding, which would satisfy the requirements for breeds, species and classes.

Conventional and ecologic production conversion will focus on the creation of a viable and sustainable agrisystem. The conversion period will last for: 2 years annual field cultures; 3 years for perennial cultures and tree-viticulture plantations; 2 years for pastures and fodder cultures; 12 months for meet cattle; 6 months for small herbivores and swine; 12 weeks for milk animals; 10 weeks for fowl destined for meet and egg production; 1year for bees.

RESULTS

According to the definition, given by the FAO (Food and Agriculture Organization), and the World Health Organization WHO in the "Codex Alimentarius", ecologic agriculture represents an "integral production process management system, which contributes to the support and consolidation of the agri-ecosystem resistance, including biodiversity, biologic cycles and biologic soil activity. Ecologic agriculture is interested in using optimal management practices, instead of introducing products manufactured outside the respective farm, and it takes into consideration the fact that due to their particularities, each region needs systems adapted to the specific of that region. This can be achieved by using, where possible, agronomic, biologic and mechanic methods instead of using synthetic materials for certain operations within the system. "Biologic agriculture" respects strict rules, established through legislative norms.
In order to practice agriculture in harmony with nature, one must take into account biologic techniques used and local conditions, adapting to the social – economic realities and also to traditional methods, through optimal usage of agri-ecosystem resources, as an essential factor in obtaining optimal and long lasting results.
The principles on which ecologic agriculture is based are universal, but the techniques used are adapted depending on pedoclimatic conditions, resources and local traditions.
Main objectives of ecologic agriculture

- to achieve agricultural products of high nutritional quality in efficient conditions;
- to develop and strengthen live systems during production cycles;
- to maintain and improve long term soil fertility;
- to avoid all forms of pollution which can result from the agricultural practice;

- to allow farmers a just remuneration which should provide satisfaction from their work and a secure and healthy working environment.
- to promote and diversify biologic cycles in agricultural systems, respecting micro-organisms, the soil flora and fauna, crops and animal breeding;
- to use, as much as possible, natural and recyclable resources on local level;
- to develop self-sufficient agricultural systems, with regards to organic matter and nutritional elements;
- to insure life conditions for animals as close possible to fundamental aspects of their natural behaviour;
- to maintain the genetic diversity of agricultural systems, their environments, including plant and wild animal protection;
- to take into account the impact of crop techniques on the environment and social relations.

The theory of biologic agriculture first occurred in Germany in Rudo1f Steiner's papers, published in 1924, regarding the obtaining of healthy crops, without soil agression (bz improper works and measures), but with proper organic fertilization, for the revival of the biologic activity and the improvement of soil physical-chemical characteristics.

This conception was ulterior developed and put into practice by Ehrenfried Pfeiffer, which, during 1924-1961 undertook research in various countries (Switzerland, Germany, Japan, India, Holland, the U.S.A.), especially by processing household and urban waste.

In the meantime, various variants of the biologic agricultural system technology occurred: Mu1ler (Switzerland), Boucher - Lemaire, Jean Pain (France), biodynamics (France), Indore (India), Italcampo (Italy), Howard (Great Britain).

All of these are based in organic fertilization, through manure and other vegetal and organic waste compost, with various component additions (medicinal plants, ruminant stomach).

Biologic agriculture represents an alternative to habitual modern intensive agricultural practice, which tries to abide by "natural laws," "life laws," considering the concept that:

- the soil is a living organism;
- and a living organism, as simple as it is, is still more complicated than a computer;
- there are still numerous biologic processes which are unknown to us, but a series of practical observations, sometimes considered to be empirical, can be used with good results;
- interventions in a biologic process have repercussions on the living organisms;
- some human interventions in biological processes of the soil, have long term effects;
- the introduction in a biological cycle of chemical substances obtained industrially, some of which did not occur in natural form (pesticides, herbicides) may have dangerous effects on living creatures, since specific enzymatic systems for their degradation did not occur in nature when they were used;
- some traditional agricultural techniques with empiric character, are harmless to the environment;
- modern agricultural techniques (chemicalization, mechanization, irrigation) constitute sometimes aggressive interventions;
- one should be very carefully when intervening in natural biological processes

The main biologic agriculture objective is to manufacture agrifood products with a high content of biologically active substances, so that it does not endanger human health and the environment.

Ecologic agriculture is a dynamic system in Romania with a moderate annual growth rate

of 23 %.

In 2007, the total surface cultivated according to ecologic production methods was of 131,448 ha of which 46,865 surface in conversion and 84,585 ecologically certified surface.

At the level of 2012, the surface cultivated in an ecologic system is of 450,000 ha, while crops of the spontaneous flora are collected on a surface of ca. 520,000 ha.

In 2012, surfaces in an ecologic system increased with 45% compared to 2011, representing ca. 3.38% of the total agricultural surface used in Romania.

From the analysis of the surfaces cultivated with the main crops in 2007, one can observe that 32,222 ha are surfaces occupied with cereals and ca. 27,713 ha oleaginous and proteic. Pastures and meadow lands occupy surface of 57,600 ha.

For the year 2012, pasture and fodder surfaces hav3 the largest share in the surface total - 44% (ca. 165,000 ha) followed by cereals - 29% (ca. 130,000 ha), oleaginous and proteic 22%, (105,000 ha). Surfaces cultivated with fruit trees, vine and vegetables have the smallest share, 2%, respectively 1%.

In the animal sector, in 2012 an increase in live stock was registered, bred according to the ecologic production method, especially in sheep and goats – 160,000 heads, 85,000 heads laying hens and 60,000 heads milk cows. Regarding the bee sector, in 2012 a number of 102,881 bee families were registered.

From the above mentioned live stock, certified live stocks are constituted of live stock from 2011, respectively 130,015 sheep and goat, 19,487 milk cows and 58,203 laying hens.

The number of operators (producers, processors and commercial agents, importers and exporters) registered in the ecologic agriculture system at M.A.D.R in 2012 is of 26,736.

This number may decrease at the end of 2012, after finalizing inspections carried out by inspection, certifying and certificate awarding organisms.

In 2012, of the total of 26,736 producers: 103 represent the processing segment, 211 the commercialization segment and 26,390 are agricultural producers.

Regarding the processed product sector, in 2012 a significant increase in number was registered with processors (from 48 units in 2007 to 103 in 2012) and the ecologic product assortment range was much more diversified, including: products processed from cow and sheep milk (salty cheese, swaitzer cheese, butter, cream etc.), soy processed products (milk, tofu, pate, croquette), sun flower oil, various bakery product assortments (bread, pasta, cookies), rice processed products, cereal flakes, plant teas, berry juice, hemp seed processed products, apicultural subproducts (wax, propolis, pollen), pork processed products (sausages, ham) and ecologic wine.

Exploitation size

The surface of an ecologic agricultural exploitation, varies in vegetal production from ca. 100 mp, for cultivating vegetables in solaria, to ca. 2000 ha for cultivating field crops. The medium surface of an exploitation in 2011 was of ca. 20 - 22 ha.

Ecologic product market

The demand for certified ecologic products increases continually.

At present, the internal market for ecologic products is extending. Ecologic products are commercialized directly the farm gate or, through specialized shops, as well as through the supermarket network.

On the internal market in 2011 we commercialized: fresh vegetables and fruit, fruit and vegetable processed products, plant tea, bread, pasta, flour, products processed from cow and sheep milk (sheep salty cheese, butter) eggs, oil, wine from certified ecologic grapes, soy processed products, honey etc.

Export

A large amount of products obtained from ecologic agriculture was destined to export. A percentage of ca. 70 - 80% from the Romanian ecologic product production is exported annually.

Import

The ecologic product import has increased annually, by hypermarket implication in their retail distribution. Thus, in 2007 the import value was of ca. 5 million, and in 2011, it reached a value of ca. 75 million euro (estimations – according to data existing on the market).

Ecologic product inspection and certification activity is carried out by private inspection and certifying organisms, approved by the Ministry of Agriculture and Rural Development, according to the community and national legislation.

In 2012, 13 inspection and certifying organisms approved on Romanian territory operated, according to the community and national legislation in the field of ecologic agriculture.

Competitiveness evaluation

Alongside with traditional products and generic name products, ecologic products are product with a high capitalization level. Ecologic products are products with competitive advantage. In Romania, the competitiveness of ecologic products is determined by the following factors:

- The number of operators registered in this sector is continually increasing and one may observe an increase in number with the processors. The surface cultivated in ecologic agriculture is increasing every year.
- The ecologic product market is extending and it is characterized by the annual diversification of the market product offer.
- More and more, consumers acknowledge the fact that aside from the quality and health value of ecologic products, ecologic agriculture has a major contribution to sustainable development. Acknowledgement by the population of the importance in practicing ecologic agriculture in the rural environment may represent a solution for the revival of the rural space.

The ecologic production method, based on not using chemical synthesis substances and respecting animal welfare is a sustainable solution.

Considering the fact that ecologic product competitiveness, the agricultural potential and the demand for ecologic products is increasing in Romania, an important factor is represented by the continued support of the sector by awarding financial support for ecologic production maintenance and, simultaneously, for the processing sector.

CONCLUSIONS

In most food and vine processing industries there is a high lack of grape, meat and vegetable capitalization capacity, which limits the volume of exportable products.

In order to be validated as ecologic and be put on the market, food product labels need to exhibit explicit references to their ecologic production methods and the quality evaluation certification awarded by supervising organizations. Ecologic farms represent a new sector.

For the development of the agri-ecologic sector and for the improvement of ecologic product competitiveness on export markets the following must be identified and implemented:

- Intercepting and holding of more value on the national chain value component by production and sales orientation towards primary, and processed products, the promotion of Romanian ecologic export products;
- Covering the existent market section by identifying new export markets and consolidating existent markets;
- implementing the legislation elaborated for this sector in order to consolidate the control system through supplementary measures meant to supervise inspection and certification organisms in order to increase to quality of export products;
- creating an optimal production, processing and marketing system for ecologic products, meant to satisfy the needs of internal and external markets;
- promoting Romanian ecologic product exports by developing the research activity;

Strategically, the qualitative objective of the sector is positioning ecologic agriculture at the centre of national agriculture, as a pivot for sustainable development in the rural environment.

- Increasing the number of exploitation modules by associating agricultural and animal farms;
- Increasing specific processing capacities in ecologic agriculture;
- Improving capacity in terms of product and added value;
- Multiplying export oriented services for ecologic agricultural products;
- Diversifying cultivated exportable species (e.g.: vegetables, fruit) and the processed product range (e.g.: bread, pastry products);
- Increasing the number of new approved investment projects.

REFERENCES

FITIU, A. (2003): „Ecologia şi protecţia mediului”[Ecology and Environmental Protection], Ed. AcademicPres, Cluj- Napoca,

I.TONCEA (2002):, „Ghid practic de agricultură ecologică”[Practical Guide for Ecologic Agriculture]**,** Ed. AcademicPres, Cluj-Napoca

LIXANDRU GH. (2003): Sisteme integrate de fertilizare în agricultură [Integrated Fertilization Systems in Agriculture], Ed. Pim, Iaşi pag. 181-189.

NIŢĂ L. (2007): Pedologie [Pedology]. Ed. Eurobit, Timişoara

Mihail Dumitru şi colab(2003); „Cod de bune practici agricole” [Good Agricultural Practices Code] vol. I, Ed. Expert, Bucureşti.

OKROS A. (2012): Sisteme de agricultură [Agricultural Systems], Ed. Eurobit, Timişoara

RUSU I., UDRESCU S., BLAGA GH., VASILE D. (1996): Pedologie [Pedology], Ed. Didactică şi Pedagogică Bucureşti.

Review on Agriculture and Rural Development 2014. vol. 3 (1) ISSN 2063-4803

THE AGRICULTURAL SYSTEM OF THE ARMENIȘ TOWNSHIP, CARAȘ SEVERIN COUNTY

SIMONA NIȚĂ[1], LUCIAN DUMITRU NIȚĂ[1], CASIANA MIHUȚ[1], ELISABETA KOCIS[1], LILIANA PANAITESCU[2], MARIUS LUNGU[2]

[1]Banat University Of Agricultural Sciences And Veterinary Medicine
"King Mihai I" From Timişoara
Calea Aradului Nr. 119 Timișoara, Romania
[2]Universitatea Ovdius Constanța, Romania
suveti_s@yahoo.com

ABSTRACT
The purpose of this paperwork is to present a common agriculture in Armeniș with the land, crop structure and companies in the agriculture of the village, soil types and subtypes of the Armeniș township area, environmental factors that influence these traits, the study of important processes and soils of the area.
The objectives of this study were to present the agricultural system and the improvement of the city and its possibilities. In the context of a perpetue changing agriculture we must always watch the opportunities that appear all the times. EU founds and programs are at ours hand, we just need a good implement of this agricultural programs in field, because otherwise we will loose the money who are so needed in this part of country. As research materials and methods were field observations, discussions with farmers and agricultural engineers from Armeniș township.
The results obtained were identified agro-zootechnical systems with opportunities for improvement.

Key words: Soil, Armeniș, Agriculture, Agricultural Systems, Land Fund

INTRODUCTION

In the context of the national economy, the agriculture represents a branch of great importance, ment to contribute to a large extent to the relaunch of economic growth in our country. it is necessary to operate some fundamental transformations of the agricultural structure, of the technical-material base, within the agricultural expliotation organization, which should ensure the practice of a modern agriculture and its inclusion in the general strategy for the Romanian economy's transition to a market economy. Agriculture is now of great interest all around the world, no matter of the economic development level. Nowadays, the most economically developed countries are also the greatest producers and exporters of agricultural products. As a basic branch of our national economy, agriculture is an esepcially complex and complicated activity field. The complexity of agriculture, as a branch of the material production, of the national economy, is determined by the role of agriculture in economic development and its technical, economical and social particularities, which enable a specific manifestation of the general economic rules with regards to agriculture**.**

MATERIAL AND METHOD

The study was made based on field research and documentation. For the elaboration of the present paper, we used data obtained from MADR and INSSE. The share of agriculture within Romania's economy decreased constantly since 1990 (the decrease rhythm being

more slowly during the first transition years and more rapid after 1997). Stil, the agriculutre's contribution to the creation of the GDP remains substantial (5.3 % in 2012) as compared to the UE average (1.7%). The regional distribution of agricultural land according to its usage is differentiated in relation to the relief conditions, with the pedo-climatic and crop suitability characteristics. As a whole, only 25% from the land total observe a superior quality and a good and very good productive potential. The agricultural production manifested very diverse specific dynamics, sectorially (vegetal and animal), as well as on a regional level, according to the agri-pedo-climatic suitability condition diversity, but also according to the prodcution factor usage level.

RESULTS

The Armeniş village is a township centre and comprises: 466 buildings, 378 households and 1226 stable inhabitants. The villages included in the township are: Satul Bătrân with: 130 buildings, 108 households and 376 inhabitants; Sub Marginea with: 87 buildings, 61 households and 200 inhabitants, Feneş with: 237 buildings, 203 households and 581 inhabitants and the village Plopu with: 35 buildings (mostly bowers), 5 households and 6 inhabitants.

The potato is largely cultivated and a special attention is given to animal feed, hay, clover and lucerne. Of the fruit trees, apples and plums are predominantly cultivated. We encounter apple breeds such as: the Jonathan, maşancul, botul oii etc. Summer plums are used for the production of „răchie" (plum brandy) but we encounter other breeds as well. Vine cultivation is poorly developed (cultivated only in yards or along the bowers), not facilitated by the climate. A part of the fruit and potato products are used in the household and the rest is sold in the markets in Caransebeş, Timişoara, Lugoj and Reşiţa or are exchanged for other agricultural products which are not cultivated in the area.

The agricultural surface (ha), respectively: plough land, grass land, meadow land, vineyards and orchards 3,143- surface total, in ha of the agricultural area, no matter the land property form.

Another occupation of the Armeniş people is animal breeding: cows, horses, sheep, pigs and fowl. Lately, a decrease in animal number is observed, determined by the very low demand and price of these products.

Aside from these ancestral occupations, another income source are craftmanships like: carpentry, smithery, tailory.

Agricultural surface

Table 1. Land usage categories in the Armeniş township 2009

Categories	2009 (ha)
Plough land	806
Meadow land	2156
Orchards	375
Grass land	1474.7

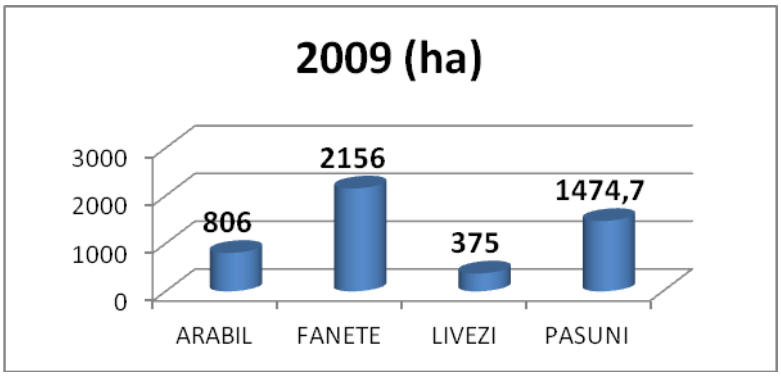


Figure 1. Agricultural surfaces on usage categories 2009

Table 2. Usage categories in the Armeniș township 2010

Categories	2010 (ha)
Plough land	806
Meadow land	2156
Orchards	375
Grass land	1474

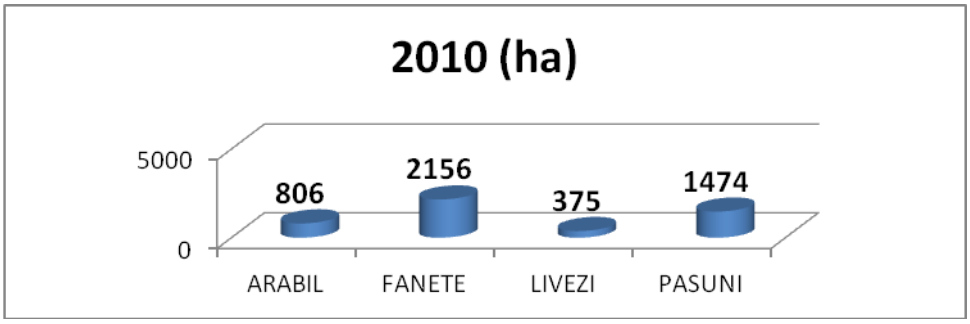


Figure 2. Agricultural surface on usage categories 2010

Table 3. Land usage categories in the Armeniș township 2011

Categories	2011 (ha)
Plough land	806
Meadow land	2156
Orchards	375
Grass land	1474

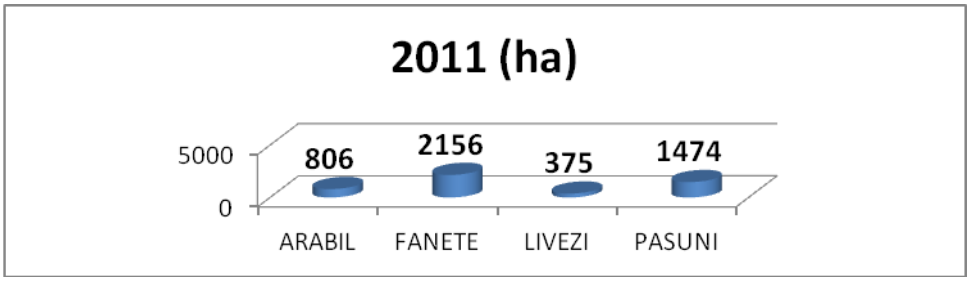


Figure 3. Agricultural surface on usage categories 2011

Table 4. Land usage categories in the Armeniș township 2012

Categories	2012 (ha)
Plough land	806
Meadow land	2106
Orchards	375
Grass land	1524.7

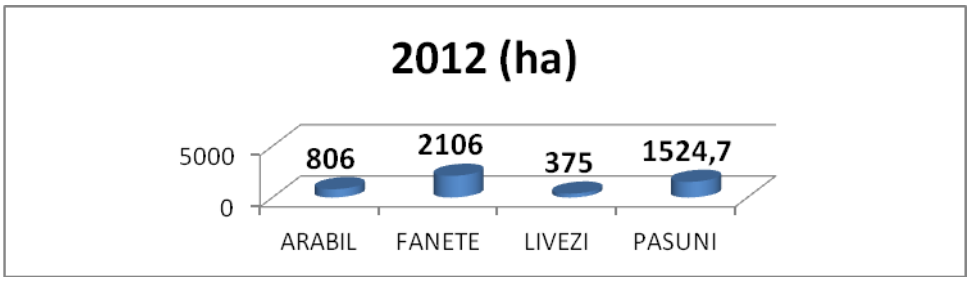


Figure 4. Agricultural surface on usage categories 2012

Table 5. Crop structure in the Armeniș village

CROPS:	Surface ha
Potatoes	335
Corn	260
Wheat	12
Fodder	199

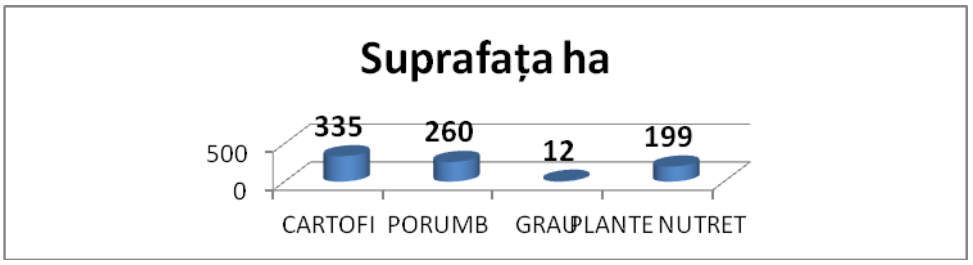


Figure 5. Crop structure in the Armeniș village
(Area of potato, corn, wheat and forage plants)

Table 6. Animal live stock in the Armeniș village

ANIMALS	Number
Cattle	807
Sheep	2813
Horse	325
Swine	1356
Fowl	6569
Bees	458

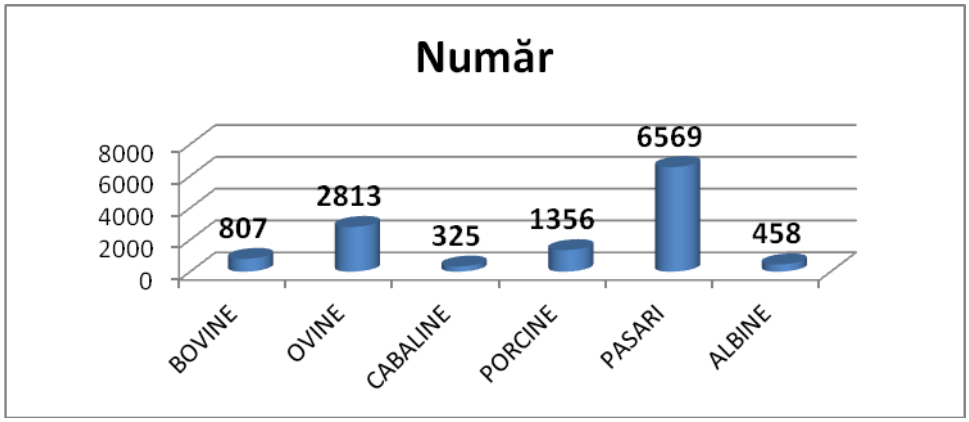


Figure 6. Animal live stock in the Armeniș village
(Number of cattle, sheep, horse, pig, fowl, bees)

Table 7. Agricultural equipment park from the Armeniș village

EQUIPMENT	Number
Tractors	287
Mowing machines	225
Ploughs with 2 bottoms	85
Ploughs with 3 bottoms	150
Ploughs trac. animala	145
Potato planting machines	5
Harvesters	3
Standing threshing machines	3

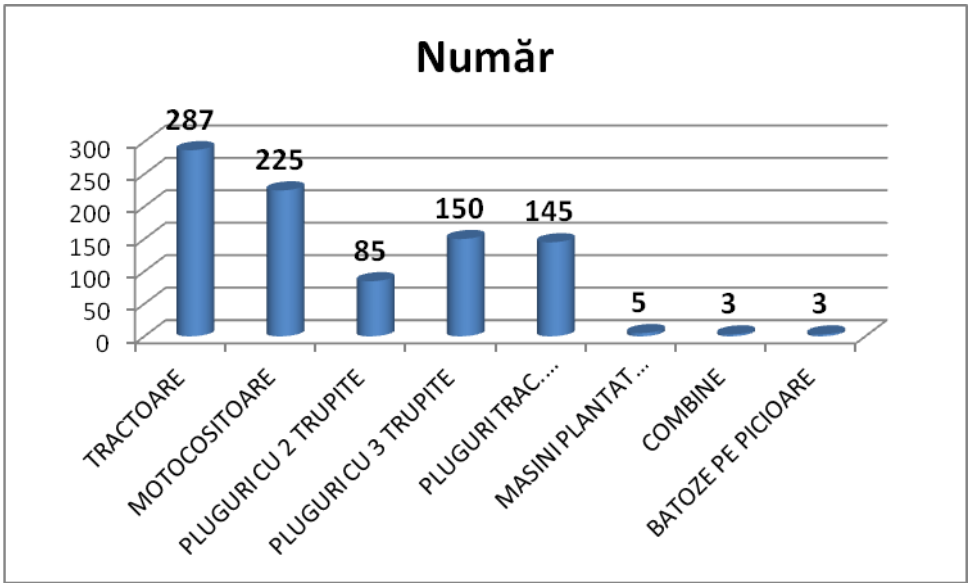


Figure 7. Agricultural equipment park from the Armeniș village
(Number of tractors, mowing machines, ploughs 2, plough 3, plough trac. Animala, potato planting machine, harvesters, standing threshing machine)

CONCLUSIONS

As a result we identified an agri-zootechnical agricultural system:

- ✓ The main products obtained are potatoes and fodder.
- ✓ The cereal demand is completed through potato exchange or by acquiring it from the market.
- ✓ Animal husbandry is well developed, capitalizing the agricultural potential of the area.
- ✓ Producers are poorly equipped with agricultural machines thus most works are carried out with a poor efficiency.
- ✓ Animal breeds, cattle, sheep, swine and fowl, with variable live stock in individual households completed the local activity range.
- ✓ However, due to difficult application processes for projects in this sector, financing is yet to be expected.
- ✓ The only real possibilities to develop agriculture in this area are to get a good price from selling potatoes and animal and fruit products as well as their derivatives.

REFERENCES

BLAGA, GH., RUSU, I., UDRESCU, S., VASILE, D. (1996): Pedologie [Pedology], Editura Didactică şi Pedagogică. R. A., Bucureşti

MUNTEANU, I. (1994): Solurile României în sistemele de clasificare internaţională [Romanian Soils in International Classification Systems], Ştiinţa solului nr. 3-4, Bucureşti

NIŢĂ LUCIAN DUMITRU (2007): Pedologie [Pedology], Editura Eurobit, Timişoara

POSEA, GR. (1997): Câmpia de Vest a României (Cămpia Banato-Crişană) [The Romanian Western Lowland (Banat-Crisana Lowland)], Ed.Fundaţiei "România de maine ", Bucureşti

TEACI, D. (1980): Bonitarea terenurilor agricole (Bonitarea şi caracterizarea tehnologică a terenurilor agricole) [Agricultural Land Bonitation (Agricultural Land Bonitation and Technological Characterization)], Ed. Ceres Bucureşti

*** Sistemul român de clasificare a solurilor [The Romanian Soil Classification System], I.C.P.A. Bucureşti, 1980,

Review on Agriculture and Rural Development 2014. vol. 3 (1) ISSN 2063-4803

ASPECTS REGARDING THE QUALITY OF LIFE IN ROUMANIAN RURAL SPACE

TABITA HURMUZACHE, IANCU TIBERIU, ANDREA FEHER, MIROSLAV RAICOV

Banat's University of Agricultural Sciences and Veterinary Medicine fromTimisoara
Faculty of Farm Management
Calea Aradului, no.119, 300645, Timisoara, Romania
tabitahurmuzache@usab-tm.ro

ABSTRACT
The quality of life, is today an area of interest for the specialists of economic and political sciences. The interest in this field is given by the importance that is given to the human factor within the society. Thus, the evolution of the main indicators characterizing the quality of life is an important tool for monitoring the economic and social phenomena that occur within the society, providing an overview regarding the welfare of society.
An important role in increasing the quality of life in rural area has the renovation and development of villages. In this respect a special attention should be paid to the modernization and expansion of basic rural infrastructure, resulting in the development of economic, social and cultural and even creating jobs, increasing employment degree of the population, thus increasing the revenue.
Improved quality of life of Romanian inhabitants of the villages, determine, in equal measure, the economic development of rural areas. This, by the effects it produces causes increased income of the population, increased consumption of goods and services, resulting in a high satisfaction of demand, increase food security measures and therefore the quality of life.
Development of entrepreneurship spirit of residents from rural area, increased accessibility degree to basic services and better capitalization of resources and traditional products are other measures which have as effect the improvement the standard of living of the rural population.

Keywords: quality of life, living standard, rural space

INTRODUCTION

Common Agricultural Policy with its two pillars - agriculture and rural development - is a policy of strategic importance to the European Union contributing to food security, environmental protection and territorial balance (FEHER, 2013).
The economic development is largely reflected not only within the development degree of the society but especially by creating some living conditions to be better as possible to satisfy under the best conditions the community needs.
The concept of life quality is often confused with the concept of living standard. Even if these concepts are often confused between them, there are some small differences. The quality of life is defined as a global expression of all conditions and activities that compose life: natural environment, habitat, work, family life, leisure, education, health, social life participation, economic and social services, social environment, while the concept of living standard is referring to issues related to: lifestyle, social position, culture, values and aspirations of community members, highlighted by indicators such as: the level and trend of incomes, people consumption, health conditions, housing conditions, education and access to culture and art.

MATERIAL AND METHOD

The preparation of this work is based on extensive documentation in the field, books, reports and national statistics and is based on the study of indicators aimed at quality of life and standard of living in Romanian rural space.

RESULTS

The concept of life quality has a wider scope than the living standard, including also the quality of the environment, demographic issues, working and leisure conditions, housing conditions, health, training and level of education and culture, level and structure of income, level structure of consumption etc.

Being a combination of factors, of economic, social and environmental nature, the analysis of life quality should be performed on its components:

- in terms of *environment*, the analysis of life quality aims: protecting biodiversity, protection and rational use of resources;
- *economically*, the following issues are considered: meeting in good conditions and a high level of individual needs, practicing some clean production technologies, exploring social utility of production;
- in *social* terms, it aims at establishing the equality between individuals, providing the means for self-satisfaction and keeping the quality of living conditions.

Currently, it pays particular attention to the rural space and its economic development. Thus, addressing the issue of life quality in rural areas is a current problem, which lies in the importance of rural space in the economic and social life of each community.

The importance of rural space is highlighted by its functions: economical, social and environmental. Thus, its role can be fulfilled only if it is characterized by an attractive living environment equipped with modern infrastructure, with a diversified economic activity, with a viable agriculture and forestry, with numerous non-agricultural activities and a landscape clean and tidy.

Even though the rural area is an area devoted to agriculture and forestry, rural space development concerns especially the introduction and development of some non-agricultural economic activities. In *Figure 1*, we present the structure of rural economy by the main economic activities.

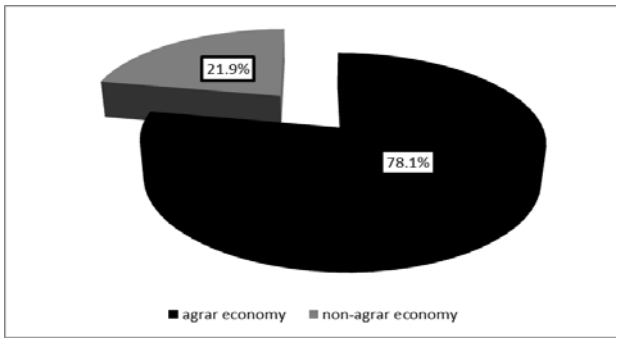


Figure 1. The structure of rural economy

The rural economy is a predominantly agrarian economy, it occupies a share of 78.1%, the remaining of 28.9 % being occupied by the non- agricultural economy (industry and services). At European Union level the situation is different, the largest share is represented by non- agricultural economy, 59.7% and 40.3% by agrarian economy. The large discrepancies between the structure of Romanian rural economy and of the

community one are due to a much lower share of services (non-agricultural) in rural areas and, in particular, to the rural tourism which in Romania practically has a very small contribution to the rural economy (OTIMAN, MATEOC, MĂNESCU, 2013).

The sustainable development of rural communities results in improving the life quality of inhabitants both economically and socially as well as for the environment. The economic development involves the increase of total income, of average income per capita, the increase of employment and therefore reducing the unemployment rate, reducing gender disparities, reducing rural- urban disparities and a less polluting environment. Nationally, rural areas represent 87.1% of country territory. The analysis of territory structure, according to methodology of OECD on rurality indicates that a share of 59.8 % represents rural space 39.4 % intermediate space and 0.8 % urban space (MINISTRY OF AGRICULTURE AND RURAL DEVELOPMENT).

The administrative- territorial organization of Romanian rural area indicates the existence of a total number of ***2,860 communes***, comprising several villages, with a total of ***12,956 villages.*** There are also met a number of ***341 localities that have rural characteristics called even villages,*** being in urban composition only administratively. There are also 67 localities with populations under 10,000 people with rank of city and ***33 communes, whose population exceeds the number of 10,000 inhabitants, and have not a city status, being considered rural areas.***

With regard to the population which is concentrated in rural areas, this is around 8.98 million inhabitants, meaning 47.2%. By comparison with the European Union, Romania's population is characterized by a certain degree of rurality more pronounced. In relation to Eurostat data from 2012, ***45.5% of the population is in rural areas, 43.9 % in intermediate regions and 10.6 % in urban areas*** (MINISTRY OF AGRICULTURE AND RURAL DEVELOPMENT).

An important indicator of the living level is the number of inhabitants per square kilometer. According to presented data, at national level the average is 91 inhab/sq km. There are, however, some regions, which exceeds the national average. For example, the North East Region where there is the highest level, 100.8 inhab/sq km, without taking into consideration Bucharest Region, but also regions where the values are lower, like South-East Region, 60.0/ sq km, with the lowest level of this indicator.

The average density of population in rural areas has remained relatively constant over the years, being 45.1 inhabitants/sq km). The analysis of this indicator at territorial level shows that over 80% of rural localities have a density close to the threshold used by the European Union to identify rural areas. There are great disparities, especially due to the influence of regional and county relief.

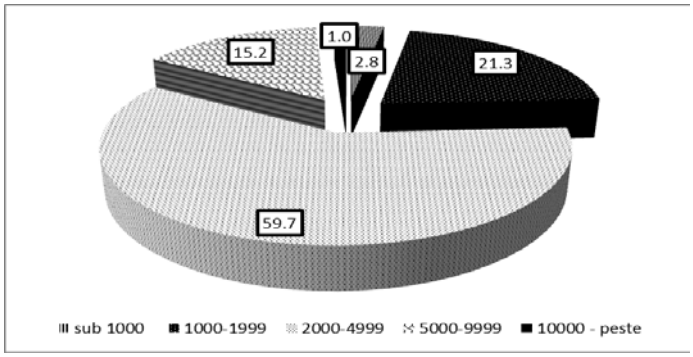


Figure 2. Grouping of communes by number of inhabitants

The average population of a commune is of 3,780 inhabitants, but there are a variety of communes in Romania in terms of population sizes. The villages have a large diversity in

terms of number of inhabitants. The size of villages varies from those that have only a few inhabitants, to the villages with a population of over 7,000-9,000 inhabitants. Still, the villages with few inhabitants are predominant, the average number of inhabitants of a village being around 800.

The main factors contributing to the socio –demographic evolution in rural areas are: **birth rate, mortality rate and migration.**

In general, there is a strong direct correlation between mortality rate and degree of demographic aging.

Table 1. The significance of demographic disparities rural - urban, 2011

INDICATORS (per 1000 inhabitants)	Rural	Urban	Difference rural - urban
Birth rate	9.8	10.0	-0.2
Mortality rate	14.7	10.0	4.7
Natural increase	-4.9	-	-4.9
Marriages	4.2	6.4	-2.2
Divorces	1.09	1.88	-0.79

Source: Romanian statistical yearbook, 2011

A third component of population trends is the movement, migration expressed by the indicator of **average migration rate** which is "the balance" of residence changes within the confines of a commune, meaning the difference between the number of those establishing their residence in the village and those who have left with the residence from the village.

The fluctuations in the population trends are a consequence of migration, particularly of young people able to work, toward urban areas in the search of better jobs and of a more attractive lifestyle.

Remaining in the rural area of a part greatest possible of young population category would be a decisive factor for rural revitalization, economic diversification, for restoring demographic imbalances, especially in areas with agricultural deficiencies.

Returning of young people to rural space has very favorable implications for the development of productive activity, their entrepreneurial spirit being easily to train and quide primarily towards non-agricultural activities which must be established and developed in the rural communities. In these circumstances, it would take place an increase of life quality, it would limit migration and alleviate social problems, including reducing unemployment in rural areas. It would also increase the employment degree of women which typically adapt more easily to non-agricultural activities.

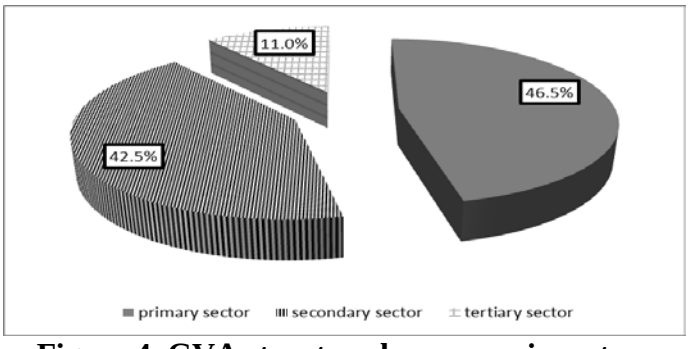


Figure 4. GVA structure by economic sectors

Romanian rural area is the main repository of the vast majority of economic resources: raw materials, agricultural resources, forestry, tourism and spas. Agriculture, along with forestry and forest exploitation have an important contribution to the GDP, while the employment in these industries represents over one third of the total population occupied of the country.

A correct layout of the structure of rural economy on activity sectors can be obtained from the analysis of gross value added by main component sectors (*Figure 4*). Thus, it can be seen that the highest share is held by tertiary sector, 46.5 %, followed by the secondary sector, 42.4 % and primary sector 11.0 % (EUROSTAT).

In terms of SMEs density per 1,000 inhabitants, there is noticed a higher concentration of them in urban areas compared to rural areas, *Figure 5*.

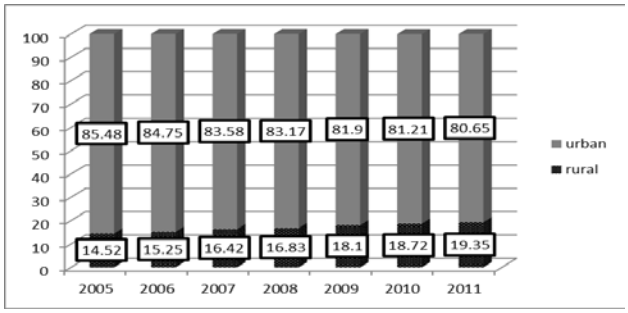


Figure 5. Evolution of SMEs by area of residence

In the period under review there can be seen an increase in the number of SMEs in rural areas, from 63,741 to 85,497 SMEs. However, they are still a pretty reduced share, below 20 % of the total SMEs existing nationally.

The structure of employed population in Romania nationally in 2011, was 30.4 % of the total employed population and it was concentrated in the primary sector, 28.8 % in the secondary sector and 40.7% in the tertiary sector. At EU-27 level, the employed population distribution by economy sectors is as follows: 5.2% of the employed population was recorded in the primary sector, 22.6% in secondary one and 70.2% in the tertiary sector.

In rural areas, the employment is concentrated mainly in agricultural sector, 29.1% in the year 2011. Regarding the professional status of rural population employed in agriculture, 52.9% are self-employed, 41.6% are family members engaged in an activity unpaid, 5.2 % are employed and 0.1% are employers.

The small number of workers employed in agriculture, of only 5.2% of total employed population is an issue with which is facing Romanian agriculture, as the qualification level of smallholders is extremely low and labor productivity, together with the results of production process are relatively low.

Due to single occupation of population from rural space in agricultural activities on their own, **the unemployment rate in rural areas** is lower than the urban population. The highest values in terms of **unemployment rate in rural areas** are registered in the Central Region (3.5%) and Southeast (2.9%) and lower values in the North - East (0.6%) and South West (1.0%). The share of women who are unemployed is much lower than men because even women's employment rate is lower.

Life quality is greatly reflected in family income level and the income incumbent on every member of the family. In the following table we present the average earning by economic activity.

If we analyze the data according to *Table 2* we find that the average level of nominal earning in activities such as agriculture, fisheries and fish breeding, hotels and restaurants, the earning is well below the national economy average.

Table 2. Net nominal average monthly earning by activities of national economy, lei / employee

Agriculture, forestry and fishing	1024	Transport, storage and communications	1557
Industry	1388	Financial intermediation	3200
Electricity, gas, steam and air conditioning	2671	Real estate activities and other services	1182
Manufacturing	1237	Public administration and defense	1968
Mining and quarrying	2435	Education	1380
Constructions	1125	Health and social assistance	1226
Trade	1166	Other activities of the national economy	824
Hotels and restaurants	786	**Total**	**1391**

Source: Romanian statistical yearbook, 2011

However, in activities such as public administration and defense, mining and quarrying, electric and thermal energy, gas and water, the earning well exceeds the average recorded for entire economy.

The analysis of life quality in developing countries and in a country like Romania, it is advisable to carry out, according to the experience gained in the field related to the evaluation and analysis of poverty, to the disparities existing within the society, taking into account the low level of revenues compared to the needs, but without neglecting the interdependence between the quality of life and the characteristics of natural, economic and political environment.

CONCLUSIONS

Romania needs to modernize and reform its policies to be able to preserve own values. Modernization is essential to be able to continue to increase the level of prosperity, social cohesion, environmental protection and quality of life.

The current state is not really an option. Through economic growth and a labor force employed in productive areas there can be achieved results that meet the expectations that the European Union has from our country. Through concerted action in areas that have a major impact on quality of life, there can progress in European integration of Romania.

The development and jobs are key points on a truly European agenda. The indicators of life quality can be red flags for drawing attention to social problems, as well as for those which may have negative consequences in a medium and long term. Selection of used indicators is also important for establishing social goals or to assess the effects of policies in the view of improving the life quality of population.

REFERENCES

FEHER ANDREA, GOȘA V., HURMUZACHE TABITA, RAICOV M. (2013): Financing of rural development in Romania - present and perspectives, Proceedings of the 6th International Scientific conference "Rural Development 2013", Volume 6, Book 1, pp. 525-531

IANCU T. (2007): Economie agrară, Editura Agroptirnt, Timișoaara

OTIMAN P. I., MATEOC-SÎRB NICOLETA, MĂNESCU CAMELIA MARIA (2013): Economie rurală, Editura Mirton

EUROSTAT (2013): Agriculture, forestry and fishery statistics – Rural development

MINISTRY OF AGRICULTURE AND RURAL DEVELOPMENT: Analiza socio-economică în perspectiva dezvoltării rurale 2014-2020

INSTITUTUL NAȚIONAL DE STATISTICĂ (2012): Anularul Statistic al României

MINISTERUL AGRICULTURII ȘI DEZVOLTĂRII RURALE (2013): Planul pentru Dezvoltare Regională, 2014-2020, Regiunea Vest

Review on Agriculture and Rural Development 2014. vol. 3 (1) ISSN 2063-4803

ROUMANIAN RURAL SPACE CHARACTERIZATION FROM WESTERN REGION

TABITA HURMUZACHE, TIBERIU IANCU, ANDREA FEHER, COSMINA TOADER

Banat's University of Agricultural Sciences and Veterinary Medicine from Timisoara
Calea Aradului, no.119, 300645, Timisoara, Romania
tabitahurmuzache@usab-tm.ro

ABSTRACT
The rural space represents the relationship that is established between man and nature, interdependency relations establishing between social actions and the natural environment where these actions occur, as well as the essence of material and spiritual civilization that emerge and evolve on a certain territory. Thus, the rural space includes many areas, communities, natural landscapes, farmlands, forests, habitats and traditional cultures, being actually the place where most resources of national economy are concentrated. Romanian rural area faces with many weaknesses. The main problems specific for rural areas are low economic development, aging, migration towards urban areas, poorly developed infrastructure and low population density. The rural space has some distinct features which are transferred within the individuality, specificity and authenticity, compared to other areas. The Western Region is one of the eight regions of development established nationally on October 28, 1998. This region consists of four counties: Arad, Caras-Severin, Hunedoara and Timis.

Keywords: rural space, Wester Region, rural development

INTRODUCTION

Rural area represent the occupied territory mostly by forests, crops and green spaces, and is based on a predominantly agricultural society.
The expansion of urban areas, the development of communication ways, setting some non-agricultural activities, introducing some techniques and technologies have led at charging the rural space with new elements and new relationships, enriching it qualitatively and quantitatively. (MINISTRY OF AGRICULTURE AND RURAL DEVELOPMENT, 2013))
To reduce these problems it is necessary to develop and implement some development strategies, taking as starting point the needs identified in the territory. An important role have local communities, witch must proceed to a dynamic development, supported by a local rural development strategy drawn up in accordance with the national strategy for rural development.

MATERIAL AND METHOD

The authors of the research methods used to collect data from various sources and Reference section of territory, their processing, analysis, interpretation and drawing conclusions.
The objectives of this study are:

- evaluation of actually stage witch characterizes rural area at regional and national level and identifies key issues;
- analysis of the main economic indicators that characterize the rural western region;
- creation some development strategies of rural area witch eliminates existent problems from the studied area;

RESULTS

Rural area as defined according to Recommendation no. 1296/1996 of the Parliamentary Assembly of the Council of Europe on the European Charter of Rural Areas as being "an interior area, including villages and small towns, where most of the lands are used for: agriculture, forestry, aquaculture and fisheries; the economic and cultural activities of the inhabitants of these areas (crafts, industry, services, etc.); arrangements for non-urban areas for leisure and amusement (or nature reserves); other uses (excluding those for housing)".

Many times the rural space is defined as opposed to urban one, more exactly *"the space characterized by a population and density relatively low and by a predominance of agricultural activity*".(MATEOC-SÎRB, MĂNESCU, 2012)

The Western Development Region is part of the Danube- Cris- Mures- Tisa Euroregion, which includes the four counties of the region, three Hungarian counties and the autonomous region of Vojvodina, Serbia.

From the administrative point of view, within the Western Development Region, in the year 2011 there were 12 cities, 30 towns and 281 villages, of which belonged a number of 1,327 villages.

In the Western Region, 37.2% of total population is concentrated in rural areas. If we make an analogy with the existent situation at national level, where the value of the population living in rural areas is 45.1%, we can state that in the rural space of Western Region a fewer number of people are concentrated.

The analysis by component counties of the region, indicates differences in terms of the value of this indicator. Thus, in Arad and Caras- Severin counties, the share of the population living in rural areas, in total population approaches as value of the national average, 45 % and 44% , while in Timis and Hunedoara counties, the recorded values are: 38.7 % and 23.3%. The low rural population from rural areas in Hunedoara county is due to the fact that this county is the second county, by urbanization degree, after Bucharest - Ilfof.

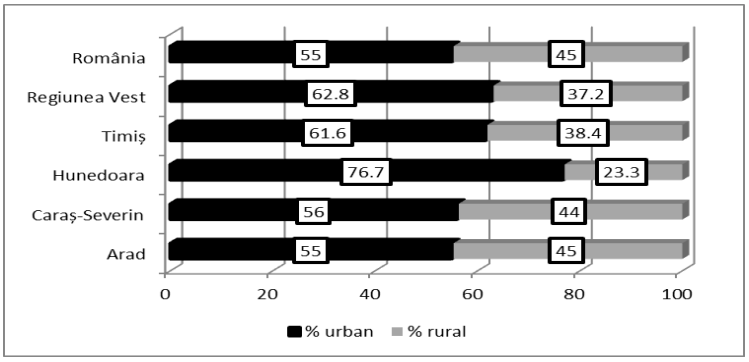


Figure 1. Population structure by area of residence
Source: Romanian statistical yearbook, 2012

The size of localities, in terms of population, in rural areas is usually low, 93.5% of them having a number of inhabitants bellow than 5,000. The remaining of 6.5% localities with over 5,000 inhabitants are found in Timis (13) and Arad (6) counties, within the latter one there is actually met and largest commune from the region, namely Vladimirescu commune with more than 10,000 inhabitants.

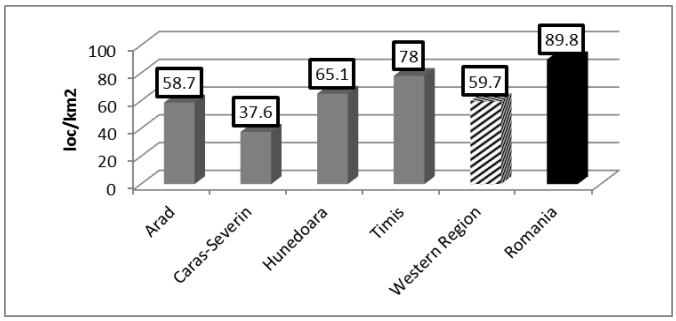


Figure 2. Population Density
Source: Regional Plan for Development, West Region, 2014-2020

In terms of population density (*Figure 2*), it can be seen that the region average, 59.7 inhab/sq km, is below the national average, 89.8 inhab/sq km. At counties level there are situations when it exceeds the average of region, namely Timis county (78 inhab/sq km) and Hunedoara (65.1 inhab/sq km) and there are counties where population density is below the region average, in Caras-Severin county (37.6 inhabitants/sq km) and Arad county (58.7 inhab/sq km).
Life expectancy at the West Region level was in 2011 of 73.06 years, lower than the national average of 73.47 years. The difference is recorder by gender and area of residence. Life expectancy among women being higher by 7 years, exceeding both the regional and national average. In rural areas, the average lifetime (72.57 years) is lower compared to urban areas (73.34 years) due to poorer living conditions and lack of medical services in some areas.
A feature of the rural population is demographic aging and the structure imbalances by aging groups. This makes that the reduction of the population in rural areas to be an issue much debated in these regions. In many cases, the decline of population exceeded the normal limits of the demographic system, creating thus imbalances.
The predominance of older people and a high mortality rate will result in an effect of 10% reduction, naturally, of the aging populatio and at rejuvenating the rural population. Thereby, the populations in coming years will be a young one, but much less numerous.

Agriculture. The Western Region has a significant agricultural potential, being on the fifth place in terms of total agricultural land distribution, by development region, *Figure 3*.

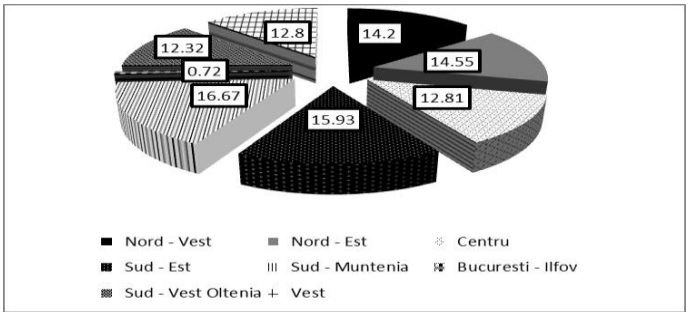


Figure 3. The structure of agricultural surface by development regions
Source: Romanian statistical yearbook, 2012

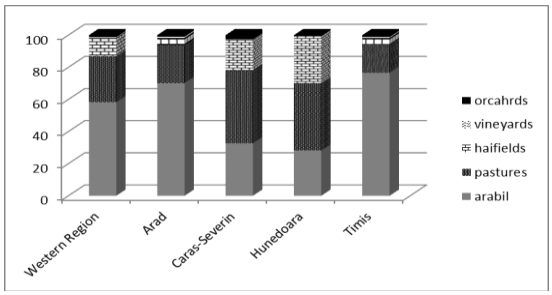


Figure 4. Structure of agricultural surfaces by counties
Source: Regional Plan for Development, West Region, 2014-2020

In the Western Region, the agricultural surface varies from county to county (*Figure 4*). Timis County holds the largest share, 37.1% , in terms of agricultural surface distribution by counties.
The structure of agricultural surface by counties is different. If in the region the arable land is predominant, 58.27%, there are counties which exceed this average: Timis county (76.59%) and Arad county (70.17%), but there are also counties where the percentage of arable surface in total agricultural surface is more reduced: Hunedoara county (28.21%) and Caras –Severin county (32.66%).
The pastures and hayfields in the region have a total of 39.94%. In Caras -Severin and Hunedoara counties these two categories have significant shares, above the average of region: 64.44% and 70.74%. This situation is due to relief, mostly mountainous. The other two categories of agricultural land use, vineyards and orchards, represent low shares, a similar situation to the regional level 1.79% and national level 2.79%.
In the West Region, there is a number of 271,891 farms of which 98.4% are individual agricultural holdings and 1.6% agricultural holdings with legal personality. These exploit an agricultural area of 774,304.02 hectares, or 44.72% of the agricultural surface of the region. Agricultural holdings with legal personality exploit 55.26 % of the total agricultural surface.
The average agricultural surface per agricultural holding is 6.32, a low value compared to the EU average, which is about 19 ha/farm.
In what regards the analysis of agricultural holdings by way of use, *Figure 5* shows that 71.1% are mixed agricultural exploitations, 25.3% are plant agricultural exploitations and 3.6% are agricultural exploitations of livestock profile.

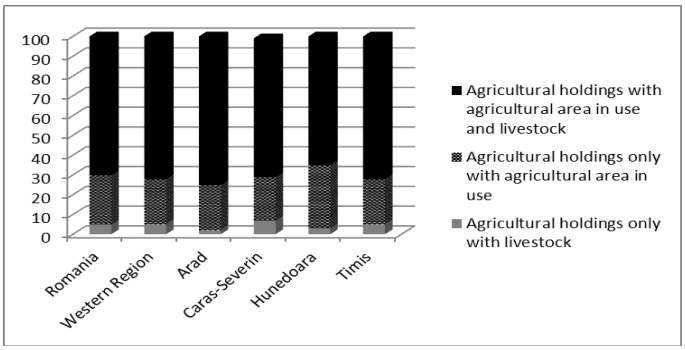


Figure 5. Agricultural exploitation structure by way of use
Source: Regional Plan for Development, West Region, 2014-2020

By comparison with holdings profile nationally, there can state that regionally is meeting a higher share of farms with mixed profile and of those with livestock profile and a lower value of farms with vegetable profile.

The analysis of the region's level by counties shows that Arad county is characterized by a higher share (both at regional and national level) of mixed agricultural exploitations. Caras- Severin county is characterized by an excess of regional and national values in terms of the share held by livestock farms and Hunedoara county by overcoming the same values concerning the farms with vegetable profile.

Farms performance is mainly determined by the quality of used production factors. Land is the main factor of production in agriculture. Lately, a growing emphasis should be given to land improvements. (FEHER, 2009)

Regarding the irrigated area, the Western Region holds only 0.55% of the total irrigated area at national level. Of the total area of the region, equipped for irrigation, 49,533 ha, only 2.65% owns the needed infrastructure for irrigations. The situation is different by counties. In first place is Arad county with 55.5% of total irrigated area in the Western Region (27,483 ha), followed by Timis county with 27.5% (13,646 ha) and Hunedoara county with 17% (8,404 ha).

In 2011 the Western Region has held 142,896 ha equipped for soil erosion control aiming at preparation for agricultural activities, at counties level, the largest agricultural equipped areas being held by Caras- Severin county (32.9%), Timis county (27, 8%), Hunedoara county (23.4%) and Arad county (15.9%).

Population employed in agriculture. A country with developed economy is characterized by the predominance of the tertiary sector both in terms of sector share in GDP forming, as well in terms of employed population structure.

Thus, a trend at EU member countries level is of reduction for the population employed in primary sector and leveraging the workforce surplus in the secondary and tertiary sector. This fact is due to engagement in the primary sector of a workforce with high productivity, benefiting thus from an agricultural with a high degree of mechanization, which replaces labor force. (IANCU, 2007)

The employed population in Romanian agriculture, 17.3% is situated at the highest level from the European Union, although lately declines of this were recorded. The main reasons behind the dcline in the share of employment in agriculture are:

- withdrawal from agricultural activity of elderly people;
- relatively low incomes obtained within this activity, these are not attractive to rural youth, and they are directing towards other activities;
- the investments performed in rural areas, still reduced, are not able to absorb the younger workforce.

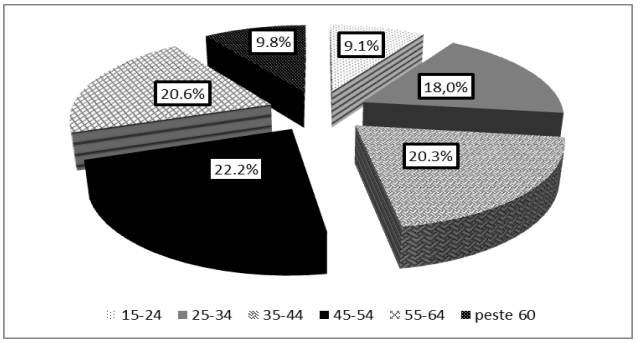


Figure 6. The structure of employed population in agriculture by age groups in the Western Region in 2011

Source: Regional Development Plan, 2014-2020, Western Region

The structure of the employed population in agriculture by age groups shows that young population represents a very small percentage, of 27.1%.

Tourism is an economic activity, a tool to support local and regional development, of economic activity restructuring, particularly in disadvantaged and rural areas.
West Region is a region with great tourism potential, given by a rich and diverse natural picture, a rich hydrographic network, a substantial forestry and wildlife fondation, a wonderful natural landscape and numerous anthropic attraction elements (churches, monasteries, citadels, museums, etc.).
Tourist accommodation in rural areas within the Western Region, rural tourist boardings and agrotouristic hold a share of 16.6% of the housing units number concentrated in this area. The majority of these can be found in Caras –Severin county.

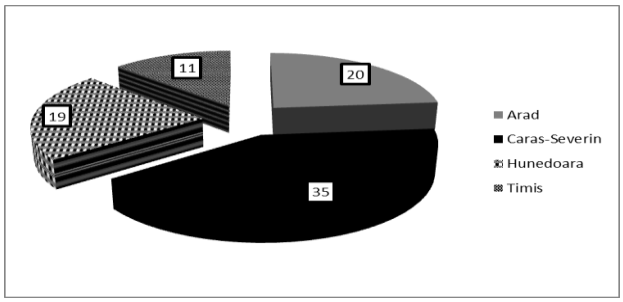


Figure 8. Distribution of agrotouristic boardings by the counties of Western Region, number
Source: Regional Development Plan, 2014-2020, Western Region

The Western Region has a particularly tourism potential, determined primarily by the diversified topography. The natural landscape is preserved mainly in rural settlements, including a number of specific economic activities.
The existing tourism resources in the region can cause practicing of some forms of tourism highly varied, of which within the rural space the most important are: Balneoclimateric tourism, cultural- historical one, viticulture and winemaking, agrotourism, rural tourism, ecotourism, hunting and fishing tourism and mountain tourism.
Rural tourism has grown in recent years due to the increase of urbanization degree. To this factor also contribute the fact that the main tourist attractions points and of heritage are in rural areas. A special form of rural tourism is ***agrotourism,*** which blends very well the agricultural activity with the touristic one. The tourism potential which underpins the development of touristic activities like rural or agro-tourism tourism, are represented by the households from rural space, but also by monastic spaces and hunting lodges. Thus, the residents of rural areas provide for tourists their own home or spaces specifically designed for tourism, offering them the opportunity to taste their traditional products and to actively participate to farm life (fruit picking, milking cows, etc.). This form of tourism is common met in mountainous areas where the local population combines very good the agricultural activities (forestry and wood processing, harvesting and processing of berries, as well the small industry or crafts) with the touristic ones .
Ecotourism is actually the most valuable manifestation of sustainable tourism. This form of tourism is aimed primarily to environmental conservation and focuses on the education of tourists in what regards protection and conservation of environment.
Ecotourism can be a viable alternative towards economic development for communities with few income-generating activities. Moreover, the ecotourism can increase the level of education and awareness of tourists, turning them into enthusiastic supporters of preserving the natural and cultural environment.

This form of tourism can be practiced in parks and natural reserves on the region territory: Mures Floodplain Natural Park, Retezat National Park, National Park Cheile Nerei-Beusnita Domogled - Cerna Valley Nation Parck and Satchinez Reserve etc.

Today, following agrotourism and ecotourism, a special attention is given to the ***viticulture and winemaking tourism***, the tourists being interested in educational travels, instead of passive ones. Thus, an organized visit in a detailed manner in one vineyard offers to visitors the possibility to learn the technological process of wine production as well of vine cultivation. On the other hand, tourists have the opportunity to become familiar with a wide variety of landscapes without giving up to comfortable accommodation conditions and not least, to discover traditional food and customs of the visited areas.

Hunting and sport fishing tourism: The Western Region has a rich heritage of hunting and fishing. The hunting tradition represents a vigorous part of Romanian material and spiritual culture. The existence of a major river networks makes possible the development of fishing tourism. We must mention as well the existent trout ponds in the region.

Featuring a rich touristic potential, the rural space of Western Region has the opportunity to develop non-agricultural activities, which will contribute greatly to increase the economic development degree and to improve the live standard of rural communities.

CONCLUSIONS

Following the analysis undertaken a further development of Wester Region is desired, so that it becomes a competitive region, both nationally and at EU level.

The economic development of the region aimes in particular towarding to a dynamic and diversified economy, the use of some highly qualified human resources and oriented towards specific activities of tertiary sector, an efficient agriculture, well equipped in technical terms and the enhancement of all available economic resources.

The development and diversification of economic activities in the region through innovation, attraction of investments and promotion of a competitive business environment are important factors that determine the economic growth and diversification of the region.

Increasing the number of jobs and of employment degree, reducing the unemployment rate and increasing the incomes for rural area residents will lead at increasing the standard of living and at improving the quality of life for the inhabitants of these areas.

Paying a particular attention to natural landscape, improving and preserving the environmental factors to ensure sustainable rural development and promoting of rural tourism, agrotourism and ecotourism will also contribute at increasing rural prosperity of rural space in the region.

REFERENCES

FEHER ANDREA (2009): Finanțarea agriculturii și dezvoltării rurale. Politici comunitare, Editura Orizonturi Universitare, Timișoara

IANCU TIBERIU (2007): Economie agară, Editura Agroptint, Timișoara

MATEOC-SÎRB NICOLETA, MĂNESCU CAMELIA-MARIA (2012): Dezvoltarea și organizarea teritoriului, Editura Mirton, Timișoara

OTIMAN P.I. (coord.) (2006): Dezvoltare rurală durabilă în România, Editura Academiei Române, București

VINCZE MARIA (2000): Dezvoltare regională și rurală, Presa Universitară Clujeană

INSTITUTUL NAȚIONAL DE STATISTICĂ (2012): Anularul Statistic al României

MINISTERUL AGRICULTURII ȘI DEZVOLTĂRII RURALE (2013): Planul pentru Dezvoltare Regională, 2014-2020, Regiunea Vest

Review on Agriculture and Rural Development 2014. vol. 3 (1) ISSN 2063-4803

ACTIVE MEASURES FOR DECREASING THE UNEMPLOYMENT RATE IN THE RURAL AREA OF THE WESTERN REGION, OF ROMANIA

TIBERIU IANCU, TABITA HURMUZACHE, IOAN BRAD

Banat's University of Agricultural Sciences and Veterinary Medicine fromTimisoara
Faculty of Farm Management
Calea Aradului, no.119, 300645, Timisoara, Romania
tibi_iancu@gmx.de

ABSTRACT
The progress of each society is based on labor. The economic development level of the society is reflected in the occupation degree of the man power. The way this is involved in the economic activity determines important consequences in the social and economic activity of a country.
Every social and economic development of the society must focus on the human being. The approach of such a subject concerning the decrease of the unemployment rate represents a very important problem for the national economy.
An important characteristic of labor force from rural area is pronounced underemployment caused directly by the lack of economic infrastructure to have on base non-agricultural activities and which would contribute to maintaining the imbalance and disparity between urban and rural areas, in witch regards social-economic development.
The structure of employment is dependent on population dynamics and constitutes a real incentive in attracting investments in all economic sectors and increasing economic development degree of a region. Thus, in the realized study we will pay a particular attention to employment and active population, achieving a meaningful analysis on economic indicators that characterize this situation: the employment rate and unemployment.

Keywords: labor, unemployment, active population, occupied population, unemployment rate

INTRODUCTION

The unemployment problem is not a national one. It is an acute problem of the contemporary world, to create conditions so that the man power gets actively involved in the economy. At global level we can find this incapacity of the society to use the most important production factor for the economic growth and development – man power.
The unemployment is considered an economic misbalance between the demand and offer of man power. In this case we talk about a higher offer man power than demand, part of the population suitable for work does not have an employment.
The western development region was founded with governmental approval on the 28th October 1998 and consists in 4 counties: Arad, Caras – Severin, Hunedoara and Timis. From economic development point of view, the western region is considered as a developed region, with higher economic results than the national average and with high growth potential.

MATERIAL AND METHOD

For a comprehensive analysis of the occupational situation the countryside of Western Region, Romania, has made a thorough analysis of statistical data. The results were interpreted and based on them were drawn a number of conclusions and some proposals have been made on reducing unemployment and increasing employment of labor in the area studied.

RESULTS

The western development region is located in the western part of Romania, at the border with Hungary and Serbia, and consists, from administrative point of view, of the following counties: Arad, Caras –Severin, Hunedoara and Timis.

Aspects characterizing man power in the Western Region

The western region has a surface of 32,034 km^2, representing 13.4% of the total country area. In year 2011, the population of West Region was 1,913,831 inhabitants, representing 8.94% from Romania 's population. West Region was situated on fifth place in terms of changes of population level. Thus, during 2000-2011, the population of West Region decreased with 130,739 persons, meaning 6.4%, while at national level there was a decrease of 4.6 %.

The analysis by counties, of the share of inhabitants, by area of residence, indicating the fact that in Arad county, 44.9 % from total the population is concentrated in rural areas. On second is placed Caras-Severin county with 44.0%, followed by Timis county with 38.5% and Hunedoara county with 23.4 %.

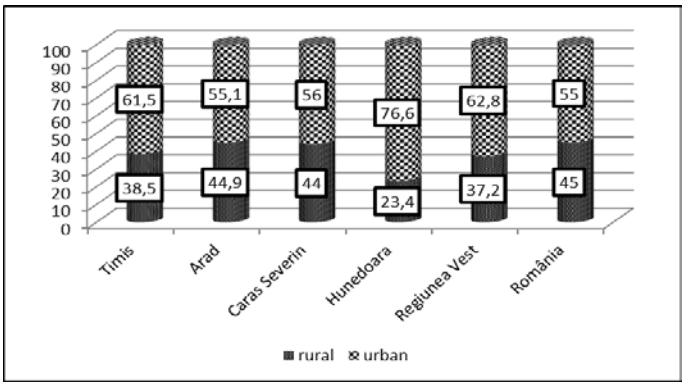


Figure 1. The population structure by residence environment

Concerning the population structure based on residence environment we can state that the western region is a rural area, 37.2% of the region population lives in the rural environment. At national level it represents 13.5% of the total rural population.

At national level rural population represents 45%, from total population. The fact that, at West Region level, the rural population has a lower value than at national average is mainly due to the high degree of urbanization specific to Hunedoara county, which is the second county , after Bucharest-Ilfov, as urbanization level.

Most of the rural population of the western region is in Timis county, 36.1% and Hunedoara county has 15.2%.

In the analysis process of the man power occupation, the occupied population has a special attention. This represents that part of the active population that is actually involved in an economic activity, being the category that produces goods and services needed by the economy.

In order to highlight how well is structured on branches and sectors the occupied population we use as indicator the occupation degree calculated as percentage between the number of occupied population and the total capable population.

The changes from the economy determined changes in the occupied population structure both from the point of view of the number of persons employed in different economic activities and of the environment, urban or rural where these activities are deployed. Most

of the rural population of the western region is in Timis county, 36.1% and Hunedoara county has 15.2%.

In the analysis process of the man power occupation, the occupied population has a special attention. This represents that part of the active population that is actually involved in an economic activity, being the category that produces goods and services needed by the economy.

In order to highlight how well is structured on branches and sectors the occupied population we use as indicator the occupation degree calculated as percentage between the number of occupied population and the total capable population.

The changes from the economy determined changes in the occupied population structure both from the point of view of the number of persons employed in different economic activities and of the environment, urban or rural where these activities are deployed.

In the period 2001 – 2011 both the active population and the occupied population registered increases of 0.01 – 0.02%. Still, the analysis of the active population according to sexes and residence environments shows a lower increase of the male active population (3000 persons) and of the active population from the rural environment (3000 persons). Concerning the occupied population we can notice similar increases, the highest are registered in the urban environment (10000 persons compared to 7000 persons from the rural environment) and in the case of male population.

In 2010 the active population of Romania consisted in 9965 persons and the occupied one consisted in 9240 persons. In both cases the number of male persons is higher and more persons are registered in the urban environment than in the rural environment.

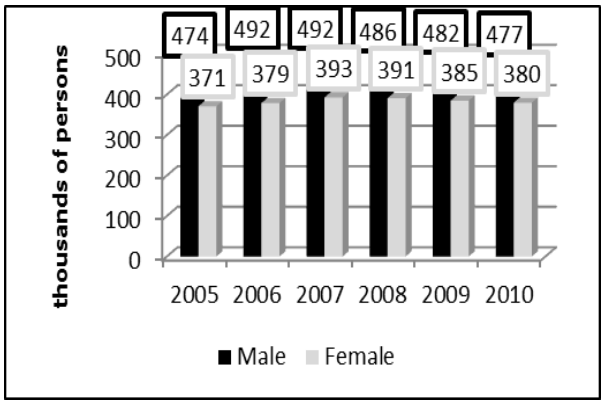


Figure 2. Active population evolution, according to sexes, 2005 – 2010
Source: Romanian statistical yearbook, 2011

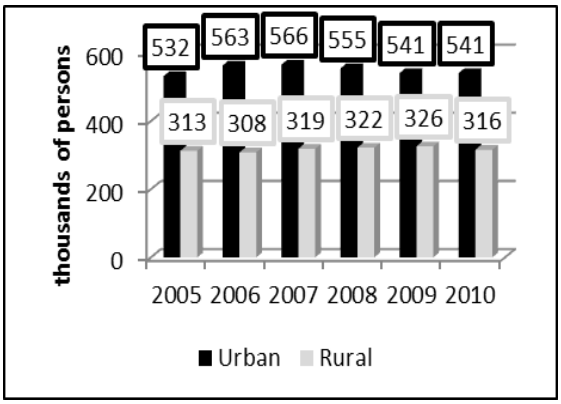


Figure 3. Active population evolution according to residence environment
Source: Romanian statistical yearbook, 2011

Concerning the analysis of the active population according to sexes we can notice different situations. In the analyzed period there is an increase of the male active population, in the first three years of the period, and then it continuously decreases. The same situation is noticed for the female population.

In the six years of analysis we can notice both increase and decrease periods. So, in the case of urban population we notice a 6.4% increase of the active population during 2005 – 2007, followed by a decrease in the first two years (4.42%), in 2010 the active population had the same value as in 2009. In the rural environment there is a fluctuating situation. The highest value is registered in 2009, 362000 persons are capable for deploying an economic activity in the rural environment. However in 2010 the number of active population decrease with 0.31%.

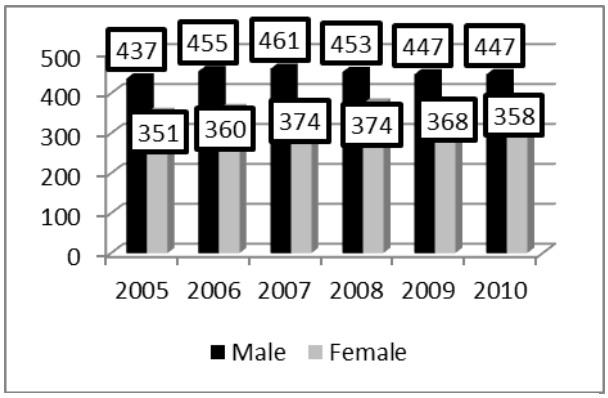


Figure 4. Occupied population evolution, according to sexes, 2005 – 2010
Source: Romanian statistical yearbook, 2011

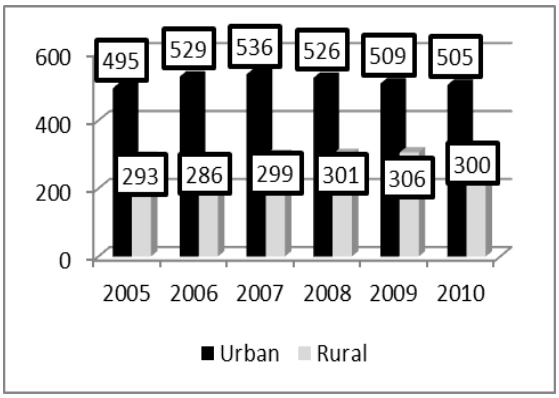


Figure 5. Occupied population evolution, according to residence environment
Source: Romanian statistical yearbook, 2011

In *Figure 4* we presented the occupied population evolution according to sexes. Concerning the evolution of the male occupied population we can notice that in 2010 this counted 10000 persons compared to 2005, after a sinuous evolution in the seven years of analysis, starting with increases till 2007 (5.49%) and followed by continuous decreases. The female occupied population decreased with 7000 persons in the analyzed period following the same evolution that the male population.

The structure of the occupied population according to residence environments shows a higher occupation degree in the urban environment than in the rural environment. Even if during the analyzed period there were significant increases related to the occupied population from the urban environment (8.28%) during 2005 – 2007, at the end of the period there is an increase of only 2%.

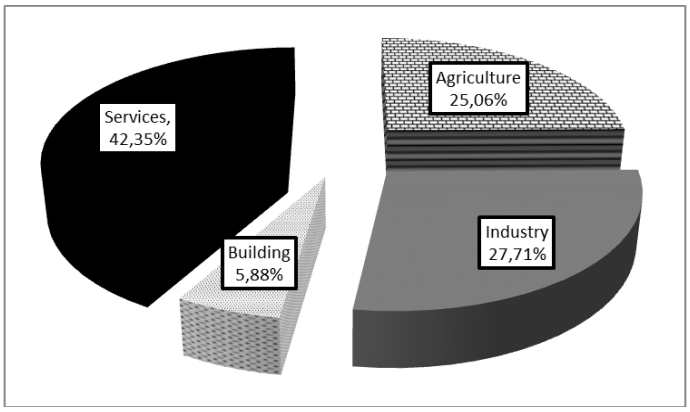


Figure 6. Occupied population structure according to main economic activities, Western region, 2010
Source: Romanian statistical yearbook, 2011

Concerning the population structure according to economic branches we can observe a decrease of the occupied population in the primary and secondary sector and increase of the occupation degree in the tertiary sector. The decrease of the occupied population in the first two sectors must be analyzed separately. So, in the case of agriculture we talk about a decrease of the labor resources because this sector is not attractive with a low productivity. Still, in agriculture there is a large number of the occupied population. In case of industry, the analysis must be realized on the composing activities because some industrial branches are in decline generating unemployment but there are also profitable industries where we notice increases of the occupied population.

Western Region unemployment analysis

The unemployment is a social phenomenon with negative influences on the human society development and is the direct result of the restructuring process and of the adaptation of national economy to the open market economy requirements.

In 2010, in the western region there were 69707 unemployed persons where 51177 were declared (*Figure 7*). The analysis of the unemployed persons at counties' level shows that Hunedoara is the county with the highest number of unemployed persons, 31% of the unemployed persons from the region. On the second place is Timis with 23.85%, followed closely by Caras – Severin with 22.99% and Arad has the lowest level of unemployment 22.18%.

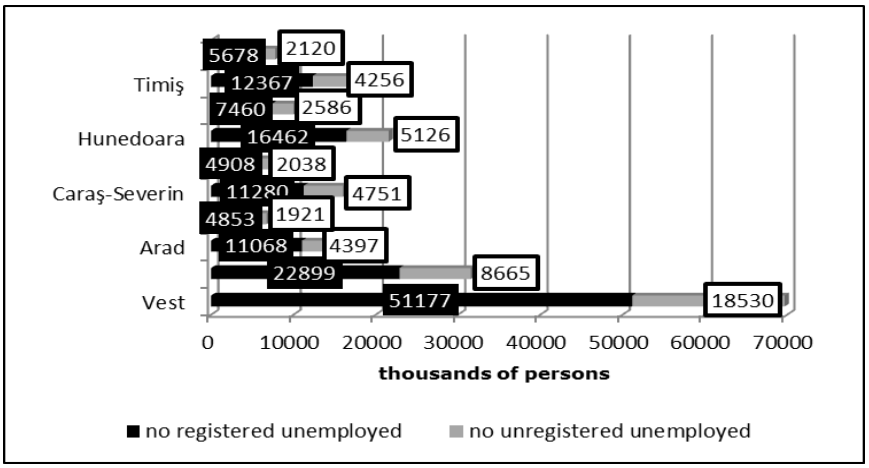


Figure 7. Unemployment number in western region, 2010

Source: Romanian statistical yearbook, 2011

In the unemployment analysis according to sexes we can notice that women represent only 45.28% of the total number, the highest percentage is represented by men. At county level, the number of female unemployed persons is the same as at global level. A more often used method to express the number of unemployed persons is the unemployment rate.

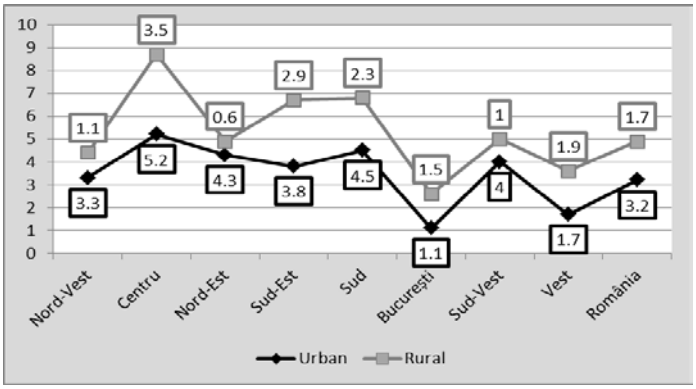


Figure 8. Unemployment rate according to development regions and residence environments, 2010

Concerning the unemployment rate according to residence environments (*Figure 8*), in the western region, we notice that it is higher in the rural area, 1.9%, compared to the urban environment 1.7%.

The masked unemployment is a phenomenon which is present also in the rural environment because almost 85% of the rural population works in agriculture with part – time due to the fact that the population already has a full-time job.

The geographical distribution of the unemployment certifies the preservation of the men occupational vulnerability; the risk of being unemployed among women exists only in the case of the counties with high demographic degradation (ageing) and where the occupational restructuring is in progress.

CONCLUSIONS

In conclusion, the unemployment is an economic misbalance which creates several negative consequences on the society, in general, and on its members, in particular:

- ✓ Decrease of the production volume for goods and services which could be realized by the unemployed persons;
- ✓ Incomplete usage of the labor resources;
- ✓ Decrease of incomes for the inactive man power, but in the same time the decrease of the contributions to the state budget which could come from the unemployed persons' contribution if they were employed;
- ✓ Decrease of the purchasing power of the unemployed persons and of the quantities of goods and services purchased by the persons in such situations;
- ✓ The decrease of state budget by paying the unemployment allocations;
- ✓ Occurrence of some antisocial phenomena as a result of the lack of an income (criminality, delinquency, etc)

In order to reduce the unemployment among the population from rural environment, we propose the following measures:

1. Correlation of studies with the demand from the labor market;
2. Inform the young people about the existent opportunities for education and training in non – agricultural activities;
3. Inform and support the occupied persons from the rural environment, from subsistence agriculture, about the development of businesses other than agriculture;
4. Involvement of local communities' in attracting foreign investors in the area in order to create new jobs;
5. Organization at local level of enterpriser training courses.

Nevertheless, the unemployment represents both an economic problem and a social one. From economic point of view, the unemployment represents an incomplete usage of the labor resource and from social point of view the unemployment is the cause of a precarious life, the persons in such situation have low incomes and try to survive.

REFERENCES

IANCU TIBERIU (2007): Economie agrară, Editura Agroprint, Timișoara

MANOLESCU A. (2003): Managementul resurselor umane, Ediţia a patra, Editura Economică, Bucureşti.

INSTITUTUL NAȚIONAL DE STATISTICĂ (2012): Anuarul Statistic al României.

INSTITUTUL NAȚIONAL DE STATISTICĂ (2011): Forţa de muncă în România. Ocupare şi şomaj pentru anii 2008-2010

MINISTERUL AGRICULTURII SI DEZVOLTĂRII RURALE (2007): Programul Naţional de Dezvoltare Rurală, 2007-2013

MINISTERUL AGRICULTURII SI DEZVOLTĂRII RURALE (2012): Programul Naţional de Dezvoltare Rurală, 2014-2020

Review on Agriculture and Rural Development 2014. vol. 3 (1) ISSN 2063-4803

LABOUR PRODUCTIVITY GROWTH FOR ECONOMIC DEVELOPMENT

YASER MUEETH A. ALKAHTANI

Szent István University, Faculty of Economics and Social Sciences
Doctoral School of Management and Business Administration
Institute of Regional Economics and Rural Development
H-2100 Gödöllő, Páter Károly u. 1.
zsarnoczai.sandor@gtk.szie.hu

ABSTRACT
The object of the case-study focuses on the RLP (real labour productivity) per hour worked in EU-27 for the period of 2000-2010. Generally the real labour productivity affects the changing of the economic structure relevant to market conditions. The real labour productivity growth per hour worked can provide the marginal competitiveness either for any economy or for any firm, or transnational corporation.
The study analyses the correlations between the real labour productivity conditions and GDP or general growth of economies based on the statistical analysing methods from point of view of macro economic level. The study makes analyses among member states in EU-27 in field of comparing the real labour productivity growth per hour worked based on using statistical data coming from IMF (International Monetary Found) and Eurostat.
In case of Germany it can be seen that the highest developed economy could also realise less GDP growth in spite of higher growth of RLP, for example 2% of RLP growth, 0.8% GDP growth in 1996, 2.3% of RLP growth, 1.7% GDP growth in 1997, 2.5% of RLP growth, 1.5% GDP growth in 2001, 0.9% of RLP growth, -0,4% GDP growth in 2003. The reason of this contradiction was resulted by decreasing trend and fall of US economy. Even less RLP growth rate can result considerable competitiveness on the world market for highly developed member states of EU, which leads to increase large significant export value for member states. The export oriented strategy of companies is very useful to increase the price incomes also by through of export increase to create higher level of real labour productivity growth.
The world economic crisis affected the economic development of the highest developed economies of EU-27 and by through of these strongest EU member states also affected other less developed member states of EU. The EU-27 could not avoid of the world economic crisis, because this was started by US, as the first foreign economic partner of EU-27. The RLP growth can not affect automatically on the real GDP growth rate volume, because influences of RLP are determined by the foreign economic contacts and foreign trade of the EU-27, which can consequently realise results of the RLP growth for GDP growth. The spirit of the RLP growth is the development of innovation.

Keywords: Labour productivity, Competitiveness, GDP growth, Innovation, Foreign trade

INTRODUCTION

The object of the case-study focuses on the RLP (real labour productivity) per hour worked in EU-27 for the period of 2000- 2010/2011. Generally the real labour productivity affects the changing of the economic structure relevant to market conditions. Therefore the labour productivity can became basis for the economic development within the free market system. The study has importance to analyse correlations between the labour productivity and economic development. The labour productivity growing rate determines the development trends of the economy and affects the employment conditions based on the different economic sectors.
At present the real labour productivity rate concerning the GDP growth is very different in each region of the world economy and main country-group, emphasizing the economic role and conditions in EU-27. These differences in field of labour productivity are very vary in case of regions and show how each country can have more favourable conditions then the other one in field of labour productivity conditions, which can be titled as the important

social approach of the economic growth.
The real labour productivity growth per hour worked can provide the marginal competitiveness either for any economy or for any firm, or transnational corporation. Naturally the real labour productivity and the competitiveness based on either comparative or competitive advantages need for continuous education for employees in order that they become more skilled and satisfactory for demands of the world market (see in detailed NESZMÉLYI, 2001; NESZMÉLYI, 1999).

MATERIAL AND METHOD

The study analyses the *correlations* between the real labour productivity conditions and GDP or general growth of economies based on the *statistical analysing methods* from point of view of *macro economic level*. Naturally the macro economic process can include some main influences on the economic background of firms or mostly transnational corporations, which can develop more the innovation concerning special economic conditions of each country or region and market conditions. The *transnational corporations* have important role in flow of goods, labour force, capital and services. Therefore the transnational corporations emphasize the using the skilled worker in the production works and service activities.

The real labour productivity conditions can be overviewed either at firm level as human resources management or at national level as labour force market conditions. From point of view of macro economic level the study makes analyses among member states in EU-27 in field of comparing the real labour productivity growth per hour worked based on using statistical data coming from *IMF (International Monetary Found)* and Eurostat. The international analyses emphasized the differences among the wage and salary costs, and also non wage costs. This study uses analysis based on per unit of labour input, measured by total number of hours worked.
Some experts emphasize wage conditions of company effecting the RLP growth was to pay for employees, which are as follows (LUPTON AND BOWEY, 1983; COLE, 1988): 1- retain and motivate sufficient numbers of suitable employees to meet production needs; 2- encourage the optimum productivity from employees; 3- ensure of a high level of quality of output; 4- recognise the value of jobs in relation to each other; 5- enable employees to share in the growth and prosperity of the organization; 6- ensure the labour costs are suitably controlled in relation to other costs and in relation to revenues (role of human resources, see in detailed in ZSARNÓCZAI, 1979).

RESULTS

The RLP (real labour productivity) growth per hour worked in % can successfully increase based on the innovation development concerning the competitiveness on the world market and not based on the lower cost of labour force, in spite that this labour cost can also decrease. The RLP sharply fluctuated in Poland, where this was -47.5% in 2000, than it increased by 4.8% in 2003, 3.6% in 2009; in Bulgaria -11.7% in 1996, 10.2% in 2000; in Romania 16.0% in 2002 and -5.1% in 2009 (*Table 3*; *Figure 2*).

Table 1. Real GDP growth rate volume, percentage change on previous year

geo\time	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
EU (27 countries)	1.8	2.7	3	3	3.9	2.2	1.3	1.4	2.5	2	3.3	3.2	0.3	-4.3	2	1.6	0.6	1.5
EU (25 countries)	1.8	2.8	3	3.1	3.9	2.1	1.3	1.4	2.5	1.9	3.3	3.2	0.2	-4.2	2	1.6	0.6	1.5
EU (15 countries)	1.7	2.7	3	3	3.9	2.1	1.2	1.2	2.4	1.8	3.1	3	0	-4.3	2	1.5	0.5	1.4
Belgium	1.4	3.7	1.9	3.5	3.7	0.8	1.4	0.8	3.3	1.7	2.7	2.9	1	-2.8	2.3	2.2	0.9	1.5
Bulgaria	-9.4	-5.6	4	4.4	5.7	4.2	4.7	5.5	6.7	6.4	6.5	6.4	6.2	-5.5	0.2	2.2	2.3	3
Czech Republic	4.5	-0.9	-0.2	1.7	4.2	3.1	2.1	3.8	4.7	6.8	7	5.7	3.1	-4.7	2.7	1.8	0.7	1.7
Denmark	2.8	3.2	2.2	2.6	3.5	0.7	0.5	0.4	2.3	2.4	3.4	1.6	-0.8	-5.8	1.3	1.2	1.4	1.7
Germany	0.8	1.7	1.9	1.9	3.1	1.5	0	-0.4	1.2	0.7	3.7	3.3	1.1	-5.1	3.7	3	0.8	1.5
Greece	2.4	3.6	3.4	3.4	3.5	4.2	3.4	5.9	4.4	2.3	5.5	3	-0.2	-3.3	-3.5	-5.5	-2.8	0.7
Spain	2.5	3.9	4.5	4.7	5	3.7	2.7	3.1	3.3	3.6	4.1	3.5	0.9	-3.7	-0.1	0.7	0.7	1.4
France	1.1	2.2	3.4	3.3	3.7	1.8	0.9	0.9	2.5	1.8	2.5	2.3	-0.1	-2.7	1.5	1.6	0.6	1.4
Italy	1.1	1.9	1.4	1.5	3.7	1.9	0.5	0	1.7	0.9	2.2	1.7	-1.2	-5.1	1.5	0.5	0.1	0.7
Hungary	0.2	3.1	4.1	3.2	4.2	3.7	4.5	3.9	4.8	4	3.9	0.1	0.9	-6.8	1.3	1.4	0.5	1.4
Netherlands	3.4	4.3	3.9	4.7	3.9	1.9	0.1	0.3	2.2	2	3.4	3.9	1.8	-3.5	1.7	1.8	0.5	1.3
Austria	2.5	2.3	3.8	3.5	3.7	0.9	1.7	0.9	2.6	2.4	3.7	3.7	1.4	-3.8	2.3	2.9	0.9	1.9
Finland	3.6	6.2	5	3.9	5.3	2.3	1.8	2	4.1	2.9	4.4	5.3	1	-8.2	3.6	3.1	1.4	1.7
Sweden	1.6	2.7	4.2	4.7	4.5	1.3	2.5	2.3	4.2	3.2	4.3	3.3	-0.6	-5.2	5.6	4	1.4	2.1
United Kingdom	**2.9**	**3.4**	**3.8**	**3.7**	**4.5**	**3.1**	**2.7**	**3.5**	**3**	**2.1**	**2.6**	**3.5**	**-1.1**	**-4.4**	**2.1**	**0.7**	**0.6**	**1.5**

Eurostat
Hyperlink to the table:
http://epp.eurostat.ec.europa.eu/tgm/table.do?tab=table&init=1&plugin=1&language=en&pcode=tsieb020
General Disclaimer of the EC: http://europa.eu/geninfo/legal_notices_en.htm
Short Description: Gross domestic product (GDP) is a measure of the economic activity, defined as the value of all goods and services produced less the value of any goods or services used in their creation. The calculation of the annual growth rate of GDP volume is intended to allow comparisons of the dynamics of economic development both over time and between economies of different sizes. For measuring the growth rate of GDP in terms of volumes, the GDP at current prices are valued in the prices of the previous year and the thus computed volume changes are imposed on the level of a reference year; this is called a chain-linked series. Accordingly, price movements will not inflate the growth rate.

Table 2. Unemployment rate by sex, world and regions (%), Both sex/Regions/year

	2000	2004	2005	2006	2007	2008	2009	2010
World	**6.3**	**6.4**	**6.2**	**5.9**	**5.6**	**5.7**	**6.3**	**6.2**
Developed Economies and European Union	6,7	7.2	6.9	6.3	5.8	6.1	8.4	8.8
Central and South-Eastern Europe (non-EU) and CIS	10,9	9.9	9.4	9.3	8.6	8.6	10.4	9.6
Middle East	10.6	11.2	11.2	10.7	10.5	10.2	10.3	10.3
North Africa	**14.1**	**11.9**	**11.6**	**10.5**	**10.2**	**9.6**	**9.9**	**9.8**

2010 are preliminary estimates; 2011 are projections.
Source: IMF, WORLD ECONOMIC OUTLOOK, OCTOBER 2010.

In general the less developed EU member states, for example Romania, were strongly influenced by the world economic conditions. Also the FDI (foreign direct investment) has wide side connections with *Romania, Poland and Bulgaria*, but *FDI* also decreased its investment activities based on the unfavourable world economic changes, which created decreasing trend of RLP in these countries. In spite that centres of transnational corporations are mainly in *Germany, U.K. (United Kingdom) and France*; these member states are not so depend on the direct influences of FDI, their real GDP growth volume has considerably decreased for periods of the world economic crisis in 2008-2009 (*Table 1*). Naturally the RLP growth is strongly depends on the export and by through of its export incomes and price incomes of the companies. The price income fall can decrease the productivity in fields of RLP and generally production.

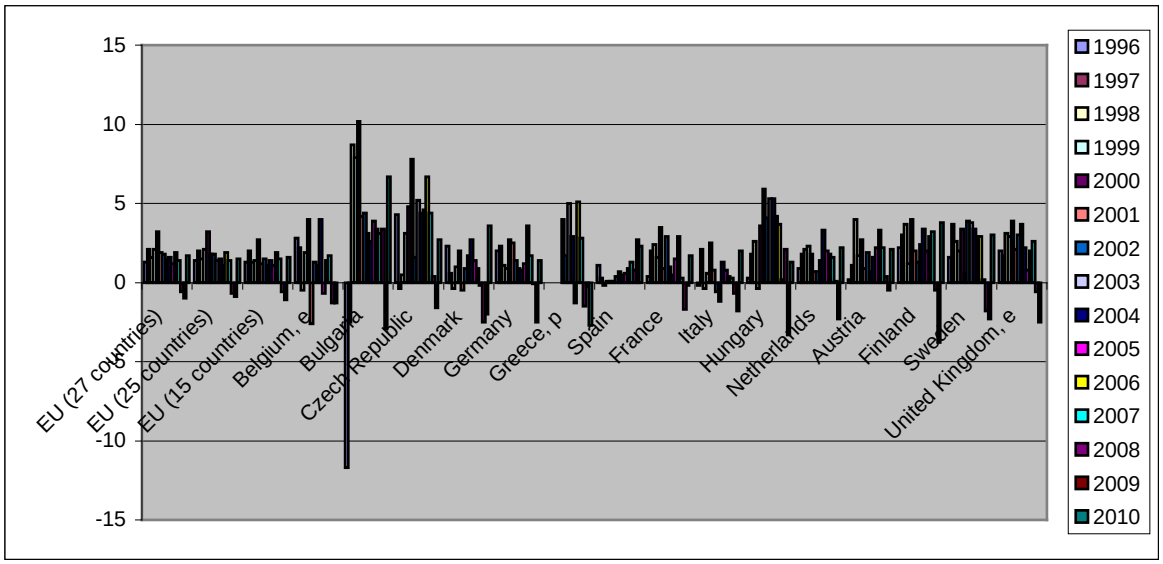


Figure 2. Real labour productivity growth per hour worked, % change over previous year, index 2000 = 100, Percentage change on previous period.

Source: :=Not available e=Estimated value b=Break in series p=Provisional value (2010)
Footnote: http://epp.eurostat.ec.europa.eu/cache/ITY_SDDS/Annexes/nama_esms_an2.htm
Source of Data: Eurostat, Hyperlink to the table:
http://epp.eurostat.ec.europa.eu/tgm/table.do?tab=table&init=1&plugin=1&language=en&pcode=tsdec310
General Disclaimer of the EC: http://europa.eu/geninfo/legal_notices_en.htm

In case of *Germany* it can be seen that the highest developed economy could also realise less GDP growth in spite of higher growth of RLP, for example 2% of RLP growth, 0.8% GDP growth in 1996, 2.3% of RLP growth, 1.7% GDP growth in 1997, 2.5% of RLP growth, 1.5% GDP growth in 2001, 0.9% of RLP growth, -0.4% GDP growth in 2003. The reason of this contradiction was resulted by decreasing trend and fall of US economy.
In general, the RLP growth per hour worked results more growing rate of the real GDP growth volume than the RLP's growth rate in member states of EU-27 (*Table 1*; *Table 2*). But even the less decreasing RLP growth rate can stimulate considerable GDP fall in EU. Also less strong economy, for example *Bulgaria*, in spite that the considerable RLP growth rate the GDP implements poorly increasing rate, in 2000 the RLP was 10.2% and the GDP growth was 5.7%. In case of other highly developed economies this difference of the RLP and GDP growth rates can happen, but almost after the economic crisis or recession process.
On the one hand this difference of the RLP and GDP growth rates can be explained that the RLP growth rate can be more difficultly calculated in service sector, than in industry.
On the other hand even less *RLP growth rate can result considerable competitiveness on the world market for highly developed member states of EU*, which leads to increase large significant *export value* for member states. The *export oriented strategy* of companies is very useful to increase the *price incomes* also by through of *export increase* to create higher level of real labour productivity growth.
In general in *Czech Republic* considerable fall has been implemented for two year period, in 1997-1998 in field of RLP, therefore the RLP change could not successfully effect on the GDP growth rate volume. In fact the favourable growth of RLP accompanying with GDP growth has occurred for almost one decade from 1999 to the end of 2007.

Table 3. Real labour productivity growth per hour worked% change over previous year, index 2000 = 100, Percentage change on previous period geo\time

	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
EU (27 countries)	1.3	2.1	1.6	2.1	3.2	1.9	1.8	1.5	1.6	1.2	1.9	1.4	-0.6	-1	1.7
EU (25 countries)	1.4	2	1.5	2.1	3.2	1.8	1.8	1.4	1.5	1.1	1.9	1.4	-0.7	-0.9	1.5
EU (15 countries)	1.3	2	1.3	1.4	2.7	1.2	1.5	1.1	1.4	1.1	1.9	1.5	-0.6	-1.1	1.6
Belgium, e	2.8	2.2	-0.5	1.9	4	-2.6	1.3	1.1	4	-0.7	1.4	1.7	-1.3	-1.3	:
Bulgaria	-11.7	-2.5	8.7	7.9	10.2	4.2	4.4	3.1	2.6	3.9	3.4	3.1	3.4	-2.9	6.7
Czech Republic	4.3	-0.4	0.5	3.1	4.8	7.8	1.6	5.2	4.4	4.6	6.7	4.4	0.4	-1.6	2.7
Denmark	2.3	0.6	-0.4	1	2	-0.5	0.9	1.7	2.7	1.4	0.9	-0.2	-2.5	-2	3.6
Germany	2	2.3	1.1	0.9	2.7	2.5	1.4	0.9	0.8	1.2	3.6	1.7	-0.1	-2.5	1.4
Greece, p	:	:	:	:	:	4	1.7	5	2.9	-1.3	5.1	2.8	-1.5	-0.3	-2.7
Spain	1.1	0.3	-0.2	0.1	0.1	0.1	0.4	0.7	0.5	0.6	0.9	1.3	0.8	2.7	2.3
France	0.4	2	2.4	1.6	3.5	0.9	2.9	1	0.5	1.5	2.9	0.3	-1.7	-0.2	1.7
Italy	-0.2	2.1	-0.4	0.6	2.5	0.8	-0.6	-1.2	1.3	0.8	0.4	0.3	-0.7	-1.8	2
Hungary	0.3	1.8	2.6	-0.4	3.6	5.9	4.1	5.3	5.3	4.2	3.7	0.2	2.1	-3.3	1.3
Netherlands	0.9	1.8	2.1	2.3	1.8	0.7	0.7	1.4	3.3	2	1.8	1.6	0.1	-2.3	2.2
Austria	0.2	1.1	4	1.7	2.7	0.9	1.9	0.7	1.6	2.2	3.3	2.2	0.4	-0.5	2.1
Finland	2.2	3	3.7	1.2	4	2	1.3	2.4	3.4	2	2.9	3.2	-0.5	-3.8	3.8
Sweden	1.6	3.7	2.6	2	3.4	0.6	3.9	3.8	3.4	2.9	2.9	0.2	-1.8	-2.3	3
United Kingdom, e	**2**	**1.7**	**3.1**	**2.9**	**3.9**	**2.1**	**3**	**3.7**	**2.2**	**0.8**	**2**	**2.6**	**-0.6**	**-2.5**	**:**

Source:=Not available e=Estimated value b=Break in series p=Provisional value
Footnote: http://epp.eurostat.ec.europa.eu/cache/ITY_SDDS/Annexes/nama_esms_an2.htm
Source of Data: Eurostat
Hyperlink to the table:
http://epp.eurostat.ec.europa.eu/tgm/table.do?tab=table&init=1&plugin=1&language=en&pcode=tsdec310
General Disclaimer of the EC: http://europa.eu/geninfo/legal_notices_en.htm
Short Description: Real labour productivity per hour worked is calculated as real output (deflated GDP measured in chain-linked volumes, reference year 2000) per unit of labour input (measured by the total number of hours worked).
Measuring labour productivity per hour worked provides a better picture of productivity developments in the economy than labour productivity per person employed, as it eliminates differences in the full time/part time composition of the workforce across countries and years.
Code: tsdec310
Total Labour Costs (TOT) cover wage and non-wage costs less subsidies. It does not include vocational training costs or other expenditures such as recruitment costs, spending on working clothes, etc.
Wage and salary costs (WAG) include direct remunerations, bonuses, and allowances paid by an employer in cash or in kind to an employee in return for work done, payments to employees saving schemes, payments for days not worked and remunerations in kind such as food, drink, fuel, company cars, etc.
Labour costs other than wages and salaries (OTH - non-wage costs) include the employers' social contributions plus employment taxes regarded as labour costs less subsidies intended to refund part or all of the employer's cost of direct remuneration. The labour cost index covers the following economic activities: - Industry (NACE Rev. 2 sectors B to E); B Mining and quarrying, C Manufacturing, D Electricity, gas, steam and air conditioning supply, E Water supply; sewerage, waste management and remediation activities. - Construction (NACE Rev. 2 sector F). - Services (NACE Rev. 2 sectors G to N);

This was resulted by favourable world market conditions and consolidated economic growth of Germany (ZSARNÓCZAI, 1996), which had considerable economic effects on Czech Republic. Hourly labour costs in the *euro area* (EA-17) rose by 2.7% in the year up to the third quarter of 2011, compared with 3.3% for the previous quarter. In the *EU-27*, the annual rise was 2.6% up to the third quarter of 2011, compared with 3.2% for the previous quarter. Compared with News Release 134/2011 of 16 September 2011, data for the second quarter of 2011 have been revised from +3.6% to +3.3% for the euro area (EA-17) and from +3.4% to +3.2% for the EU-27. (EUROSTAT, 191/2011 – 16. December,

2011). RLP should be developed more in Hungary, even after 2010 and also in agricultural sector (SZABÓ AND ZSARNÓCZAI, 2004).

CONCLUSIONS

In general it can be declared that the *world economic crisis of 2008-2009 caused significant economic decrease of EU-27 in fields of RLP and GDP growth*. The world economic crisis affected the economic development of the highest developed economies of EU-27 and by through of these strongest EU member states also affected other less developed member states of EU. The EU-27 could not avoid the world economic crisis, because this was started by US, as the first foreign economic partner of EU-27. This world economic crisis was first bank- financial crisis, which extended to other economic sectors and the employment conditions.

The RLP growth can not affect automatically on the real GDP growth rate volume, because influences of RLP are determined by the foreign economic contacts and foreign trade of the EU-27, which can consequently realise results of the RLP growth for GDP growth. The spirit of the RLP growth is the *development of innovation*, as the final basic element for the competitiveness of EU member states on the world market. In spite that increasing unemployment rate in EU also after the world economic crisis, the EU can remain its competitiveness because of increasing of its RLP growth (*Table 2*).

REFERENCES

COLE, G. A. (1988): Personnel management, D.P. Publications Ltd, London

EUROSTAT, 191/2011 – 16. December, 2011

IMF, WORLD ECONOMIC OUTLOOK, OCTOBER 2010.

LUPTON, T., BOWEY, A. M. (1983): Wages and Salaries (2nd. Edn.), Gower

NESZMÉLYI, GY. (2001): The Prospectives of the Economic Cooperation between Hungary and the Republic of Korea Focusing on the Food and Agricultural Sector. East European Studies (ISSN: 1229-442X) 10: (1) 237-253.

NESZMÉLYI, GY. (1999): Main Characteristics and Prospects for Foreign Trade Relations Between Hungary and the ASEAN Countries. Hungarian Agricultural Research, Budapest, 1999, 8: 3. 19-22.

SZABÓ, L., ZSARNÓCZAI, J.S. (2004): Economic conditions of Hungarian agricultural producers in 1990s. (A magyar mezőgazdasági termelők gazdasági helyzete). Agricultural Economics, Czech Academy of Sciences, Institute of Agricultural and Food Information. 50, Prague, (6): 249-254. ISSN 0139-570X.

ZSARNÓCZAI, J.S. (1979): Gazdasági fejlődés és tervgazdálkodás Szíriában. (Economic development and plan-economy in Syria). No 9. Hungarian Academy of Sciences, Economic Review, September, 1103-1118., ISSN 0023-4346.

ZSARNÓCZAI, J.S. (1996): Németország mezőgazdasági helyzete az 1990-es évek első felében. (Agricultural condtions of Germany in second half of 1990-ies). Statisztikai Szemle. KSH, Statistical Review, 74: 3, 230-238. ISSN 0039 0690

Review on Agriculture and Rural Development 2014. vol. 3 (1) ISSN 2063-4803

ECONOMIC STRUCTURE CHANGES IN SAUDI ARABIA

YASER MUEETH A. ALKAHTANI

Szent István University, Faculty of Economics and Social Sciences
Doctoral School of Management and Business Administration
Institute of Regional Economics and Rural Development
H-2100 Gödöllő, Páter Károly u. 1.
zsarnoczai.sandor@gtk.szie.hu

ABSTRACT
The economic structure changes are overviewed from point of employment conditions in Saudi Arabia, because the economic growth is based on skilled level of labour forces and in the same time on the innovation development. The mining sector of fossil energy in Saudi Arabia is basic principle sector, but the Saudi economy needs to extent its economic structure in order that most of population of the country can obtain jobs for employment. In general the *mining sector is very efficient* and productive in Saudi Arabia, which means based on the innovation development this sector provides considerable share of the GDP and export-price income for the country. The study uses analyse methods based on the statistical data and their compares, which emphasizes the economic structure of Saudi Arabia concerning different economic sectors. The data can provide overview on shares of some main economic branches and their roles in employment issues and GDP production.
The mining and quarrying sector provided jobs for 1.78% of all employees in 2000 and 1.6% of them in middle of 2000s in Saudi Arabia. In the same time the mineral products had 88.3% share of all export of Saudi Arabia in 2000-2002 and 88.0% of all export by middle 2000s in million riyals. This means that the export price income after selling crude oils and other mining products ensured 2354 riyal per employee of this sector in 2000-2002 and 4357.4 riyal per employee of this sector in middle 2000s.
In general in Saudi Arabia the *mining sector based on the crude oil withdraw could be efficient* and productive, because of the high world market price can provide enough highly export-price income for the country with using less number of employees in this sector than in the other one. Less than 2% of all employees produced 88% of all export of Saudi Arabia in 2000s. Even the share of employees in the mining and quarrying sector has decreased since 2000s, but its share of export value remained at almost same level in Saudi Arabia. Even the share of employees in the mining and quarrying sector has decreased since 2000s, but its share of export value remained at almost same level in Saudi Arabia. The Saudi Arabia should develop the manufacturing industries in order *to produce highly value added products* leading to higher export price income, than to sell only crude oil to the world market. Also manufacturing value added production helps Saudi Arabia to become diversified economy less sensitive from effects of the world economy.

Keywords: Economic structure, Employment conditions, Economic growth, Mining sector. Export-price income

INTRODUCTION

The economic structure changes are overviewed from point of employment conditions in Saudi Arabia, because the economic growth is based on skilled level of labour forces and in the same time on the innovation development. The economic structure changes should meet the market demands and the labour force should be changed to follow demands of the economic structure changes. In this case the market demands, the economic structure changes, and the labour force structure changes have very strong correlations among themselves.
Naturally the economic growth or the economic structure changes are appearing in the economic activities of companies based on the general economic background at national and international economic levels. At national level the governmental, fiscal policy and

also the monetary policy help or stimulate companies to follow the needed trends of economic growth. At the international level governments create the cross border economic co-operations to extent possibilities of economic activities for private companies. Saudi Arabia plays important role in field of supplying fossil energy resources on the world market.

The mining sector of fossil energy in Saudi Arabia is basic principle sector, but the Saudi economy needs to extent its economic structure in order that most of population of the country can obtain jobs for employment. In general the *mining sector is very efficient* and productive in Saudi Arabia, which means based on the innovation development this sector provides considerable share of the GDP and export-price income for the country. But fewer amounts of labour force or workers are employed in this mining sector, and even the number of employees in fossil energy resource sector continuously decreases from year to year. But the other part of employees should get works to keep satisfactory standard of their life. This economic process emphasizes the importance of economic structure changes for interest of economic growth.

There are some examples for cross border cooperation at the international level as co-operation of Hungary with South Korea and other Asian economies in works of NESZMÉLYI, (2001) and NESZMÉLYI, (1999). Also other authors declared that how each economic sector or branch, for example the agricultural sector in Hungary should be developed to create the competitiveness SZABÓ - ZSARNÓCZAI (2004).

According to above mentioned works of different authors in general any economic branch can contribute to harmonized economic growth of each national economy.

MATERIAL AND METHOD

The study uses analyse methods based on the statistical data and their compares, which emphasizes the economic structure of Saudi Arabia concerning different economic sectors. The data can provide overview on shares of some main economic branches and their roles in employment issues and GDP production.

For development of Saudi Arab economy there are some important essential scientific ideas, namely, labour markets are not only impacted by but can also impact outcomes related to global economic rebalancing. In countries that have historically relied on consumption for growth and which are seeking to expand exports, enhancing productivity will be essential as this reduces unit labour cost and can increase competitiveness in the global economy (ILO, 2011).

This emphasizes the international economic influences for economies, including also Saudi Arabia, how the national economies are impacted by the global economic processes. Also Zsarnóczai emphasized role of education for employees to become skilled workers in order that any national economy can get competitiveness on the world market (ZSARNÓCZAI, 1979). Also ZSARNÓCZAI (1996) emphasized the cooperation between producers even in agricultural sector with using advisory system to keep the competitiveness of producers on national-domestic and international markets.

Also some authors emphasized the costs for skill, when they selected costs for labour forces, namely BOWEY AND LUPTON (1973) devised basis for making comparisons between rates of pay in different companies. They selected five factors for comparisons among jobs: skill, responsibility, metal effort, physical effort, working conditions. Other experts worked out that despite the apparent diversity of types of costs, the literature trends to classify them under three heading: *variable costs* (i.e. the hourly wage rate), *quasi fixed costs* (i.e. employer lump sum payroll taxes) and *adjustment costs*; i.e. hiring and firing costs, such as

training costs and redundancy payment (see in detailed in BOSWORTH ET AL, 2006; and NICKELL, 1986). It can be declared from point of view of variable costs, the productiveness of labour force is essential issue for competitiveness. Naturally there are some other costs of labour force, for example adjustment costs are for developing their skill and knowledge.

RESULTS

In general in Saudi Arabia the *mining sector based on the crude oil withdraw could be efficient* and productive, because of the high world market price can provide enough highly export-price income for the country with using less number of employees in this sector than in the other one.

The mining and quarrying sector provided jobs for 1.78% of all employees in 2000 and 1.6% of them in middle of 2000s in Saudi Arabia. In the same time the mineral products had 88,3% share of all export of Saudi Arabia in 2000-2002 and 88,0% of all export by middle 2000s in million riyals. This means that the export price income after selling crude oils and other mining products ensured 2354 riyal per employee of this sector in 2000-2002 and 4357.4 riyal per employee in middle 2000s.

The other sectors had only several % share of the export value, for example chemical products had 5.0% in 2000-2002 and 3.9% in middle 2000s, plastic products had only 3.9% in 2000-2002 and 2.6% in middle 2000s.

From point of view of the export capacity of Saudi Arabia one employee in Saudi mining and quarrying sector was very efficient in 2000s, and the other sectors' employees worked less efficient, because 47.6 riyal export value was per one employee of all of the sectors in 2000-2002 and 79.7 riyal export value was per one employee in middle 2000s in Saudi Arabia. It should be mentioned that not every economic sector played important role in export value or volume, and also not only crude oil production or other products of mining and quarrying sector participated in export of Saudi Arabia. In general it can be mentioned that less than 2% of all employees produced 88% of all export of Saudi Arabia in 2000s. Even the share of employees in the mining and quarrying sector has decreased since 2000s, but its share of export value remained at almost same level in Saudi Arabia.

The Saudi Arabia has favourable possibilities in its foreign trade, namely its all export value was higher than the import value, which means that the export value was 100%, but its import value only 50.9% of the export value in 2000-2002, and its import value only 47.2% of the export value in middle 2000s. This means that the share of import value has decreased in value of export since the beginning of 2000 in Saudi Arabia. The foreign exchange rate was very favourable in 2000s. The positive foreign exchange rate can be remained by the continuous innovation development process in the mining and quarrying sector having the biggest share of Saudi export value. This innovation development of the mining and quarrying sector can ensure the competitiveness of this sector on the world market for the future (see *Table 1* and *Table 2;* REPORT, 2010).

Also it can be mentioned that one side character of economic and consequently export structure resulted in not flexible and unfavourable conditions for structure of labour force in Saudi Arabia. *The import volume is generally very considerable for volume of demands of the domestic Saudi market*, but for the volume of export capacity is very favourable. Also the domestic market volume generally is not so large comparably for other large economies' one. *The considerable import volume* is resulted by unfavourable economic structure based on the non diversified economic structure, which stimulates continuously highly level of import in fields of different kinds of products, for example electrical

machines, equipments, tools; transport equipment and spare parts, base metal and articles of base metal, also chemical products.

Table 1. Employment conditions in Saudi Arabia between 2000 and middle 2000s
(1000 persons aged years and over)

Sectors	2000	Middle of 2000s
Agriculture, hunting and forestry	341.5	263.4
Fishing	7.9	12.2
Mining and quarrying	101.9	95.4
Manufacturing	440.7	448.3
Electricity, gas and water	76.0	65.6
Construction	515.9	629.6
Wholesale and retail trade	901.5	861.7
Restaurant and hotels	164.6	170.3
Transport and communications	242.3	265.3
Financial intermediation	42.5	49.8
Real estate, renting and business	139.5	143.2
Public administration and defence	1116.2	1212.9
Education	713.0	751.5
Health and social work	217.6	224.0
Other community and personal services	133.0	115.4
Private households with employed persons	551.0	595.9
Extra territorial organizations	5.3	8.4
Other activities	3.0	12.5
Total employed	5713.4	5925.4

Source: ILO, 2010, Report of Ministry of Economy and Planning, Saudi Arabia, Riyadh.

Table 2. Export structure in Saudi Arabia between 2000 and middle 2000s in million riyals

Sectors	2002	Middle of 2000s
Mineral products	239.973	415.696
Chemical products	13.704	18.673
Plastic products	5.717	12.455
Total export including others	271.741	472.491

Source: Report of Ministry of Economy and Planning, Saudi Arabia, Riyadh., 2010

CONCLUSIONS

In general it can be declared that the as much as the export value was higher than the value of import the Saudi Government could use over plus crude oil export price incomes to cover costs of: 1- reconstructing highly developed infrastructure network for the industrial production, civil social life; 2- social-family supports, increasing standard of life for people of Saudi Arabia; 3- Foreign Direct Investments (FDI) provided by the Saudi Government and national corporations abroad, including bank deposits into international banks.
On the hand also the highly costly administration, governmental office network should be covered by the over plus crude oil export price incomes, which kind of costs can be titled

as inproductive, but important service sector. This service sector can provides large amount of people of the Saudi economy.

On the other hand the FDIs invested by Saudi corporations are often very successful and effective, because these investments were realised mostly in highly developed economies, as US, European Union and some other important economies, as Switzerland and Japan.

The non diversified economic structure is determined mostly by the unfavourable geographical background, for example drought, scarcity water, lack of many kinds of mining materials over the crude oil, lack of basic metal material in nature, less amount of natural resources over crude oil. These natural conditions led to very expensively agricultural production in Saudi Arabia, for example cost of the milk production is three times more than the world marker price of milk, and cereal production cost is four times more than the world market price of cereals (ZSARNÓCZAI, 1997). Even that the food, agricultural production and food manufacture production are needed for every-day life for Saudi population; these are not productive and efficient because of the unfavourable natural conditions. Therefore the import of these kinds of products is more cheaply than it is to be produced based on the food self sufficiency strategy. Also the agricultural production needs additional costs to direct production costs, for example infrastructure one, transport, road network, storing capacity, information network based on the computer techniques, feed supply for animals, veterinary service, frequently water irrigation supply and system-network, water storing. Any kinds of costs are to cover expenditures of agricultural production make agricultural production is non competitive sector in Saudi Arabia based on the international compare.

Naturally in the highly developed economies, in US or in EU, the agricultural production is very highly costly. Even the cost level of farmers' life standard in these economies is by several times higher than the average level of farmers' life standard in the world economy. The agro-business including the costs of industrial inputs and manufacturing agricultural outputs with building up irrigation system has about 18% of GDP in the USA.

The Saudi Arabia should develop the manufacturing industries in order *to produce highly value added products* leading to higher export price income, than to sell only crude oil to the world market. Also manufacturing value added production helps Saudi Arabia to become diversified economy less sensitive from the effects of the world economy.

REFERENCES

BOSWORTH, D, DAWKINS, P AND STROMBACK, T. (2006): The economics of the labour market. Pearson Education Ltd., Harlow, Essex, London, England, UK, New York, USA, ISBN 0582-44377-6, p. 360

BOWEY, A., LUPTON, T. (1973): Job and pay comparisons, Gower Press

ILO, (International Labour Organisation, 2011): Global Employment Trends 2011, UN ILO, Geneva, Switzerland, 2011, ISBN 978-92-2-124546-9

NESZMÉLYI, GY. (2001): The Prospectives of the Economic Cooperation between Hungary and the Republic of Korea Focusing on the Food and Agricultural Sector. East European Studies (ISSN: 1229-442X) Vol 10 (1): 237-253.

NESZMÉLYI, GY. (1999): Main Characteristics and Prospects for Foreign Trade Relations Between Hungary and the ASEAN Countries. Hungarian Agricultural Research, Budapest, 8 (3): 19-22.

NICKELL, S.J. (1986): 'Dynamic Models of Labour Demand'. In O. Ashenfelter and R. Layard (eds.) Handbook of Labour Economics, Amsterdam, North -Holland

REPORT of Ministry of Economy and Planning, Saudi Arabia, Riyadh., 2010

SZABÓ, L., ZSARNÓCZAI J.S. (2004): Economic conditions of Hungarian agricultural producers in 1990s. (A magyar mezőgazdasági termelők gazdasági helyzete). Agricultural Economics, Czech Academy of Sciences, Institute of Agricultural and Food Information. 50, Prague, (6): 249-254. ISSN 0139-570X.

ZSARNÓCZAI, J. S. (1979): Gazdasági fejlődés és tervgazdálkodás Szíriában. (Economic development and plan-economy in Syria). MTA, Közgazdasági Szemle, No 9. Hungarian Academy of Sciences, Economic Review, September, 1103-1118., ISSN 0023-4346.

ZSARNÓCZAI, J.S. (1996): Németország mezőgazdasági helyzete az 1990-es évek első felében. (Agricultural conditions of Germany in second half of 1990-ies). Statisztikai Szemle. KSH (Hungarian Statistical Office, Statistical Review), 74. (3): 230-238. ISSN 0039 0690

ZSARNÓCZAI, J.S. (1997): Közel-Kelet élelmiszerhelyzetének kilátásai. (Perspective of food condition in Middle East). Gazdálkodás (Agricultural Economy) agricultural scientific monthly bulletin 41. (11): 55-61. HU ISSN 0046-5518

Review on Agriculture and Rural Development 2014. vol. 3 (1) ISSN 2063-4803

THE HYDROCULTURE OF *EUPHORBIA PULCHERRIMA* WILLD.

ZSUZSA TURI - FARKAS

Kecskemet College, Faculty of Horticulture, Department of Horticulture
Kecskemét 6000. Erdei F. tér 1-3., Hungary
turine.zsuzsa@kfk.kefo.hu

ABSTRACT
Euphorbia pulcherrima is getting more popular. Its decorative upper leaf rosettes are colourful (red, pink, white This is typically a short day plant. It is a water demanding plant, so it can be used in hydroponics. This growing method is getting more importance in our days, because closed-cycle system satisfies the strictest environmental requirements. The growing was taking place in two growing houses, the French Filclair plastic house and Prmeur-1 German glass house.The purpose of the research was to compare varieties and the effect of the two growing houses. According to our findings the height of 'Freedom Red' – as a medium growth variety- exceeded that of 'Cortez Red' and 'Cortez White' varieties. The number of laves of 'Cortez White' variety exceeded the two other varieties. As for the diameter of the rosettes 'Freedom Red' variety had the best quality, as these were the biggest. By comparing the two growing houses (Filclair plastic and Primeu-1) we found that growing houses did not influence the quality (height, number of leaves, diameter of upper leaves) of the flowers at any of the 3 varieties.

Keywords: variety test, plant height, number of leaves, diameter of upper leaves, growing equipment.

INTRODUCTION

After we terminated growing greenhouse cut flowers we started to grow poinsettia in hydroponics at the College Faculty of Horticulture of the Kecskemét College. This plant is mostly grown in pots but also used as cut flower in our days. The popularity of poinsettia is increasing. Its red, pink, and white rosette upper leaves are very ornamental. Most of the grown varieties have red rosettes. These are the most popular. Poinsettia is a typically short day plant. Due to its high water demand it is successfully grown in hydroponics. Hydroponic growing technique is spreading, because closed circulating systems satisfy the strictest environmental demands. The purpose of the research was to compare different varieties in two different growing houses.

Poinsettia is originated in Central America highlands, in humid, tropic climate. The plant height can be 3-4 meter. It is a bush or a tree. It is a monoecious, bisexual, with very reduced flowers at the shoot tip. The upper leaves are toning from the end of November till the end of December in our light conditions (IMRE, 1999). It is an obligate short day plant. Its critical light time is 12 hour. The period of reaction time, from the beginning of short day until booming, is 8-11 weeks depending on variety (GYARMATHY, 1998). 18-24 ^{o}C is its optimal temperature demand (OSZKÓNÉ, 1979; IMRE, 1999; DALLMANN, WARTENBERG, 1999; SCHMIDT, 2002). According to NAGY (1986) in generative stage 18 ^{o}C is enough. It needs a continuous water supply, but is sensitive to slack water. It demands light, slightly acidic (6,0-6,5 pH) growing substrate. It demands nutrients (MERZ, 1999). It is especially sensitive to the lack of Molybdenum in low pH (IMRE, 1999). It tolerates medium nutriment concentration (NAGY, 1986). This plant is propagated in a vegetative way, by shoot cuttings. The timing of cutting determines the quality of the goods. Retardants (Alar, CCC, Basacel) can be used to have a more compact plant with more branches. According to the latest findings a better branching can be achieved without nipping.

Erwinia and Pytium and Rhizoctonia bacteria can infect poinsettia (MERZ, 1999). Its most common pests are glashouse whitefly, wooly scale insect and the larvae of Lycoriella

modesta in the soil (NAGY, 1986; GYOLLAINÉ, 1999). Trichogamma can be used against glasshouse whitefly resistant races as a biological control (KREBS, 1993).

MATERIAL AND METHOD

We tested 3 varieties in our research:

- 'Freedom Red': red upper leaves, medium growth. Its reaction time is 6-7 weeks.
- 'Cortez Red': red upper leaves, compact growth. Its reaction time is 8 weeks.
- 'Cortez White': white upper leaves, compact growth. Its reaction time is 8 weeks.

Two types of growing houses were used: French Filclair plastic and East-German Primer 1 glass house. Poinsettia rooted cuttings were planted in 12 cm diameter pots in the first decade of August. Chopped Polyurethane-ether foam was used as growing substrate. Potted plants were placed in beds which were padded by plastic foil. Nutrient solution was circulated in a closed system between the nutrient solution container and the beds. As we stated it before closed circulation systems meet the strictest environmental requirements. Volldünger fertilizer was used for nutrient supply. During growing we continuously measured and adjusted EC and pH of nutrient solution. We set the pH to 5.0-6.5 and the conductivity to 2,5-3,5 mS/cm. Plant protection was made similar to conventional growing method. Plants were raised without retardants and nipping. The development of the plant, plant height, number of leaves and the diameter of rosettes before marketing were measured weekly. The research was repeated in 4 times. During the research we compared the effect of applied varieties and growing houses.

RESULTS

In poinsettia hydroponics the height of 'Freedom Red' variety, that is a medium growth variety, exceeded that of the 'Cortez Red' a 'Cortez White' varieties *(Table 1)*. The later varieties had a compact shape.

Table 1. Poinsettia height in different growing houses
Kecskemét, year 2010

Dates of measure-ments	average plant height (cm)					
	'Freedom Red'		'Cortez Red'		'Cortez White'	
	plastic	glass	plastic	glass	plastic	glass
08 09	13	-	11	-	11	-
15 09	15	-	13	-	13	-
22 09	17	-	15	-	15	-
29 09	20	-	18	-	18	-
06 10	22	-	20	-	21	-
13 10	24	24	20	23	23	22
20 10	26	25	23	23	24	23
27 10	30	28	26	27	27	26
03 11	33	33	29	31	30	29
10 11	37	38	31	33	32	31
17 11	38	40	32	34	31	31
24 11	38	40	33	34	33	32

Source: TURI – FARKAS (2010)

As far as leaf development is concerned ’Cortez’ variety had the most compact shape.

They formed the most leaves and had a bushy shape *(Table 2).* 'Cortez White' had the most leaves exceeding the two others.

Table 2. Poinsettia leaf number in to different growing houses Kecskemét, year 2010

Dates of measure-ments	average number of leaves (peace)					
	'Freedom Red'		'Cortez Red'		'Cortez White'	
	plastic	glass	plastic	glass	plastic	glass
08 09	15	-	14	-	15	-
15 09	17	-	16	-	16	-
22 09	20	-	19	-	19	-
29 09	22	-	22	-	21	-
06 10	24	-	36	-	50	-
13 10	26	24	41	38	61	46
20 10	27	26	41	41	64	49
27 10	29	30	44	45	66	58
03 11	31	32	49	49	75	63
10 11	33	34	55	58	83	72
17 11	34	37	58	63	91	58
24 11	34	38	60	66	102	88

Source: TURI – FARKAS (2010)

As far as the upper leaf rosettes' diameter is concerned 'Freedom Red' was the most favourable *(Table 3).* These leaves were the biggest of all the varieties.

Table 3. The diameter of decorative poinsettia upper leaves in different houses Kecskemét, year 2010

diameter of upper leaves (cm)					
'Freedom Red'		'Cortez Red'		'Cortez White'	
plastic	glass	plastic	glass	plastic	glass
30	30	26	24	23	22

Source: TURI – FARKAS (2010)

CONCLUSIONS

When the two houses (Filclair plastic and Primer-1 glass) are compared (see in *Tables 1-2-3*) we found that the type of house only slightly influence flower quality (height, number of leaves, diameter of upper leaf rosette).

Only two variants were considered: growing house and variety. 'Freedom Red', a variety of medium growth, had higher shoots than that of 'Cortez'.

'Cortez Red' and 'Cortez White' varieties had a compact growth, but an intensive development of foliage.

'Freedom Red' had the largest bracts diameter. Growing houses had no significant effect on the quality attributes of flower.

This growing method makes it possible to grow not only cut flower and potted plants, but also mother plant in hydroponics. Furthermore it makes possible to further utilize foam mediums that were used in a previous cut flower growing.

REFERENCES

DALLMANN, M., WARTENBERG, S. (1999): Qualitätsplus durch weißen Tischbelag. Deutscher Gartenbau 20. 18 - 19 p.
GYARMATHY S. (1998.) Mikulásvirág in Czáka Sarolta: Cserepes dísznövények. Mezõgazda Kiadó, Budapest. 112 - 126 p.
GYOLLAINÉ MERÉNYI A. (1999): A mikulásvirágról. Kertészet és Szõlészet 30. 12 - 13 p.
IMRE CS. (1999): A mikulásvirág termesztése in Schmidt Gábor: Növényházi dísznövények termesztése KÉE Kertészeti Kar Budapest, Jegyzet. 147 - 151 p.
KREBS, E - K. (1993): Bemisia in Poinsettien biologisch bekämpfbar. Gartenbau magazine 58 - 60 p.
MERZ, F. (1999): Poinsettien. Deutscher Gartenbau 26. 34 - 35 p.
NAGY B. (1986): Növényházi dísznövények termesztése és hajtatása. Mezõgazdasági Kiadó, Budapest 319 - 324 p.
OSZKÓNÉ SIPOS E. (1979): A mikulásvirág. Mezõgazdasági Kiadó, Budapest 216 p.
SCHMIDT G. (2002): Növényházi dísznövények termesztése. Mezőgazda Kiadó, Budapest, 626 p.

Review on Agriculture and Rural Development 2014. vol. 3 (1) ISSN 2063-4803

DEVELOPMENT OF HYDRO – CULTURAL CUT FLOWERS GROWING

ZSUZSA TURI - FARKAS

Kecskemet College,
Faculty of Horticulture
Department of Horticulture
Kecskemét 6000. Erdei F. tér 1-3.
turine.zsuzsa@kfk.kefo.hu

ABSTRACT
Closed, circulation system hydroponics satisfies the strictest environmental protection regulations, environmentally friendly, nutriments do not contaminate soil water and there is no need for soil sterilization, no chemicals pollutes environment. It is well mechanised and controlled and optimal conditions for the plant are provided. Thus, yield increases. It is saving nutriment and water. By considering these facts we can say that there is a better timing, better programmed then chemo culture.
As for the cut flowers we found that stem yield in hydroponics is about the same than that is in traditional soil mix and chemo culture. Flower quality is however better due to the more balanced nutriment supply. This is especially true for the vase-endurance
Processing data by phytomonitor enables to develop an optimal nutriment supply, a cost saving and environmentally friendly technology.

Keywords: hydroculture, Zantedeschia, rose, Phytomonitor

INTRODUCTION

The advantages of hydroponics are:
- soil is not needed (TARJÁNYINÉ, 1980),
- independent from soil characteristics (no soil cultivation, no soil exchange and sterilisation) (IMRE, 1995),
- it is easier to sterilise substrates than the soils (TARJÁNYINÉ, 1980),
- less labour consuming as there is no soil cultivation needed (TARJÁNYINÉ, 1980),
- no pests in the root substrate (IMRE, 1995),
- substrate is inorganic and there is no need to protect plants against soil pests (TARJÁNYINÉ, 1980),
- the crop is standard especially in the root surrounding (BENOIT, CEUSTERMANS, 1995),
- we exclude soil infection and the accumulation of pesticide residues (BENOIT, CEUSTERMANS, 1995; FISCHER, 1991),
- energy input can be lowered in the root zone (BENOIT, CEUSTERMANS, 1995; MORGAN, MOUSTAFA, 1986; IMRE, 1995),
- water uptake is reduced (BENOIT, CEUSTERMANS, 1995; FISCHER, 1991; IMRE, 1995),
- more efficient nutriment uptake (BENOIT, CEUSTERMANS, 1995; FISCHER, 1991; IMRE, 1995),
- more efficient control of plant vegetative and generative development (BENOIT, CEUSTERMANS, 1995; FISCHER, 1991),
- earlier and higher yield (BENOIT, CEUSTERMANS, 1995; MORGAN, MOUSTAFA,1986; FERENCZ, 1998 a),
- longer growing season (plants are more healthy), changes of crops arefaster than on soil (IMRE, 1995),
- plant productivity is better utilized (IMRE, 1995),

- higher income is achieved (FERENCZ, 1998 b),
- better quality crop (BENOIT, CEUSTERMANS, 1995),
- more rational logistic (BENOIT, CEUSTERMANS, 1995; FERENCZ, 1996),
- better automation and mechanization of crop (BENOIT, CEUSTERMANS, 1995; MORGAN, MOUSTAFA, 1986; IMRE, 1995),
- 90% more utilization of space (MORGAN, MOUSTAFA, 1986),
- better stem, leaf and flower quality and more sprout is developed (MORGAN, MOUSTAFA 1986),
- environmentally friendly (BENOIT, CEUSTERMANS, 1995; IMRE, 1995).

MATERIAL AND METHOD

The plant species, used since 1998, are greenhouse carnation, *Zantedeschia* and rose.
The experiments were done in Filclair and Primőr-1 greenhouses. The plants were planted in 4 repetitions. The main aspects of hydroponic research are: optimal nutrient supply, timing of cultivation, effects of cultivation substrates, effects of cultivation methods, comparison of varieties, stem yield, flower quality attributes (length of stem, thickness of stem, flower size), vase life. During the statistical analysis we made analysis of variance and calculated the SD 5% values by F-test Student-type.
A PhyTech company plays a pioneer role in the Phytomonitoring ™ system, it detects the plants remotely. It uses advanced methods, collects and analyses the data derived from wireless communication sensors and innovative softwares. The main purpose is the detection of early plant stress, optimal growth and quality of product to increase income.

RESULTS

Vase life of *Zantedeschia*

In case of both the treatment without preserving agents and that with Zwetin solution, the flower of the hydro-cultural stock was significantly more stable at the five survey times compared to the control chemo-cultural stock. The flowers grown in hydro-culture were 3-6 days more durable due to the better supply of nourishing material (*Table 1).*

Table 1. Vase life of *Zantedeschia*, Kecskemét, year 2010

Dates of measure ments	02.03.	09.03.	16.03.	23.03.	30.03.
Metod of growing	**(day)**				
In container	10.75	11.00	11.00	10.75	10.50
In sponge	11.75	11.75	12.00	12.00	12.00
In soil heated container	10.25	10.25	10.50	10.50	10.50
Control	6.75	6.25	7.50	7.50	6.25
Experiment					
In container + Zwetin	13.25	12.75	13.25	13.25	13.50
In sponge + Zwetin	13.50	13.50	14.50	13.50	14.50
In soil heated container + Zwetin	11.00	11.00	11.75	11.50	13.25
Control + Zwetin	9.75	9.25	10.50	10.25	9.25
SD 5%	1.06	1.07	1.10	1.26	0.86

Source: TURI – FARKAS (2010)

Vase life of rose

Vase life of rose is shown in *Table 2.*

Table 2. Vase life of *rose* varieties

Varieties	Vase life (day)	Vase life according to catalogue (day)
'Aloha'	10	12
'Circus'	15	14
'Corvette'	13	14
'Dream'	16	16
'Fantasia'	15	14
'Frisco'	18	16
'Metaliana'	14	12
'Red Corvette'	14	14
'Sioux'	17	18

Source: TURI – FARKAS (2010)

The fluctuation of air temperature well indicates the change of the phases of the day (*Figure 1).*

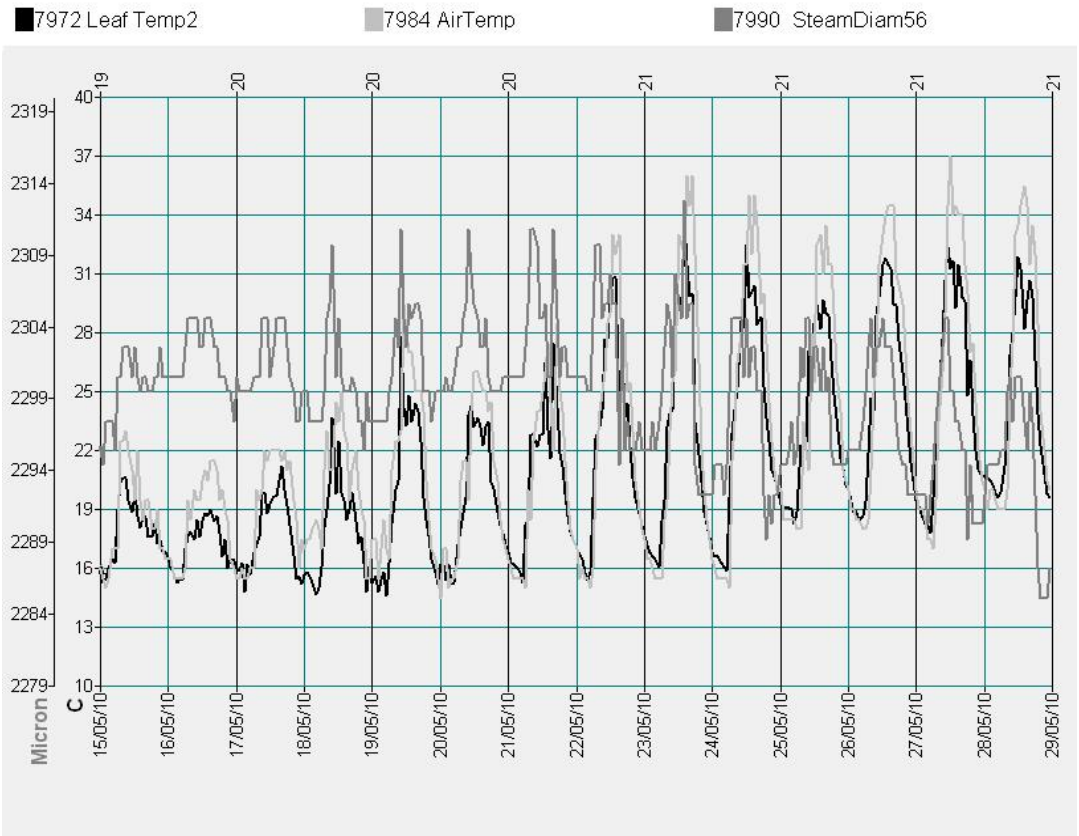


Figure 1. The effect of air temperature on rose leaf temperature and expansion of stem

Source: TURI – FARKAS (2010)

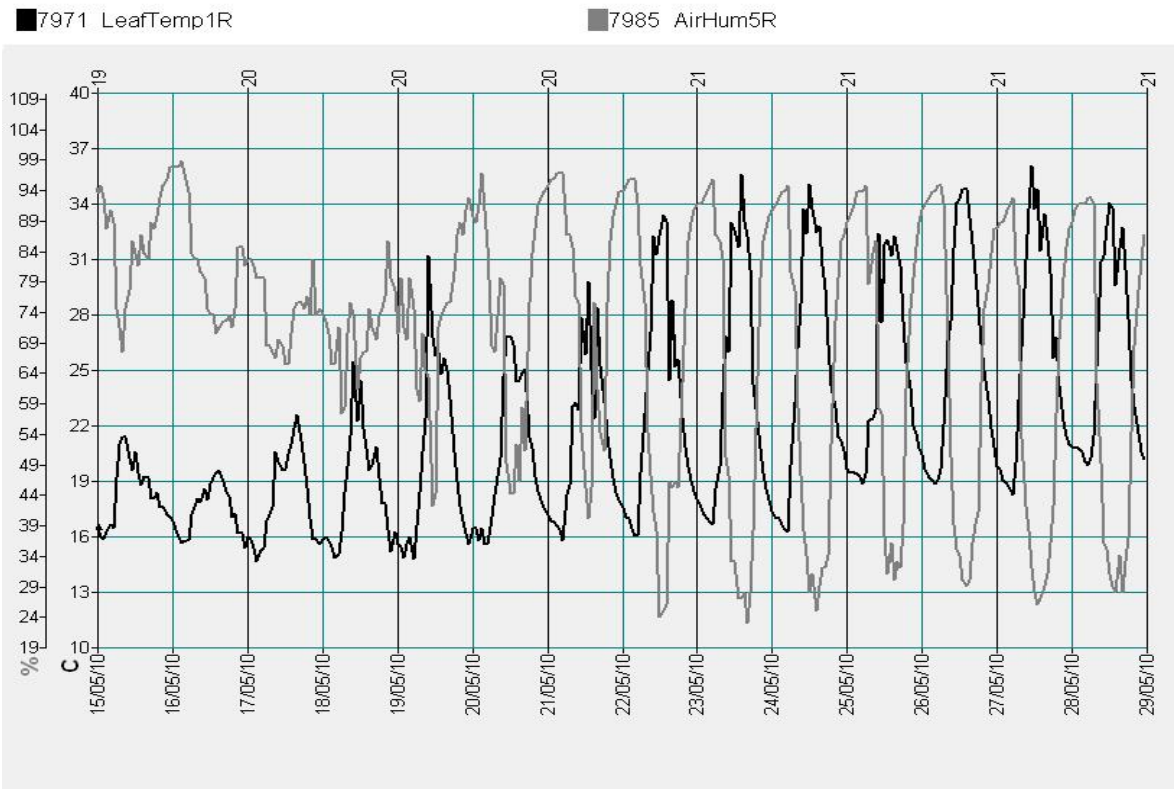


Figure 2. Rose leaf temperature in relation with the air humidity
Source: TURI – FARKAS (2010)

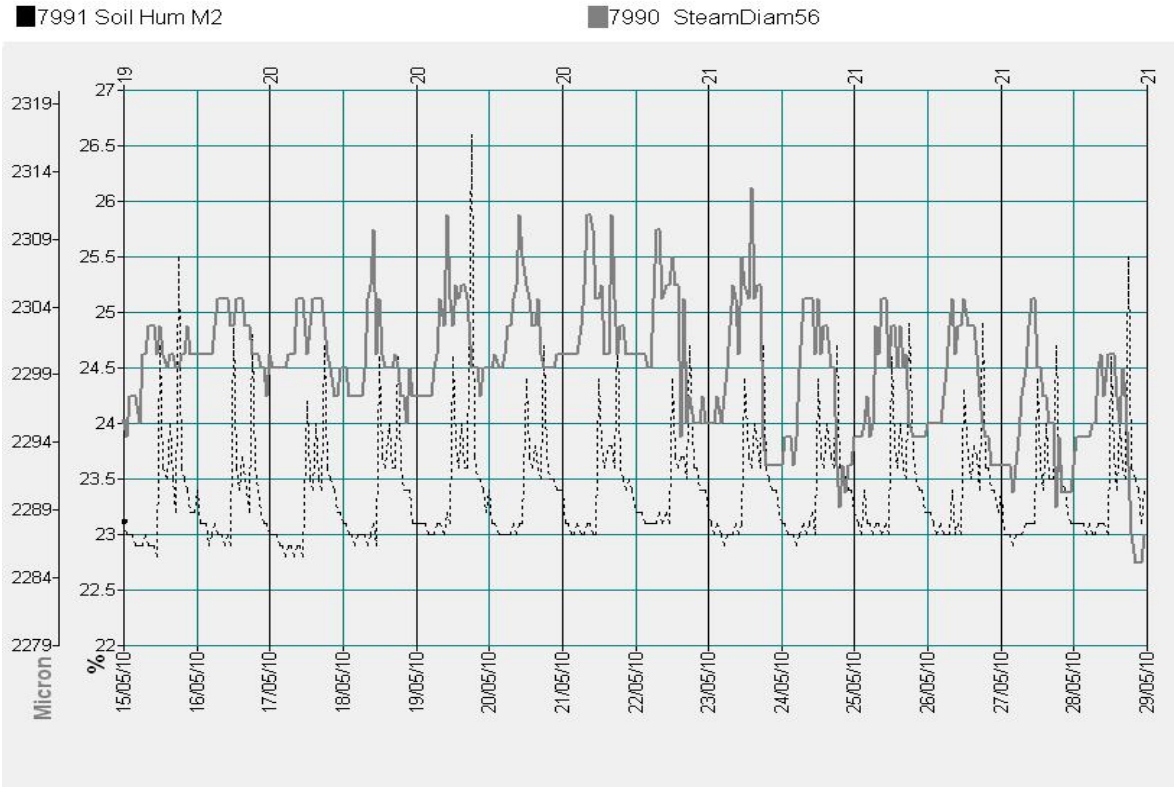


Figure 3. The expansion of rose stem in accordance with soil wetness
Source: TURI – FARKAS (2010)

The expansion of stem follows this cycle. It was pointed out that the higher was the daily

maximum temperature the expansion of stems were more intensive. Respectively the fewer daily fluctuation made the stem expansion more stable. By the increase of daily temperature the expansion of stems are significant. The temperature of leaves increases paralell with the air temperature.
By the increase of temperature the relative humidity decreases. The temperature change of leaves follows the change of air temperature (*Figure 2*). According to it, the relative humidity is higher in the night and lower in the day.
The wetness of soil indicates the time of irrigation (*Figure 3*). The expansion of stems well follows the wetness of the soil.

CONCLUSIONS

We have found that stem yield in greenhouse cut flowers is the same as in hydroponics, traditional soil-mix and in chemo-culture.
However, flower quality is better due to a more harmonised nutrient supply. It is especially the case in vase-life.
The aim of our research is to study the environmental factors on the growth and development of rose with special regard to stem expansion.
The research is being made continuously so that the hydroponics of rose could be analysed in a complex way - together with a detailed environmental and physiologic data processing.
The rose phytomonitor has been developed by the Israeli Phytech Ltd. in order to follow the growth and development of plants. Growers can observe the daily stem expansion, and if it differs from optimal due to a stress situation he can intervene.
Processing the data of the phytomonitor enables the development of an optimal nutrient supply and a less costly, environmentally friendly technology so that it could be more commonly used in the domestic ornamental plant growing.

REFERENCES

BENOIT, F. CEUSTERMANS, N. (1995): Horticultural Aspects of Ecological Soilless Growing Methods. Acta Horticulturae, 346, 11-18 p.
BUSCHMANN, F. (1993): Rosen im Lamstedter Blahton-Substrat Lecaton Typ E. Zierpflanzenbau, 10, 422-423 p.
FISCHER, P. (1991): Geschlossene Anbausysteme bei Schnittblumen. Deutscher Gartenbau, 45 (2) 80-82. p.
FERENCZ Á. (1996): Szegfűtermesztés munkaszervezése Agrárfőiskolák Szövetségének Tudományos Közleményei Szeged, 19/1. 40-46.p.
FERENCZ Á. (1998 a): The economical valuation of gerbera prodution Publicationes Universitas Horticulture Industricque Alimentariae vol. LVII. 59-62.p.
FERENCZ Á. (1998 b): Üvegházi szegfűtermesztés munkaszervezési és ökonómiai értékelése. Phd doktori értekezés. Kertészeti és Élelmiszeripari Egyetem Budapest, 100 p.
IMRE CS. (1995): A hidrokultúra múltja és jövője. Kertészet és Szőlészet, 36, 18 p.
MORGAN, J. V., MOUSTAFA, A. T. (1986): Propagation and growing of spray Chrysanthemums in hydroponics 105 (20) 2-5. p.
TARJÁNYINÉ (1980): Zöldséghajtatás talaj nélküli tápoldattal. Hajtatás, korai termesztés, 11, 2.