

EVALUATION OF IRON CONTENT IN THE GRAIN OF SOME WINTER WHEAT CULTIVARS

SIMION ALDA, LIANA MARIA ALDA, DESPINA MARIA BORDEAN,
DIANA MOIGRADEAN, MIRELA POPA, IOAN GOGOASA, IOSIF GERGEN

University of Agricultural Science and Veterinary Medicine of Banat,
Timisoara, Aradului St. 119.

aldasimion@yahoo.com

ABSTRACT

The purpose of the research is to follow the influence of the biological factor on iron content of nine varieties of winter wheat: Alex, Potenzial, Soissons, Kalango, Apache, Kristina, Lovrin 34, Chevalier and Panonnikus. Two of these (Potenzial, Chevalier) are of German origin, three (Apache, Kalango, Soissons) of French origin, one (Kristina) of Yugoslavian origin, one of Austrian origin (Panonnikus) and two (Alex and Lovrin 34) were created at S.C.D.A Lovrin, Romania. The experimental field was placed on a cambic chernozem in Timisoara (west of Romania) in 2010, and the fertilization level was $N_{120}P_{60}K_{60}$. Quality parameters monitored were: moisture, protein content, hectolitre mass and iron content. Variation in the iron content of different winter wheat cultivars was found in this study. Soissons winter wheat cultivar registered the highest value of iron content (54.3 mg/kg dry matter) followed by Kristina (52.07 mg/kg dry matter) and Kalango (50.45 mg/kg dry matter) winter wheat cultivar. Potenzial and Apache winter wheat cultivars registered the lowest values of iron content: 21.29 (mg/kg dry matter) and 20.5 (mg/kg dry matter), respectively.

Keywords: winter wheat, cultivar, iron content, hectolitre mass, protein

INTRODUCTION

Due to the high consumption of wheat in a variety of food products all over the world, wheat is considered an important source of minerals. Flour is one of the main sources of iron in the diet, which is an important mineral, essential for healthy blood cells and good circulation. The major source of iron is from cereals including wheat flour and other cereal based products. Bread is an excellent source of iron. Nutritional value and bread-making quality in winter wheat depends on the content of starch, fats, mineral substances, vitamins and proteins, which varies between 8- 26% (TABARA ET AL., 2009).

Minerals are important components required by humans in their daily food. Minerals are divided into two groups: macro minerals, which are needed in large amounts, e.g., calcium (Ca), magnesium (Mg) and potassium (K), *etc.*, and micro minerals which are required in smaller quantities, e.g., copper (Cu), zinc (Zn), iron (Fe), boron (B), selenium (Se) (MARTINEZ ET AL., 2009).

The concentration of minerals in wheat flour is genetically determined by the choice of cultivar and environmentally, determined by soil, climate and management practices (DIKEMAN ET AL., 1982). Genetic difference for grain mineral concentration has also been reported from various varietal trials (PETERSON ET AL., 1986; GRAHAM ET AL., 1999; ZHAO ET AL., 2009).

Iron has been considered an essential mineral for human body for over a century. Iron functions primarily as a carrier of oxygen in the body as a part of hemoglobin in the blood and of myoglobin in the muscles. It also aids in immune function, cognitive development, temperature regulation, energy metabolism, and work performance.

The iron content of wheat is strongly influenced by locality and it is positively correlated with protein content (GREER ET AL., 2006).

Hectoliter mass is a winter wheat yield component and represents the weight of one hectoliter of wheat expressed in kilograms.

MATERIAL AND METHOD

Nine wheat varieties were used in this experience: two of these (Potenzial, Chevalier) being of German origin, three (Apache, Kalango, Soissons) of French origin, one (Kristina) of Yugoslavian origin, one of Austrian origin (Panonnikus) and two (Alex and Lovrin 34) created at S.C.D.A Lovrin, Romania.

The experimental field was placed on a cambic chernozem in Timisoara (west of Romania) and the fertilization level was $N_{120}P_{60}K_{60}$. Sampling was done from the mass of wheat grain after harvest. Wheat samples were cleaned of foreign matter and then were processed.

The heavy metal contents in edible parts of vegetables were carried out in HNO_3 solution resulted by plant ash digestion (LĂCĂTUSU ET AL., 2008; KHAN ET AL., 2008).

Each sample solution was prepared with dilute HNO_3 (0,5 N) to a final volume of 50 mL and analyzed by flame atomic absorption spectrometry. Necessary dilutions were made.

The concentrations of Fe in the filtrate was determined by using flame atomic absorption spectrophotometer with high resolution continuum source (Model ContrAA 300, Analytik Jena, Germany). The iron concentration (mean of measurements of three analytical samples) was expressed as mg/kg dry matter.

OmegAnalyzer G device was used for the determination of moisture, protein content and hectoliter mass. This is a German engineered whole grain and seed NIR analyser for rapid analysis, operating in the 730 nm to 1100 nm wavelength range.

RESULTS

The aim of this study was to measure the levels of iron found in nine winter wheat varieties, cultivated under pedoclimatic condition of Banat area, in the 2009/2010 agricultural year.

Humidity is the first quality indicator that was determined, and the winter wheat cultivars had the following values of this parameter: Alex (11.1%), Potenzial (10.7%), Soissons (11.6%), Kalango (11.3%), Apache (10.9%), Chevalier (10.9%), Kristina (11.4%), Lovrin 34 (12.5%) and Panonnikus (12.8%). For these cultivars, the iron content varies between 20.5 mg/kg (Apache) and 54.3 mg/kg (Soissons).

On the comparison of iron concentration (mg/kg dry matter) we observed that Soissons winter wheat variety registered the highest value (54.3 mg/kg) of this parameter, followed by Kristina (52.07 mg/kg) and Kalango (50.45 mg/kg). Potenzial and Apache registered the lowest values of iron content: 21.29 mg/kg and 20.5 mg/kg, respectively.

The hectoliter mass registered values were between 67.7 kg/hl (Soissons) and 76.9 kg/hl (Potenzial).

In *Figure 1* we can observe a negative correlation between hectoliter mass and iron content.

The values of the protein content registered by cultivars are between 10.8% (Apache) and 14.4% (Soissons).

In *Figure 2* the correlation between iron and protein contents in winter wheat cultivars is presented.

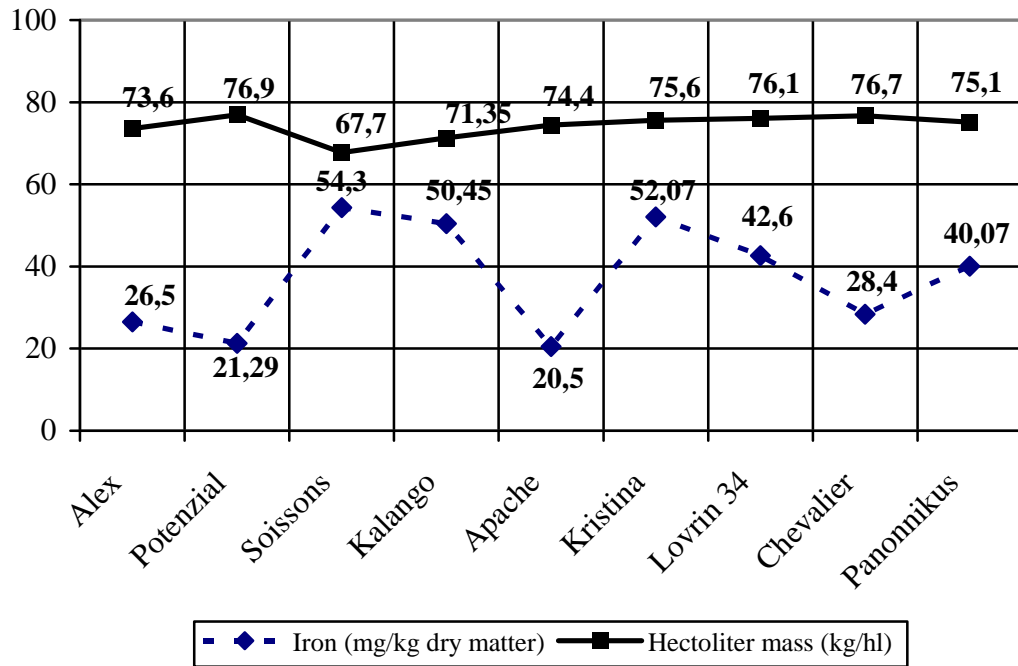


Figure 1. Graphical representation of mean concentration of iron (mg/kg dry matter) and hectoliter mass of winter wheat cultivars

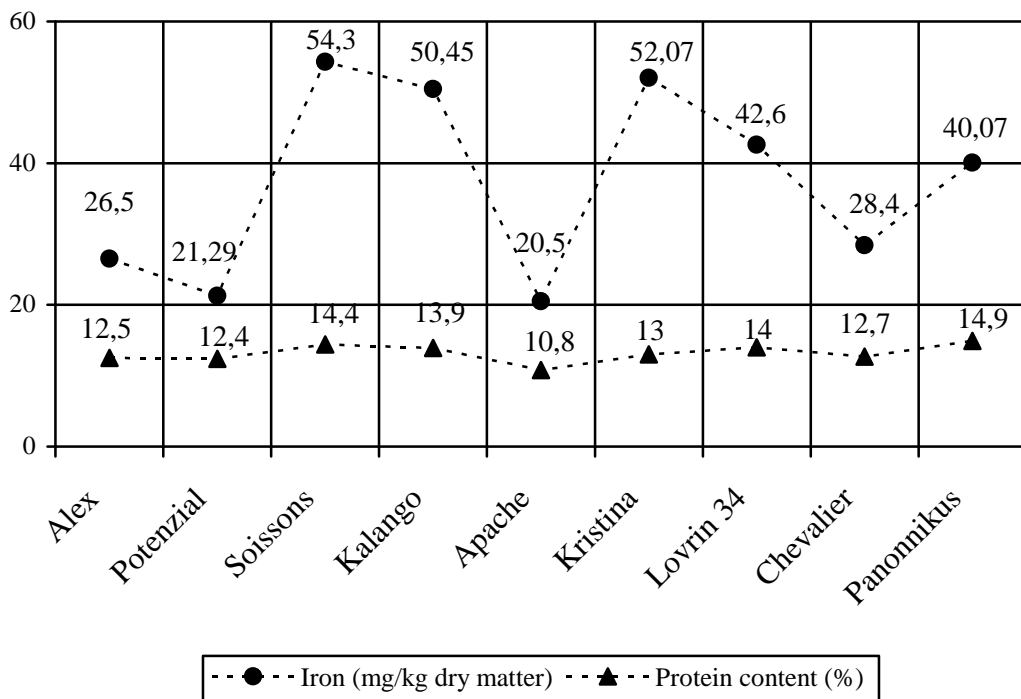


Figure 2. Graphical representation of mean concentration of iron (mg/kg dry matter) and protein content of winter wheat cultivars

CONCLUSIONS

Variation in mineral composition of different winter wheat cultivars found in this study can be used in further breeding to improve the nutritional quality of wheat grain.

In winter wheat, iron content is positively correlated with protein content and negatively correlated with hectoliter mass.

Soissons winter wheat cultivar registered the highest value of iron content (54.3 mg/kg dry matter) followed by Kristina (52.07 mg/kg dry matter) and Kalango (50.45 mg/kg dry matter) winter wheat cultivar.

Potenzial and Apache winter wheat varieties registered the lowest value of iron content: 21.29 (mg/kg dry matter) and 20.5 (mg/kg dry matter), respectively.

REFERENCES

- DIKEMAN, E., POMERANZ, Y., LAI, F.S. (1982): Minerals and protein contents in hard red winter-wheat. *Cereal Chem.*, Volume 59, pp. 139–142.
- GRAHAM, R., SENADHIRA, D., BEEBE, S., IGLESIAS, C., MONASTERIO, I. (1999): Breeding for micronutrient density in edible portions of staple food crops: Conventional approaches. *Field Crop. Res.*, Volume 60, pp. 57-80.
- GREER, E.N., PRINGLE, W.J.S, KENT, N.L. (2006): The composition of British-grown winter wheat. II—iron and manganese contents- DOI: 10.1002/jsfa.2740030103 *Journal of the Science of Food and Agriculture*
- KHAN, S., CAO, Q., ZHENG, Y.M., HUANG, Y.Z., ZHU, Y.G. (2008): Health risks of heavy metals in contaminated soils and food crops irrigated with wastewater in Beijing, China. *Environ Pollut*, Volume 152, pp. 686-692.
- LĂCĂTUSU, R., LĂCĂTUSU, A.R. (2008): Vegetable and fruits quality within heavy metals polluted areas in Romania. *Carph. J. of Earth and Environmental Science*, Vol. 3, pp. 115-129.
- MARTINEZ-BALLESTA, M.C., DOMINGUEZ-PERLES, R., MORENO, D.A., MURIES, B., ALCARAZ-LOPEZ, C., BASTIAS, E., GARCIA-VIGUERA, C., CARVAJAL, Á. (2009): Minerals in plant food: effect of agricultural practices and role in human health. A review. *Agron. Sustain. Dev.*, Volume 30., Number 1., pp. 295-309.
- PETERSON, C.J., JOHNSON, V.A., MATTERN, P.J. (1986): Influence of cultivar and environment on mineral and protein concentrations of wheat-flour, bran, and grain. *Cereal Chem.*, Volume 63, pp. 183-186.
- TABĂRĂ, V., NITĂ, S., POP, G., PRODAN, M., DUMA, C., TABĂRĂ, C.G., PASCA, M., NEDELICU, F. (2009): Breadmaking quality of some winter wheat cultivars in western Romania. *Buletinul AGIR*, 1-2, pp. 182-185.
- ZHAO, F.J., SU, Y.H., DUNHAM, S.J., RAKSZEI, M., BEDO, Z., MCGRATH, S.P., SHEWRY, P.R. (2009): Variation in mineral micronutrient concentrations in grain of wheat lines of diverse origin. *J. Cereal Sci.*, Volume 49, pp. 290-295.

EFFECTS OF THE ROOTSTOCK *ROSA CANINA* VAR. *LAXA* ON THE GROWTH AND DEVELOPMENT OF FIVE MINIATURE ROSE CULTIVARS

NEXHAT BALAJ

Ministry of Environment and Spatial Planning – Prishtina, Republic of Kosovo
florikultura05@hotmail.com

ABSTRACT

Generally, in Republic Kosovo rose propagation by budding resulted in about 100-130 thousand seedlings during a year. In Kosovo the most frequent rootstocks for roses are species *Rosa canina* 'Laxa'. Miniature varieties of roses (*Rosa hybrida* L.) are among the most important garden plants in our country.

The goal of this research was to study the level of compatibility for some Miniature Roses, a same rootstock of *Rosa canina* 'Laxa'.

Roses are conventionally propagated by cutting, budding, grafting and layering. Cutting and budding would be the simplest way to increase the desirable rose varieties. Plant propagation by grafting is one of the oldest horticultural practices and one that has intrigued the gardening and non-gardening public alike.

In this study there are included five miniature rose cultivars: 'Zwergkönig', 'Roulettii', 'Bianco', 'Fire Princess', 'Dresden Doll'. The experiment was conducted during 2010-2011, tested in a commercial farm in Prizren, Kosovo. During the vegetation these parameters were measured: number and diameter of roots, length of flower stems, diameter of structural shoots, number of flowers etc.

There was found a significant level of compatibility between rootstock with all tested cultivars.

Key words: miniature roses, rootstock, grafted, compatibility

INTRODUCTION

Traditionally, roses are supplied to the grower as grafted plants in which the cultivar is grafted onto a rootstock. Grafting is a technique in which parts of different plants are physically combined and continue growth as a single plant (HARTMANN AND KESTER, 2002).

The part of the graft combination which constitutes the upper part of the plant is referred to as the 'scion'. Rootstock may affect (either directly or indirectly) scion characteristics such as plant architecture, vigour, nutrient status, flower yield and quality of flowers (DE VRIES AND DUBOIS, 1996).

Miniature varieties of roses (*Rosa hybrida* L.) are among the economically most important garden plants in the Republic of Kosovo. Generally, in our country rose propagation by budding resulted in about 100-130 thousand seedlings during a year.

In Kosovo the most frequent rootstock for roses is *Rosa canina* cultivar 'Laxa' (BALAJ, 2011). For miniature rose propagation, garden cultivars are propagated by T-budding. Budding is a recognized commercial method of propagating roses throughout the world.

Interest in the use rootstock was in the first place in establishing the rapid economic multiplication of desirable scion cultivars that are unable to grow on their own roots.

For roses rootstock is used for several reasons, including economical aspects of propagation, flower production, flower quality, adaption to different kinds of soil and disease resistance (DE VRIES, 2003).

The number of axillary buds per plant and the number of released buds, but also the readiness to break out and, thereafter, the time required to develop a harvestable flower, are important

factors in determining the total amount of flowers produced. Production of roses depends on cultivar, rootstock and growing conditions. The use of rootstocks can be highly positive compared with their own roots, especially in the open (VECERA, 1967).

The goal of this research was to study the level of compatibility for some Miniature Roses, a same rootstock of *Rosa canina* 'Laxa'.

MATERIAL AND METHODS

In this study five miniature rose cultivars are included: 'Zwergkönig', 'Roulettii', 'Bianco', 'Fire Princess', 'Dresden Doll'. The experiment was conducted during 2010-2011, in a commercial farm in Prizren, Kosovo.

Propagation by grafting was conducted in August, in the form T-budding, at a height of 5 cm above soil level, on a same rootstock of *Rosa canina* 'Laxa'. The plants were planted in soil in raised beds in April, on a commercial farm. The grafted plants and the own rooted ones were planted in open fields in distance 70 x 25 cm. The scheme of experiment was a randomized complete block design with four replications. During the vegetation these parameters were measured: plant height, number and diameter of roots, length of flower stems, diameter of shoots, number of flower stems, number of flowers, etc. Kosovo is located in the central part of Balkan Peninsula. It lies between 41°50'58" and 43 ° 51'42" of northern geographic latitude and 20°01'3" and 21°48'02" of eastern geographic length. Kosovo has an area of 10,908 km². The average annual temperatures in Kosovo are 10 °C, with the minimum temperature of -27.2 °C and maximum of 39.2°C.



Figure 1. Produced seedlings from *Rosa canina* 'Laxa'

RESULTS AND DISCUSSION

Diameter of structural shoots, number and colour of flowers

Regarding the diameter of structural shoots according to the cultivars and influence by the rootstocks *Rosa canina* 'Laxa', the highest diameter was achieved with the cultivar 'Bianco' (5.5 mm), while the lowest diameter with the cultivar 'Fire Princess' (4.1 mm). The other cultivars were between these specified values. The diameter of flowers is a feature of the

cultivar, from our study about the mentioned rootstocks we have achieved the highest value in cultivar ‘Zwergkönig’ with 4.5 cm and the lowest one in cultivar ‘Bianco’ with a diameter of 3.9 cm. During the growth of shoots, the plant produces flowers even in the first year after grafting. This number is different, the highest is achieved in ‘Rouletti’ with 14.2 flowers and the lowest in ‘Fire Princess’ with 10.7 flowers per plant (*Table 1*).

Table 1. Diameter of structural shoots (mm), diameter flowers (cm), number of flowers

Cultivars	Diameter of structural shoots (mm)	Diameter of flowers (cm)	Number of flowers	Colour
‘Zwergkönig’	5.3	4.5	12.5	red
‘Roulettii’	4.8	4.3	14.2	pink
‘Bianco’	5.5	3.9	11.5	white
‘Fire Princess’	4.1	4.4	10.7	red
‘Dresden Doll’	5.3	4.1	12.8	yellow

Length, number and diameter of roots

The highest length of roots in the two years of study has been achieved at the cultivar ‘Zwergkönig’ (31.20 cm), while the lowest one at the cultivar ‘Roulettii’ (27.4 cm), the average values of other cultivars being between them. The highest diameter of roots was reached at the ‘Roulettii’ (6.72 mm), the lowest one at the cultivar ‘Fire Princess’ (5.78 mm). The number of secondary roots is different, according to cultivars and varies between the highest at the cultivar ‘Zwergkönig’ with 36.88 and the lowest at ‘Dresden Doll’ with 31.33 roots per plants (*Table 2*).

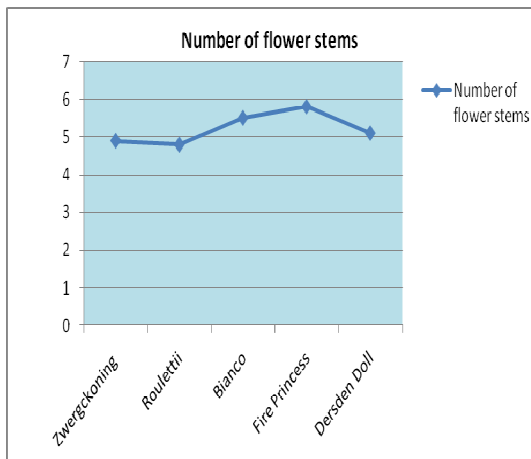
Table 2. Length, number and diameter of roots

Cultivars	Length(cm)	No. of roots	Diameter (mm)	Secondary roots
‘Zwergkönig’	31.20	5.11	6.12	36.88
‘Roulettii’	27.41	6.21	6.72	34.22
‘Bianco’	28.35	6.32	6.11	38.45
‘Fire Princess’	30.34	5.35	5.78	34.55
‘Dresden Doll’	31.08	5.55	6.32	31.33

Number of flower stems

To the roses it is important to be established an optimal number of flower stems (3-5) with a diameter of 4-5 mm, serving during the pruning to form the sprouts production area for the coming year. The biggest number of flower stems as the average of two years of study, we had at the cultivar 'Fire Princess' with 5.8 flower stems per plants, and the lowest at the cultivar Roulettii with 4.8, while the other cultivars were between the values mentioned above (Figure 2a).

a)



b)

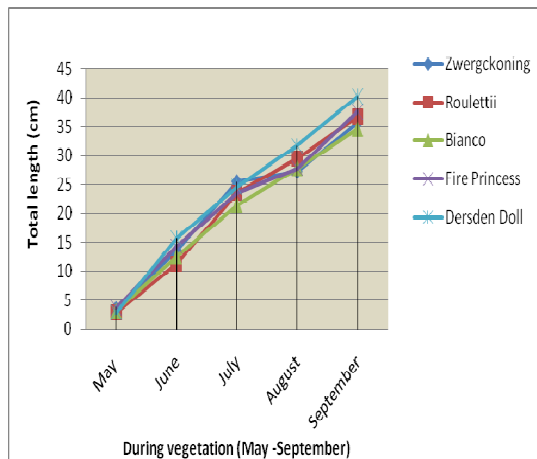


Figure 2. The number of flower stems (a) and the total length (cm) of flower stems (b) influenced by the rootstock *Rosa canina* 'Laxa'

Total length (cm) of flower stems as influenced by the rootstock

The growth of flower stems during the vegetation was various depending on cultivars. The highest growth was the cultivar Doll Dersden with (36.51 cm) and the lowest one was to Bianco with (27.92 cm). Other cultivars are in the interval between the values mentioned above (Figure 2b).

CONCLUSIONS

There was found a significant level of compatibility between the rootstock *Rosa canina* 'Laxa' and all tested miniature rose cultivars. This confirms the ability of using this rootstock in large scale commercial rose production in Kosovo climatic and soil condition. Significant mutual effects were also found between the rootstock and the commercial varieties according to the length and diameter of the flowering shoots, flower diameter of both the rootstock and the scion.

Rootstocks has a great effect in adaptation to certain pH values and drainage conditions of the soil, climatic factors, disease resistance, plant longevity, productivity and flower quality.

Therefore, recommend this kind of rootstock for the growing of miniature roses to be used in the future. However, the spreading other kind of rootstock is important in our country.

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REFERENCES

- BALAJ, N (2011), *Roses in Urban Landscape design*. Prishtina, Kosovo.
- DE VRIES (2003): *Clonal rootstock*, Encyciopedia of roses science, volume 2.
- DE VRIES, D.P., DUBOIS, L.A.M. (1996): *Roses breeding, past, present, prospects*. Acta horticulturae 424.
- HARTMANN, H.T., KESTER, D.E. (2002): *Plant propagation: Principles and Practices*. New Jersey
- VECERA, L. (1967): *Verhalten verschiedener Rosen Standardrosen in Kombination mit einger Unterlagen bei Freiland Kultur*. Gartenwelt 67; 437-438.

THE EFFECT OF BEDDING PLANTS (*TAGETES ERECTA* AND *ANTIRRHINUM MAJUS*) IN THE URBAN LANDSCAPE ARCHITECTURE

NEXHAT BALAJ^{1*}, FADIL HASANI², ISA TAHIRI³

¹ European Institute 'Juridica' - Faculty of Public Policy and Management, Prishtina, Republic of Kosovo

² Ministry of Environment and Spatial Planning – Prishtina, Republic of Kosovo

³ University of Prishtina, FXM, Mitrovica
agroalbi54@hotmail.com

ABSTRACT

The purpose of our work was the study of characteristics of flowering stage, ornamental values and used bedding plant (*Tagetes* and *Antirrhinum*) cultivars as integral components in landscape architecture and urban design in Kosovo.

Ornamental plant production in the Republic of Kosovo has a seventy years old tradition. Production of ornamental plants is mainly performed under protected environment while the production of ornamental trees, shrubs, rose seedlings is organized outdoors. Primarily grown are cut flowers, roses, gerbera, carnations, bedding plants, etc. Two bedding plants with five cultivars have been studied: *Tagetes erecta* 'Lemon Mum', *Tagetes erecta* 'Kilimanjaro White' and *Antirrhinum majus* 'Sonnet', *Antirrhinum majus* 'Black Prince' etc. During the vegetation were measured: blooming seasons, number of flowers, diameter of flowers, colour and length of growth.

The cultivars studied have a rich range of colors in garden, from white, yellow, green, dark red, etc. Blooming time depends on cultivar, and it begins for *Tagetes* and *Antirrhinum* cultivars in May and continues until October. Bedding plants have manifested high decorative values in urban landscape under the Kosovo climate condition.

Key words: Kosovo, bedding plant, landscape design, *Tagetes*, *Antirrhinum*

INTRODUCTION

In the Republic of Kosovo there is an increased the tendency for environmental regulation with different ornamental plants, in parallel with the expansion of urban centers, large cities, new houses, residential areas. *Tagetes* and *Antirrhinum* species are the most popular bedding plants grown in Kosovo (BALAJ, 2010).

The urban green spaces influence the social, economical and environmental politics, contributing in several ways to the quality of life, affecting directly the livability of the city. Landscape trees and shrubs, bedding plants, foliage plants, flowering potted plants and cut flowers have long been appreciated for their contributions to the quality of the environments in which we live and work.

Bedding plants can be annuals, biennials or perennials. Annuals are plants which are grown from seed, produce flowers and seed and die in one growing season. Bedding plants with their seemingly infinite variety of flower color and plant form fit into almost any landscape situation (VUKSANI, 2004).

The importance of urban green spaces has been known for decades; however the relationship between urban live ability and green areas as incorporated in overall urban green structures has become the focus of international studies especially during the last 10 to 15 years (TZOULAS AND JAMES, 2004).

Many bedding plants bloom during the winter months, contributing splendidly to a colorful landscape and producing flowers for home decorations. Others grow and flower during the trying months of June, July, August and September, persistently blooming through the heat and heavy summer rains (ARMITAGE, 1994).

Tagetes erecta L. and *Tagetes patula* L. belong to the family of *Asteraceae*. They originated from Central America, mainly distributed in western Mexico and southeastern Arizona. Nowadays, the species widely used throughout the world are *T. erecta* L., *T. patula* L. and *T. tenuifolia* (DOULE, 2005).

The purpose of our work was the study of characteristics of flowering stage, ornamental values and used bedding plant (*Tagetes* and *Antirrhinum*) cultivars, as integral components in landscape architecture and urban design in Kosovo.

MATERIAL AND METHOD

During the 2010-2011 period, the subjects of the research in our experimental field (Figure 1), two bedding plants with five cultivars have been studied: *Tagetes erecta* 'Lemon Mum', 'Kilimanjaro White', 'Antigua Yellow', 'Jubilee Diamond', 'Safari Yellow' and *Antirrhinum majus* 'Sonnet', 'Black Prince', 'Madame Butterfly', 'Sweetheart Series', 'White Wonder'. Plants were planted in the period from 20.04.2010 – 25.04.2010. The experimental design was 'randomized block' with four replications and 200 plants for each variety. Distance of planting was 35 x 25 cm. The growth period and flowering stage of the plants in urban landscape design were studied from April to November under Kosovo climate conditions. All the species were investigated for the main morphological and decorative characteristics: blooming time, color of flowers, plant height, length, number of flowers, mean florets diameter and number of florets open in the same time. Kosovo is located in the central part of Balkan. It lies between 41°50'58" and 43°51'42" of northern geographic latitude and between 20°01'34" and 21°48'02" of eastern geographic length. Kosovo has an area of 10,908 km². The climate is continental-like, with a dominant influence of Adriatic-Mediterranean climate in Dukagjini Plane, through the valley of Drin i Bardhe.



Figure 1. Experimental field of plants types in the study (*Tagetes erecta* and *Antirrhinum majus*) cultivars

RESULTS

Morphological characteristics and blooming period of *Tagetes erecta* cultivars

Morphological characteristics and blooming period of *Tagetes erecta* cultivars are presented in *Table 1*:

- Plant height

The average value for this parameter was 64.6 cm, the most vigorous being 'Safari Yellow' (73 cm), 'Antigua Yellow' (70 cm) followed by 'Jubilee Diamond', while the cultivar 'KilimanjaroWhite' was less vigorous (55 cm).

- Flower diameter

Flowers diameter is one of the most important qualitative characteristics of ornamental plants. From the results of the study for five cultivars it is demonstrated that the size of the flowers is different and it is an essential feature of the cultivar. The largest diameter of flowers has been achieved at the cultivar 'KilimanjaroWhite' (5.5 cm) and the cultivar 'Yellow Antigua' has a smaller diameter of flowers (4.2 cm). Other cultivars are with a diameter of flowers in the average value between them.

- Floral stem

The length of the floral stem was between 35.5 cm 'KilimanjaroWhite' and 30.3 cm 'Jubilee Diamond'. This property is very important for cut flowers and the vigorous cultivars can also be used as individuals or in plant groups in landscape design. The average value of this character was 32.6 cm.

- Color of flowers

The cultivars studied have a range of colors from white ('Kilimanjaro White', 'Jubilee Diamond') and yellow ('Antigua Yellow', 'Safari Yellow') to orange ('Lemon Mum'). There is a large variation of varieties associated with the intensity of colors and have beautiful views of gardens.

- Number of flowers/plant

The cultivars under study show a number of flowers per plant between 118.3 and 95.3. The greatest number of flowers per plant was at the 'Safari Yellow' (118.3), while the smallest number of flowers per plant was at the 'Jubilee Diamond' (95.3) cultivar. The average value of this character was 110.4 flowers per plant.

Table 1. Morphological characteristics of *Tagetes erecta* cultivars

Cultivars	Color of flower	Height of plant (cm)	No. of flowers/ plant	Floral stem (cm)	Diameter of flower (cm)
'Lemon Mum'	Orange	65	105.0	31.3	4.5
'Kilimanjaro White'	White	55	123.3	35.5	5.5
'Antigua Yellow'	Yellow	70	110.5	31.5	4.2
'Jubilee Diamond'	White	60	95.3	30.3	5.1
'Safari Yellow'	Yellow	73	118.3	32.7	4.7

Dynamics of the blooming period according to the cultivar

For all cultivars the blooming begins in May. There exist different number of flowers (2-3) per plant. The number of flowers per plant begins to increase in June and the highest is achieved at the cultivar 'Yellow Safari' (12), while the lowest one at the cultivar 'Yellow' (10). Maximum blooming (the largest number of flowers) is achieved in July and August, depending on the cultivars; the highest was recorded at the cultivar 'Diamond Jubilee' with 41 flowers per plant, the lowest one with 38 flowers at the cultivar 'Diamond Jubilee'. Blooming ends in late October or early November depending on the decrease of temperature. The smallest number of flowers was detected at the cultivar 'Lemon Mum' with 1 flower per plant and the highest at cultivar 'Safari Yellow' with 3 flowers per plant (*Figure 2a*).

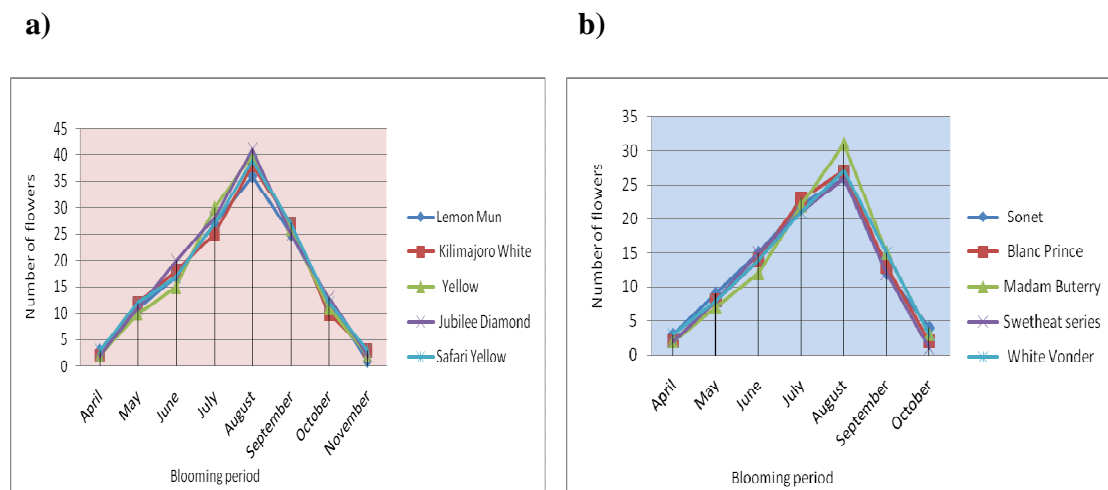


Figure 2. Flowering period of the *Tagetes* (a) and *Antirrhinum* (b) cultivars

Morphological characteristics and blooming period of *Antirrhinum majus* cultivars

Morphological characteristics and blooming period of *Antirrhinum* cultivars are presented in *Table 2*:

- Plant height

The plant height of *Antirrhinum* cultivars was over 50 cm, the most vigorous being 'Madame Butterfly' (63 cm) followed by 'Black Prince' (53 cm), while the cultivars 'Sweetheart Series' were less vigorous (48 cm). The average value for this parameter was 52.3 cm.

- Color of flowers

The cultivars studied have a range of colors from white ('White Wonder'), yellow ('Sweetheart Series'), rose ('Sonnet') to red ('Black Prince' and 'Madame Butterfly').

- Number of flowers/plant

The cultivars under study show a number of flowers per plant between 50 and 65. The greatest number of flowers per plant was at 'Black Prince' (65), while the smallest number of flowers per plant was at 'Madame Butterfly' (48). The average value of this character is 54.6 flowers per plant.

Dynamics of the blooming period of the *Antirrhinum* cultivars is presented in *Figure 2b*. For all *Antirrhinum* cultivars the blooming begins in May, while blooming ends in late October or early November depending on the decrease of temperature.

Table 2. Morphological characteristics of *Antirrhinum majus* cultivars

Cultivars	Color of flower	Height of plant (cm)	No. of flowers/plant	Floral stem (cm)	Diameter of flower (cm)
'Sonnet'	Rose	45	55	25	4.3
'Black Prince'	Red	53	65	30	4.2
'Madame Butterfly'	Red	63	48	35	3.8
'Sweetheart Series'	Yellow	48	55	34	4.0
'White Wonder'	White	52	50	29	3.7

CONCLUSIONS

From our study and the obtained results it is proved that the studied species (*Tagetes erecta* and *Antirrhinum majus*) have a very good blooming due to favourable climatic conditions in Kosovo, which affected the growth, quality and colour of the flowers. Hybrids of species of flowers like *Tagetes* and *Antirrhinum*, have demonstrated high decorative value and long period with flowers, good growing, leaves and flowers of different colours (white, red, yellow, pink, etc.). There is variability among cultivars, in terms of number of flowers and blooming period. In all cultivars, blooming begins in May with various number of flowers (2-4) per plant. The maximum blooming (the largest number of flowers) is achieved in July and August, while the blooming ends in late of October. The studied cultivars have an impact on urban landscape architecture, achieving the maximum aesthetic appearance, with beautiful colours (leaves, flowers) at homes or in urban environments. For a good architecture of the urban landscape, the studied cultivars of *Tagetes* and *Antirrhinum* species should be included in the planting structure.

ACKNOWLEDGEMENTS

It is my honour to express my gratitude and thank all the staff of the Faculty of Agriculture, Department of Horticulture of the Agricultural University of Tirana. In particular I would like to thank the Scientific Leader Prof. Dr. Llazar Haxhinasto, who with high dedication and without hesitation helped me in setting up the experiment and fieldwork. Furthermore, it is my pleasure to thank all my colleagues and friends from Albania and Kosovo, for the readiness and their support they shown in my address, in order to conclude this study. I thank the horticulturist centre Alb-flora, who enabled the establishment of the experiment.

REFERENCES

- ARMITAGE, A.M. (1994): Growing-on: Ornamental Bedding Plants. CAB International, Wallingford, United Kingdom.
- BALAJ, N. (2010): Toward, ecology of cities – beyond buildings, trees and urban parks in Prishtina, Kosovo. International Journal of Ecosystems and Ecology Sciences.
- DOULE, J.M., (2005): Flowering Control. In: Floriculture: Principles and Practies.
- TZOULAS, K., JAMES, P. (2004): Finding links between urban biodiversity and human health and well-being, The 4th International postgraduate research conference in Salford, 29th March – 2nd April.
- VUKSANI, GJ. (2004): Florikulture, Agricultural University of Tirana, Albania.

GROUNDWATER POLLUTION IMPACT ON THE RURAL AREAS

DAIANA BALIGA, STANA OCTAVIAN

Politehnica University of Timișoara
Department of Hydrotechnical Engineering
Timișoara 300022 George Enescu Street 1/A.
daiana_baliga@yahoo.com

ABSTRACT

This paper presents the impact of groundwater pollution on the land around irregular deposits on bordering rural communities. Rural area has the ability to preserve and restore the natural environment due to reduced anthropogenic pressure, associated with the type of economic exploitation and general development level of productive forces. Environmental quality of rural life has important antistress effects and therefore it is considered a heritage of humanity and should be kept. The paper is particularly important because we have taken into account that aquifer is an important source of water. Pollution is a serious problem affecting the environment and human health, in this case we want to present the study on pollution spreading. Historical pollution site has not been seen to be dangerous, till now. The purpose of this paper is to highlight the influence of pollution on rural areas in the neighborhood of inappropriate landfills and dumps storing waste or byproducts from various industries. In this paper we show the evolution of the pollutant plume from the landfill Șag-Parța and a slag and ash dump Utvin, Timiș county. Both deposits are located near the town of Timișoara. The models presented in this paper were performed using MODFLOW software.

Keywords: rural area, pollution plume, groundwater, dump, environmental protection.

INTRODUCTION

Rural areas

Etymologically, the word "rural" comes from the Latin "rurs, ruris", and refers at culture, fields, occupied territory, inhabited, arranged and worked by man. The rural is land area which is dominated by forests, crops and green spaces that rely on a predominantly agricultural society.

Rural area has the ability to preserve and restore the natural environment following to reduced anthropogenic pressure, associated with the type of economic exploitation and general development level of productive forces. Extensive fields of culture, the absence of the main ways of communication, the insular presence of framework built of smaller dimensions and herds of animals, betrays the present of rural areas.

The problem of development and rural arrangement is one of the most complex contemporary themes, because, in his essence, means achieving a balance between conservation requirement of rural areas in terms of economic, ecological and socio-cultural, on the one hand, and tendency to modernize rural life, on the other. (BOLD, 2003) A rural area is: agricultural land - used for crop and livestock - and non-agricultural land - used for housing, small industry, services and other human activities - seen as a whole. Rural area is defined as "the inner and coastal area which includes villages and small towns where the bulk of the land is used for agriculture and forestry, arrangement of mountain areas for leisure, natural reserves, for habitation, for activities crafts and for services or industrial activities." (HANCU, 2004)

In Europe from the years 1987-1988 began a new process more pronounced of

appreciation of the rural. During this period took place European Campaign for the Rural World, organized by the Council of Europe, campaign comprises a series of events and conference on various topics, which were largely at the origin of publication of Swiss Charter for Development of Rural World, adopted by the National Committee of Rural Areas on 16 December 1987.

The first project of the European Charter of Rural Area was presented Parliamentary Assembly on July 28, 1995, in Strasbourg. Final form of the Charter was obtained at ordinary session of the Parliamentary Assembly of Council of Europe on 23 April 1996 as the 1296 Recommendation regarding the European Charter of Rural Area. (MAN, 2007)

Characteristics of the rural areas:

- * The most important branch of activity in rural area is agriculture;
- * In some areas, particular importance has forestry and wood processing industry;
- * There are mountainous areas or areas of delta in which agro-tourism has a large and growing importance;
- * In rural areas primary economic sectors have the highest proportion;
- * The main occupations of those in rural areas are: crafts, practice or in primary manufacturing industry, requiring many qualifications (obviously aren't missing highly skilled professions: education, culture, etc.);
- * Most common form of ownership is private property, family; there are also state properties but more restricted, as research stations, reserves and national parks, areas covered by way of communications, etc.
- * Population density and area of the locality in rural areas are smaller but from socially point of view human relationships are much closer;
- * Environmental quality of rural life has an important relaxing effect and therefore it is regarded as a heritage of humanity;
- * The true value and dimension of the rural area is given by lifestyle and popular culture;
- * Economic development based primarily on agriculture and forestry, shall be designed so that agricultural raw materials to be processed as close to where they were produced; (HANCU, 2004)

Groundwater

To describe and characterize the flow it is necessary first to define the term "aquifer" and then to discuss the movement of groundwater in this environment. Definition of aquifer term can be done as:

Aquifer is an underground area of permeable rocks that have capabilities to store significant amounts of water and allow water flow to wells.

Aquifers can be classified into two distinct groups:

- * Unconfined aquifers, which are bounded only below by an impermeable layer and
- * Confined aquifers or under pressure, which is between two impermeable layers.

The flow rate of water in a saturated zone, is regulated by three key factors:

Hydraulic gradient

$$i = \frac{Q}{k \cdot A}$$

i- hydraulic gradient

Q – flow rate

k – hydraulic conductivity

A – cross sectional of flow area

Hydraulic conductivity is the ability of rock or sediment to transmit fluid, in other words the speed of water flow under a hydraulic gradient.

Rock porosity is the relationship between pore volume and total volume of solid particles of the rock. Porosity depends on geological material and can be determined by field tests or laboratory tests.

MATERIAL AND METHOD

Description of the region

The studied area is located SW of the city Timișoara, is bounded to the north of Bega river and south of the Timiș river. In the area bounded by the two rivers are two pollution sources, namely: landfill Parța-Șag and slag and ash dump Utvin.

Parta-Sag Landfill was opened in 1973, with a projected area of 16.6 ha and a capacity of 1,800,000 m³ with the owner on the City Council of Timisoara. The authorized operator is S.C. Retim S.A. Timisoara. As technical data we can say that the deposit has a volume of waste stored of 1.8 million m³, with a free capacity of 100,000 m³ and an annually stored volume of 103.80 thousand m³. The landfill is located at a distance of 10 km from Timisoara, 3 km from Sag, 7 km from Parta and 4 km of the river Timis (nearest surface water source). Parta-Sag landfill is a inappropriate deposit located on a former clay quarry. Because the leachate resulted from leakage from landfill pollutes aquifer, the European Union forced Romania to close the landfill. Thus, in 31.XII.2008 Parta- Sag landfill was closed permanently, but still continues to pollute.

Utvin slag and ash dump is a deposit of lowland, which occupies an area of 150 hectares. The dump has a trapezoidal form with the large base of 1100 m, the lower base of 900 m and the trapezoidal height of 500 m. The dump began operating in 1988 and is open till today.

Dump is located at: 1,5 km SW of Utvin Village and about 4 km west of Timișoara City. The dump is located at approx. 2 km SE of Bega river and is located near the Nivelda creek, which passing approximately 500m south of the deposit. The deposit is designed for a total capacity of 4 821 000 m³.

Waterproofing system

According to the hydrogeological survey, slag and ash dump Utvin is located on a clay layer of 3,5 to 6,5 m thick, which has an average permeability of $k = 0,05 \text{ m / day}$ ($k = 5 \times 10^{-5} \text{ cm/s}$). The permeability of soil and dams is $k = 5 - 5,7 \times 10^{-5} \text{ cm/s}$, seismic degree is 7. (MMDD, 2008)

Modelling software

The forecast of pollutant plume was performed using software MODLOW. MODFLOW is a simulation system for modeling groundwater flow and pollution. This software allows modeling of flow in the aquifer and it's made also to present the pollutant plume in space and time.

RESULTS

Because both waste deposits (the Parța-Șag dump and the Utvin ash and slug dump) are

not isolated very good, the leachate infiltrated the aquifer affecting the groundwater for the entire area.

The study followed the evolution of the pollution plume in the aquifer between 1993-2013 and continued with the forecast until 2033, in the case that no measures of prevention are taken. The mathematical models used to determine the evolution of the pollution plume where performed using the MODFLOW software.

The spreading of the pollutant towards the rural areas can be highlighted using the following models:

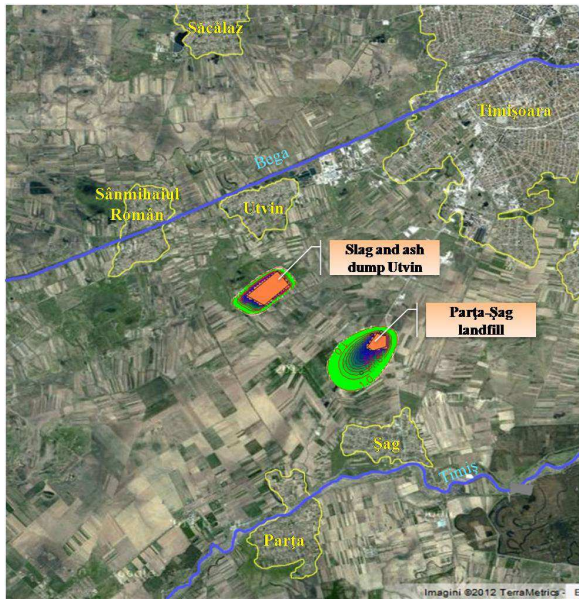


Figure 1. Pollution plum 1993 (5 years slag and ash dump Utvin; 20 years Parța-Șag landfill)

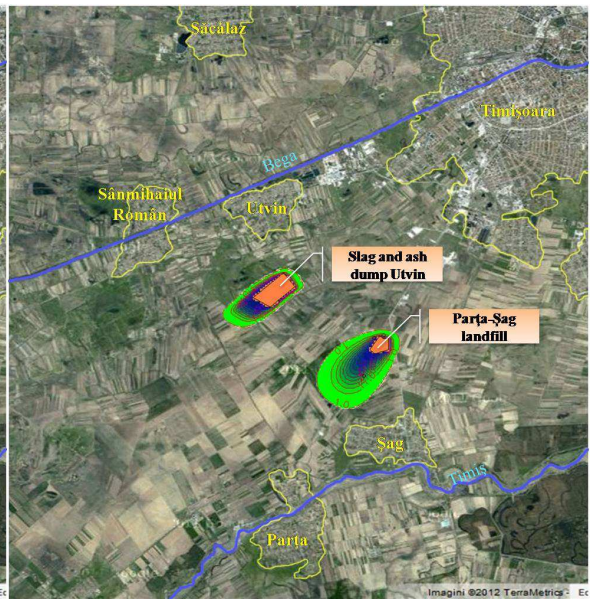


Figure 2. Pollution plum 2003 (15 years slag and ash dump Utvin; 30 years Parța-Șag landfill)

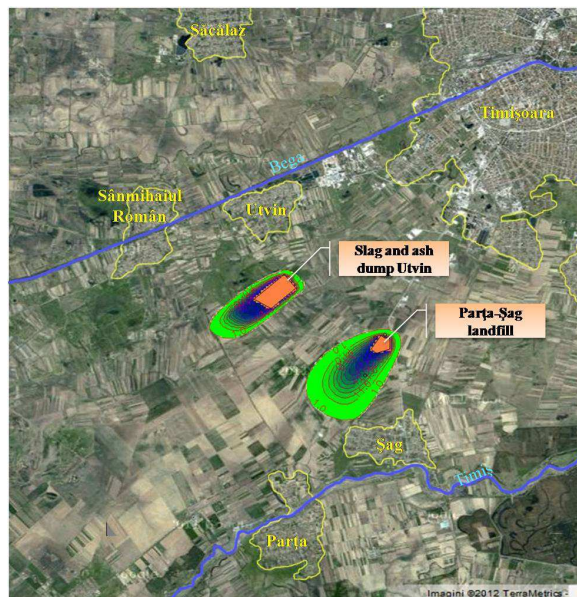


Figure 3. Pollution plum 2013 (25 years slag and ash dump Utvin; 40 years Parța-Șag landfill)

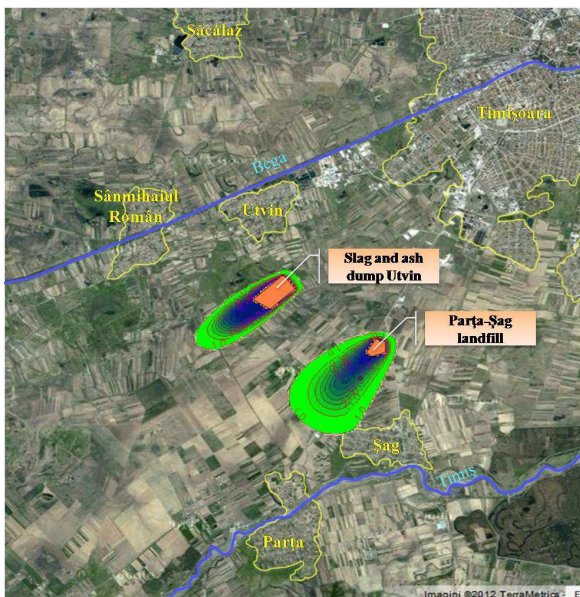


Figure 4. Pollution plum 2023 (35 years slag and ash dump Utvin; 50 years Parța-Șag landfill)

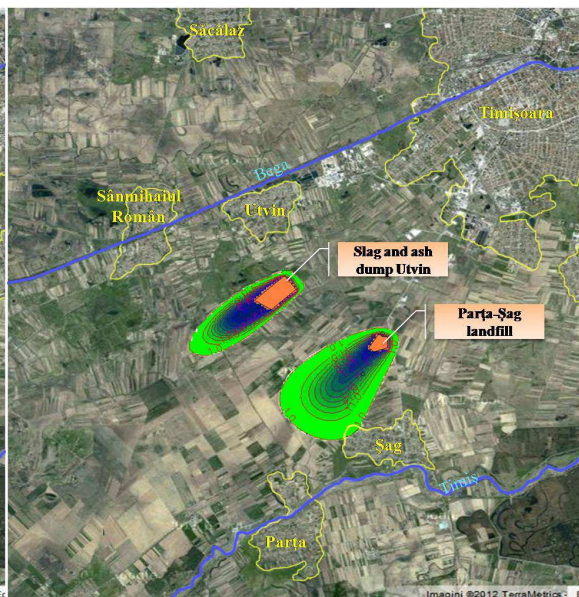


Figure 5. Pollution plum 2033 (45 years slag and ash dump Utvin; 60 years Parța-Șag landfill)

All ready from the year 1993, at 20 respectively 5 years of functioning (*fig.1*), the spreading of the pollutant in the aquifer can be highlighted. After 10 years, 2003 (*fig.2*), there is a visible impact on the soil, also a shifting of the pollutant towards the rural areas can be observed, in this case Șag and Parța.

In the year 2013 (*fig. 3*), 40 years from the opening of the Șag-Parța landfill and 25 years from the opening of the Utvin dump, this representing the current situation, the pollution plume is moving closer and closer towards Șag, endangering the fountains situated at the outskirts of the village.

If no measures of prevention and treatment are taken in the near future, between 2022 (*fig. 4*) and 2033 (*fig. 5*) the pollutant will contaminate the groundwater of the entire Șag village and will head for the village of Parța and finally the Timiș river.

CONCLUSIONS

A balance between man and the natural environment is need in order to have a more authentic and natural rural area. Anthropic actions should have very little effect on the natural environment in order for it to have the power purify and conserve it's self.

Development of rural areas, regardless of geographic area, ways of development and needs of local people, must be made according to certain rules considering the limiting factors, only in this case can we talk about sustainable development.

The pollution of the aquifer has negative effects on the groundwater, agriculture and the overall development of the area. Because the pollutant shifts alongside the aquifer, the noxious substances (heavy metals, nitrates, nitrites, etc.) infiltrate the soil affecting the quantity and the quality of the crops.

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REFERENCES

MINISTERUL MEDIULUI SI DEZVOLTARII DURABILE (2008): Agenția Națională pentru Protecția Mediului: Autorizație integrată de mediu nr. 21 din 04. 02. 2008, pp 12-13

DAVID I. ET AL. (2007): Final Report "Research Contract - Development and Consultancy", between: University Polytechnica Timisoara, Faculty of Hydrotechnics and Grontmij Nederland

CORNELIU DAN HANCU (2004): Dezvoltare rurala, editura Matrix Rom, Bucuresti; pp 8-14

MAN TEODOR EUGEN, MATEOC-SIRB NICOLETA (2007): Dezvoltare rurala si Regionala Durabila a satului romanesc, editura Politehnica, Timisoara 2007 pp 8-12

I. BOLD, E. BUCIUMAN, M. DRAGHICI (2003): Spatiul Rural. Definire. Organizare. Dezvoltare, editura Mirton, Timisoara pp 15-63;

ANALYSIS OF FACTORS OF EFFECTS ON VENISON AS FOOD RAW MATERIAL (A PLERIMINARY STUDY)

NORBERT BLEIER, MIKLÓS HELTAI, KRISZTIÁN KATONA, KRISZTINA SONKOLY,
JUDIT GALLÓ, LÁSZLÓ SZEMETHY, LÁSZLÓ SZABÓ

Szent István University, Institute for Wildlife Conservation
Páter K. street 1., Gödöllő H-2100,
bnorbi@ns.vvt.gau.hu

ABSTRACT

In Hungary, approximately 200-250 thousand big game animals are hunted annually. Animals are not only hunted for valuable trophies, but also for thousands of tons of venison for consumption. A major part of this is sold abroad, bypassing the Hungarian market. It can be said in general that venison is low in fat and carbohydrate and rich in protein, micro- and macro elements, as well as vitamins. Currently in Hungary, venison is produced in free ranging areas, game preserves and game farms. There are significant differences between them in terms of environmental conditions and the employed keeping and feeding technologies. Impacts of these factors on the meat quality are well-known in domestic animals, but they are only partially understood in game species. The quality of red deer venison, the influential factors and risks have been examined in the current project. Red deer venison has been acquired from free ranging areas, game preserves and game farms. Changes in the volume of venison in Hungary and its distribution between game species were estimated, as well as the tendency in the number of game preserves and game farms was shown in this study. In Hungary, the quantity of hunted game species was approximately 10.000 tons in 2010, from which wild boar and red deer were the most abundant. We expect it to be the same in the future.

Keywords: wild boar, red deer, game management and farming, game meat

INTRODUCTION

Wildlife management in Hungary is based on one of the best-organized hunting-systems in Europe, which considers the interests of the landowners (the law 1996/LV), the game (hunting area is at least 3000 ha), and other sectors managing natural resources (agricultural and silviculture. Due to appropriate game density and excellent trophies (more world records belong to Hungary) more than 50000 Hungarian people are hunting, in addition to the 20000-30000 foreign hunters visiting Hungary annually. The annual hunting bag includes about 240 000 individual big game (roe deer, red deer, fallow-deer, mouflon, wild boar), and more than 500 000 small game (CSÁNYI ET AL. 2011). Passing about 10 thousand ton of available venison (CSÁNYI ET AL. 2011) to Hungarian customers has not been successful in the last decades (HERNÁDI, 2011). However, the demand for healthy, affordable and available venison could be important (ANONYMOUS, 2003). It may slightly increase the revenues of wildlife management, and it might contribute to the development of quality of life of rural populations and attractiveness of the country. Venison, which is a low environmental load healthy food, used primarily locally or delivered not too far away can be a part of local business through local restaurants, hotels and rural tourism, and it can directly improve the livelihoods of families living there. The size of the potential home-market is about 2.5 million people, or 34 percent of the adult population in Hungary. They rate venison as a beloved food. However, the majority of consumers do not know the beneficial nutritional properties of venison. The fat-content of roe-deer is almost one-tenth that of beef, while roe-deer meat contains 450 times more B1 vitamin than beef (VÖRÖS, 2009). Therefore, venison can and should be promoted as an excellent component of almost any healthy nutrition plan (LUGASI, 2006).

It is widely known that venison is not produced under standard conditions like in animal breeding. Accordingly, it is particularly important to reveal the effects of the different keeping and feeding technologies on venison quality, as well as the variability of the most relevant venison quality parameters that depend on the feeding technology. Furthermore, it is necessary to gather information about the venison distribution in EU member states and about rules for the utilization of venison. The current study is a subprogram („Manufacture of animal products”) of a larger project (code: TÁMOP-4.2.1.B-11/2/KMR, title: Level up the education and research at Szent István University) supported by Social Renewal Operational Programme. In this paper, the main steps/actions of the total research activity are presented, as well as the background information and antecedents considered during the planning and development. There is a brief overview about the provisions of the Hungarian and EU legislation concerning venison, since the legal framework for production and distribution are determined by them.

Field-work has been divided into three different subjects/issues:

- Study the potential risks of venison production.
- Reveal the difference of the venison quality produced in game preserves and farms, especially the effects of feeding technologies.
- Study new feeding opportunities.

MATERIAL AND METHOD

Characterization of the volume of domestic venison production, its distribution of game species and temporal changes, as well as changes the number of game preserves and game farms were analyzed based on data from the Hungarian Game Management Database (HGMD). Quantity of venison after processing was calculated as follows: body mass of the hunted game was reduced by losses during processing. The used “correction numbers” of wild boar and red deer were determined by VÖRÖS (2009), while other correction numbers for other game species were estimated by us. The correction numbers were: red deer 0.5, fallow-deer 0.5, roe deer 0.5, mouflon 0.5 and wild boar 0.35. It means that the net weight of venison was obtained by eviscerated body mass corrected by these correction numbers.

RESULTS

Rules on venison utilization and distribution

The issues of wildlife management, game keeping and venison distribution are regulated in Act LV of 1996 on game protection, game management and hunting. Certain issues related to the implementation of the Act are contained in Decree No.79/2004. (V. 4.) of the Minister of Agriculture and Rural Development, as well as in Decree No. 43/2011. (V. 4.) of the Minister of Rural Development (food hygiene conditions of handling and distribution of hunted animals).

It is obligatory to apply the relevant provisions of the European Parliament in case of Decree No. 43/2011 (178/2002/EC, 2075/2005/EC, 1069/2009/EC), and Act XLVI of 2008 on the Food Supply Chain and on Control and Supervision of the Food Supply Chain, as well. This regulation establishes the Regulation (EC) No 852/2004 of the European Parliament and of the Council of 29 April 2004 on the hygiene of foodstuffs, and the Regulation (EC) No 853/2004 of the European Parliament and of the Council of 29 April 2004 laying down specific hygiene rules for food and animal origin.

Volume of hunting bags and processed venison rose sharply between 1997 and 2002 (Fig.1-2.). It declined slightly until 2006, but increased again between 2007 and 2010 and quantity of the hunting bag was close to 10000 tons (Fig. 1), and venison was more than 4000 tons (Fig. 2). The significance of each game species shows considerable differences; 80 percent of the total volume is the wild boar and red deer. The rate of wild boar within the total amount steadily increased between 1994 and 1999, and then it fluctuated about 50 percent, while the ratio of red deer was 30-35 percent. The rate of roe deer was around 10-12%, fallow-deer only 5% and mouflon approximately 1% during the whole period.

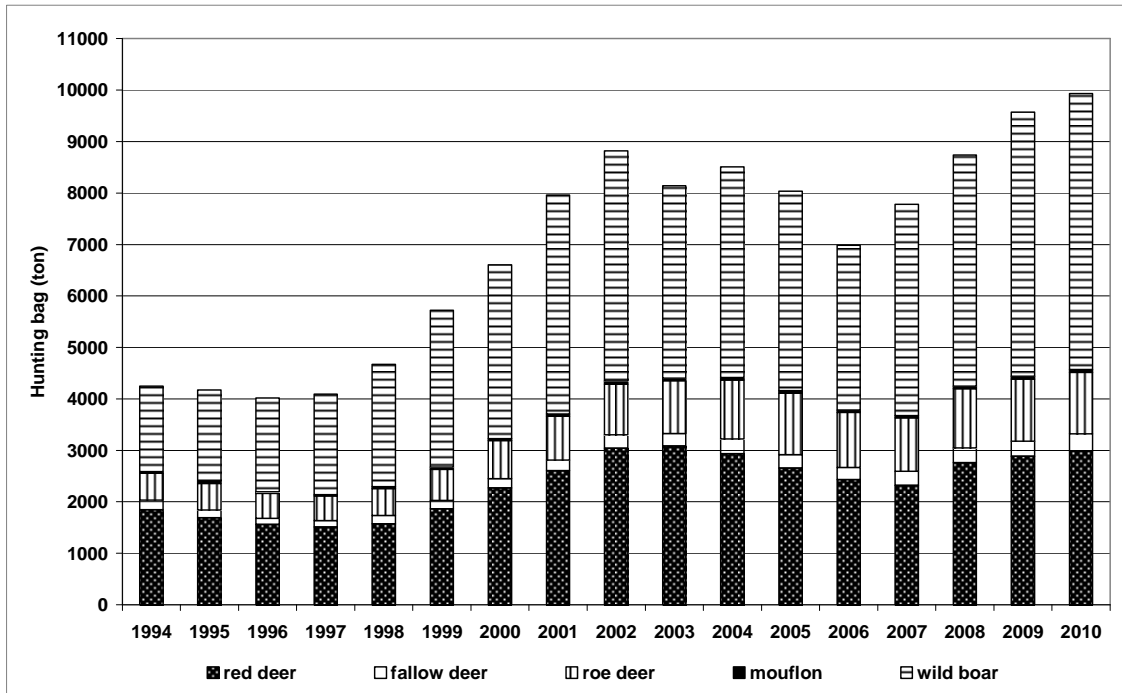


Fig. 1. Changing of the hunting bag in Hungary (based on HGMD)

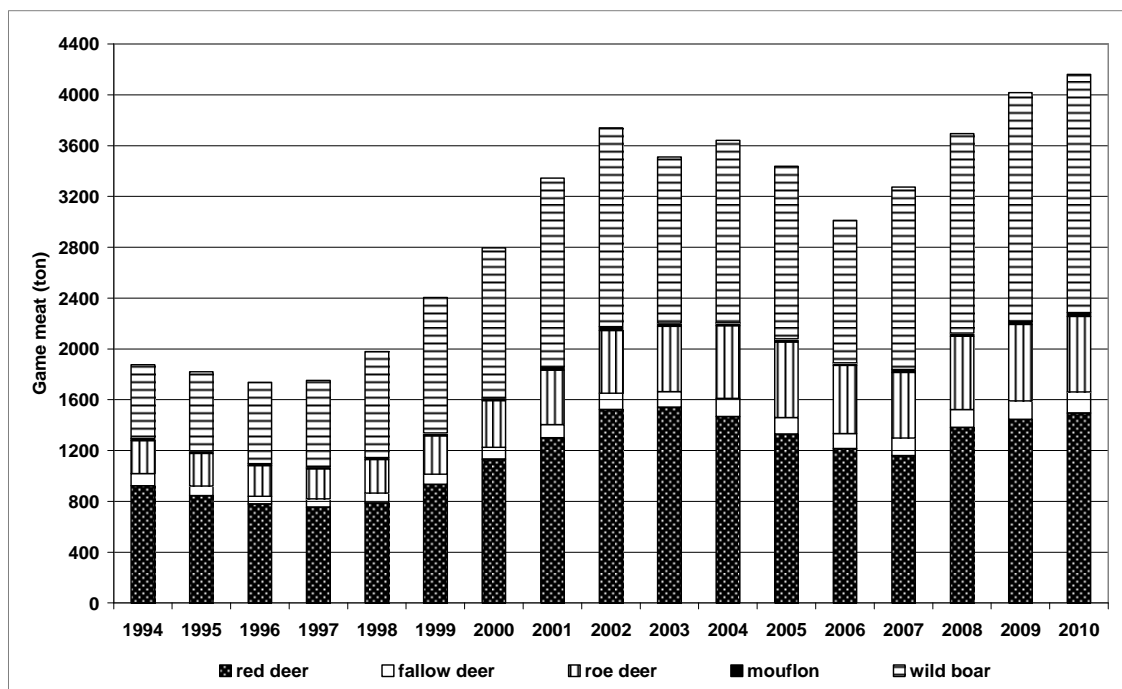


Fig. 2. Changing of the processed venison in Hungary (own calculation based on the data of the HGMD)

Changing of the game preserves and game farms

Game preserves are registered by the hunting authority. Data have been certified by the HGMD since 1997 (Fig.3.). The establishment of game farms has been allowed by the Hunting Law (25/A. § (1)) since 2009, so data are available since 2009, as well. The number of game preserves nearly doubled during the studied period. However, establishment of a significant number of new game preserves is not expected in the future. Nevertheless, a sudden change can be seen in the case of farms, which is largely due to the fact that most of these facilities already existed, but there was no information about them.

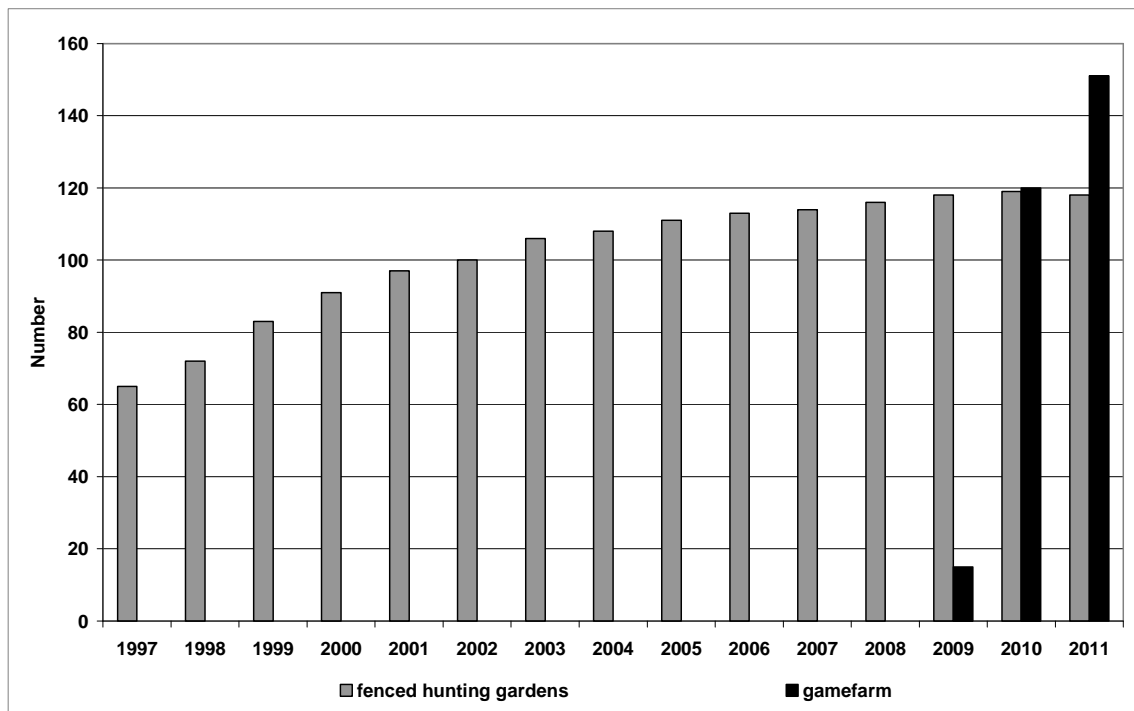


Fig. 3. The number of game preserves and the number of game farms in Hungary (based on HGMD)

CONCLUSIONS

The dominance of wild boar and red deer can be clearly seen examining the volume of the hunting bag. Regarding the proportions, significant change cannot be expected. However, increasing of the hunting bag of the wild boar and red deer can be predicted considering the European tendencies (APOLLONIO ET AL. 2010) and the expected effects of the Hungarian afforestation program (SOLYMOS, 2000).

Based on the tendency of the number of game preserves, any further significant increase cannot be expected. The future of game farms is difficult to predict, but further growth is likely to occur if the law does not eliminate this possibility.

The significance of any further study is confirmed by above-mentioned facts and factors, which try to reveal the qualitative differences in venison and factors influencing venison production.

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REFERENCES

- ANONYMOUS (2003): Vadhúspiac az EU-ban. GfK Hungária Piackutató Intézet tanulmánya. 52pp.
- APOLLONIO M, ANDERSEN R, PUTMAN R (ed.) (2010): European ungulates and their management in the 21st century. Cambridge University Press, Cambridge
- BODNÁRNÉ SKOBRÁK E., GUNDEL J. ÉS JÁVOR A. (2011): A vaddisznóhús és a sertéshús fontosabb beltartalmi paramétereinek összehasonlító vizsgálata. A hús, 2011/1-2: 29-34.o.
- CSÁNYI S., LEHOCZKI R. ÉS SONKOLY K. (szerk.) (2011): Vadgazdálkodási adattár 2010/2011. vadászati év. Országos Vadgazdálkodási Adattár, Gödöllő.
- HERNÁDI ZS. (2011): De hol a vadhús?
http://www.demokrata.hu/ujsagcikk/de_hol_a_vadhus/?szavazas=11
- HGMD: [HTTP://WWW.OVA.INFO.HU/](http://www.oiva.info.hu/)
- LUGASI A. (2006): A vadhúsok szerepe a táplálkozásban tekintettel kémiai összetételükre és egyes élelmiszer-biztonsági szempontokra. A hús, 2006/2: 85-90.o.
- SOLYMOS R. (2000): Afforestation programmes in Hungary – A story of success. EFI Proceedings No. 35:167-174
- VÖRÖS G. (2009): Amit tudnunk kell a vadhúsról. In Pechtol J. (szerk.) Vadászévkönyv 2009. 106-114.o. ISBN 978-963-9783-11-9

THE INFLUENCE OF MINERAL AND ORGANIC - MINERAL FERTILISATION ON THE HAYFIELD VEGETATION FROM BANAT (ROMANIA) HILL REGION

MARIUS COMAN, VERONICA SARATEANU, ALEXANDRU MOISUC

Banat's University of Agricultural Sciences and Veterinary Medicine from Timisoara
Faculty of Agriculture
Calea Aradului, no. 119, RO 300645
comanmario81@yahoo.com

ABSTRACT

In this study the objective was to determine the effects of mineral and organic – mineral fertilizers on the vegetation cover of a hayfield from the hill area of western Romania, respectively Fibiş (Timiș County). The average of the annual air temperature in this region is 10.7 °C and the average of the annual rainfall amount is 608 mm. The climate in the studied area is temperate continental with Mediterranean influences. The experimental field was organized by setting 6 fertilisation variants (3 mineral and 3 organic – mineral fertilisation variants) and a control non-fertilised variant. Every studied variant had three replicates. The vegetation data were collected using the linear point quadrat method, thus calculating several vegetation features. The vegetation features taken in account were: the botanical composition, the biodiversity (species richness, Shannon and Simpson indexes), some ecological indexes (temperature, humidity, soil reaction and light). The fertilisation influenced mainly the biodiversity and the light and soil reaction ecological spectre.

Keywords: hayfield, fertilisation, botanical composition, biodiversity, ecological indexes

INTRODUCTION

The aim of this research is to evidence several aspects of the fertilisation influence on the forest steppe grassland vegetation. Loss of biodiversity is a pressing problem for the biosphere. Current estimations for one of the attributes of the biodiversity – species richness – indicate that the extinction rates are higher than in the recent past and are still increasing (AGUIAR, 2005). The researches in this way are numerous there being approached different issues of this topic. Former researches developed by PAVLŪ *et al.* (2011) have evidenced that the consequent management cessation increased uniformity of grassland communities and only several dominant plant species prevailed there. The results show that some temperate grassland can be resistant to short-term perturbation by fertilisation. PIERIK *et al.* (2011) show that plant species richness can, at least partially, recover after an initial diversity decline caused by fertilization. JEANNERET *et al.* (2007) has investigated the intensity of management on the grassland biodiversity, considering the fertilisation and exploitation. The obtained results showed that for biodiversity at farm level, extensive grasslands all over the farm would be the best.

MATERIAL AND METHOD

The objective of this study is to compare different mineral and organic-mineral fertilisation doses applied on forest steppe grassland vegetation from the hill area of western Romania, respectively Fibiş (Timiș County). The research plots were set on a homogenous vegetation sector of the hayfield. The fertilisation variants applied were the following: V1 – control; V2 - N₁₀₀ + P₅₀ + K₅₀; V3 - N₁₅₀ + P₅₀ + K₅₀; V4 - N₁₀₀₊₁₀₀ + P₅₀ + K₅₀; V5 - 20 t

sheep manure + P₅₀; V6 - 20 t sheep manure + P₅₀ + K₅₀; V7 - 20 t sheep manure + N₅₀ + P₅₀ + K₅₀. The plots were set in blocks with seven variants and three replicates, each having a surface of 20 square meters (4 m x 5 m). They have been harvested by cutting twice a year. The fertilisers were applied in November 2010 and the data were collected in 2011.

The vegetation data were collected using the linear point quadrat method (DAGET *et al.* POISSONET, 1971). The data obtained in this way were processed for the calculation of the biodiversity indexes Shannon and Simpson. Also there were realised the ecological spectres for temperature, humidity, soil reaction and light using the indexes set by KOVACS (1979) for Romanian grasslands after ELLENBERG (1988).

The significance of the analysed ecological indexes is the following:

- **temperature (T):** 1 – species found in cold areas (boreal, arctic or alpine); 3 – species found in cool areas (mountain, subalpine); 5 – species found in temperate areas (hilly, sub-mountain); 7 – species found mainly in warm areas (plain); 9 – species found in warm areas (Mediterranean); x (0) – species indifferent for temperature;
- **humidity (U):** 1 – species found on very dry soils; 3 – species found on dry soils; 5 – species found on moderate humid soils; 7 – species found on moderate humid to humid soils (that do not dry out); 9 – species found on humid – wet soils (often airless); 10 – species found on flooded soils; x (0) – species indifferent for humidity;
- **soil pH (R):** 1 – species found only on very acid soils; 3 – species found mainly on acid soils; 5 – species found mainly on moderate acid soils; 7 – neutral soils (from moderate acid to moderate alkaline); 9 – species found only on neutral and alkaline soils; x – species indifferent for the soil pH;
- **light (L):** 1 – species found in full shade; 3 – species found in shade; 5 – species found in moderate shade (that are growing in shade but tolerate a moderate shading); 7 – species found in light (low tolerance to moderate light); 9 – species found in full light (KOVACS, 1979).

The Shannon index formula used in this work is the entropy one: $H' = -\sum_{i=1}^S p_i \times \ln p_i$

where: S = species number from the studied sample (species richness); p_i = percentage of the species i din S (BEALS *et al.*, 2000).

The Simpson index formula used here is: $D = \sum (n_i / N)^2 = \sum_{i=1}^S p_i^2$

where: n_i = the total number of individuals of the species i ; N = the total number of individuals of the all species from the sample; $p_i = n_i / N$ (SAMFIRA *et al.*, 2011).

RESULTS

The analysed grassland vegetation cover is dominated by *Agropyron repens* and *Festuca arundinacea*. An important contribution was determined also for the following species: *Bromus hordeaceus*, *Poa pratensis* and *Lotus corniculatus*. The botanical composition of

the analysed fertilisation variants is presented in *Figure 1* and it shows that the chemical fertilisation has determined the increase of the grasses contribution, while the mixed fertilisation has determined the increase of the contribution of the species from other botanical families.

The total plants species number in the control plot (V1) was 29, this value decreasing in the case of the chemical fertilisation variant (V2, V3, V4) and the last organic – mineral fertilised variant (V7) (*Figure 2*). The biodiversity assessing using the Shannon index (H') (*Figure 4*) and Simpson index (D) (*Figure 5*) have evidenced the same situation, H' being the inverse of D . According to PLANTUREX *et al.* (2005), the fertilization determinates the decrease of species richness. Other researches developed by VÎNTU *et al.* (2011) show that the organic fertilizer rates triggered changes in the canopy structure by reducing the percentage of grasses, from 70% to 14-31%, and increasing the percentage of legumes.

The fertilisation doses applied have determined the increase of the percentage of species found in light (L7) and the decrease of their coverage, except V5 variant. The humidity (U) and temperature (T) spectres were slightly influenced by fertilisation. In the case of the ecological spectre for soil reaction (R), the greatest changes have been noticed in V2 (mineral) and V6 (organic-mineral).

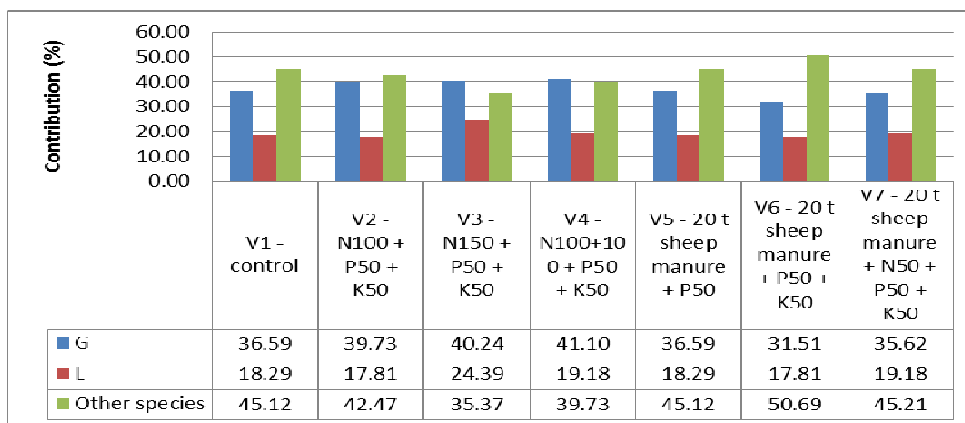


Figure 1. Influence of fertilisation on the floristic composition

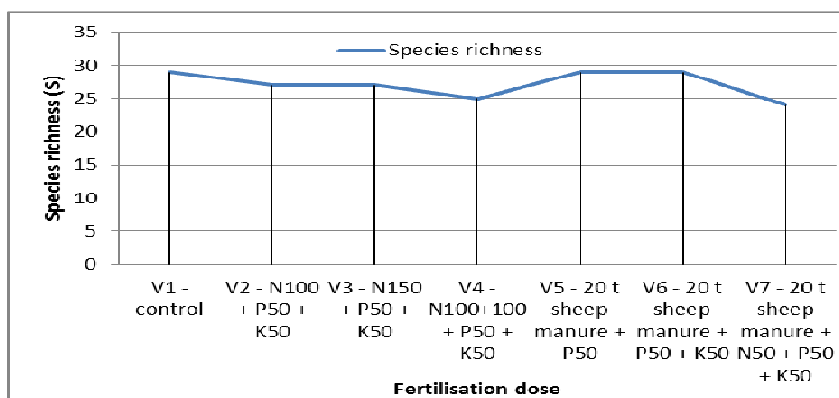


Figure 2. Influence of fertilisation on the species richness

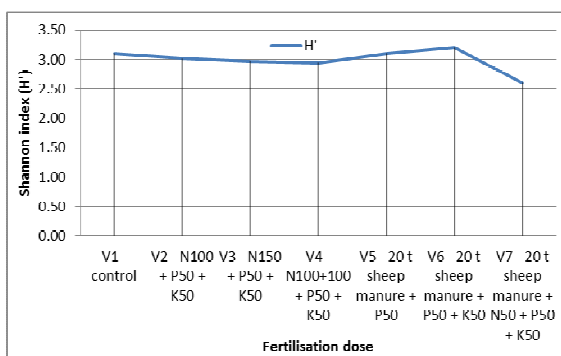


Figure 3. Influence of fertilisation on H'

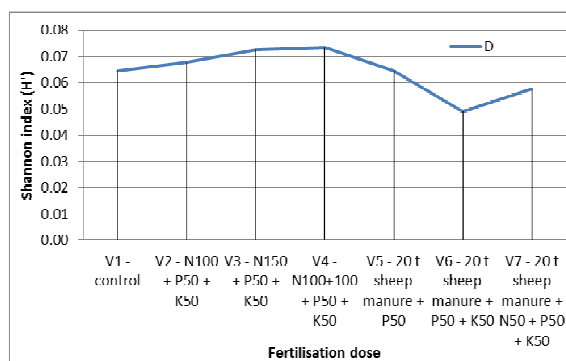


Figure 4. Influence of fertilisation on D

Other aspects analysed were the influence of the fertilisation on the ecological spectres for light (L) (Figure 5), temperature (T) (Figure 6), humidity (U) (Figure 7) and soil reaction (R) (Figure 8).

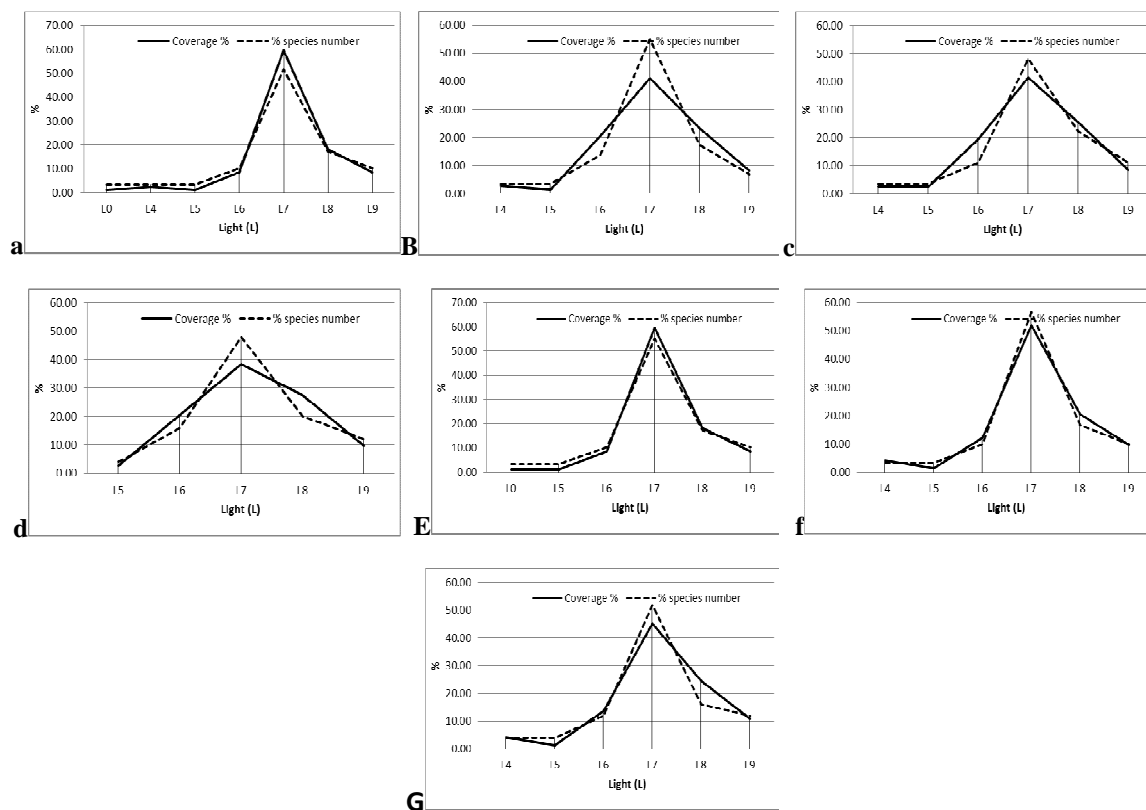


Figure 5. Influence of fertilisation on the ecological spectre for light (L) (a-V2; b-V2; c- V3; d-V4; e -V5; f-V6; g-V7)

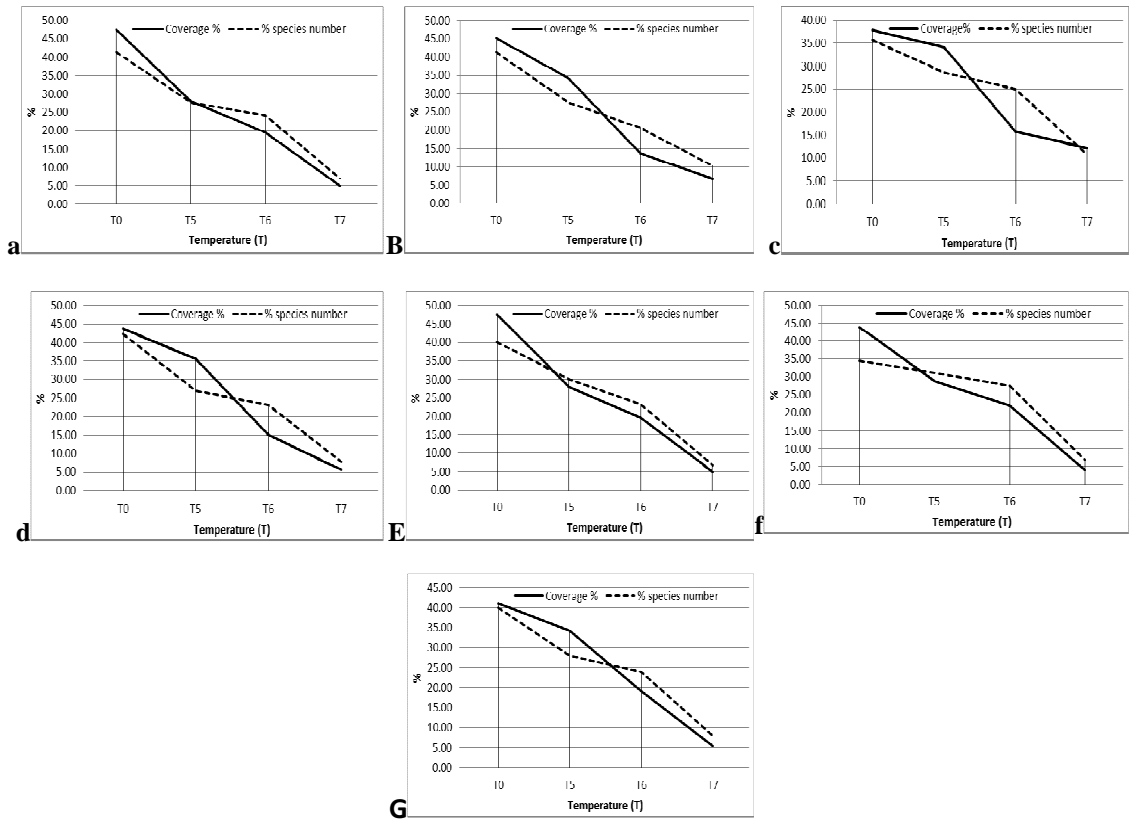


Figure 6. Influence of fertilisation on the ecological spectre for temperature (T) (a-V2; b-V2; c- V3; d-V4; e -V5; f-V6; g-V7)

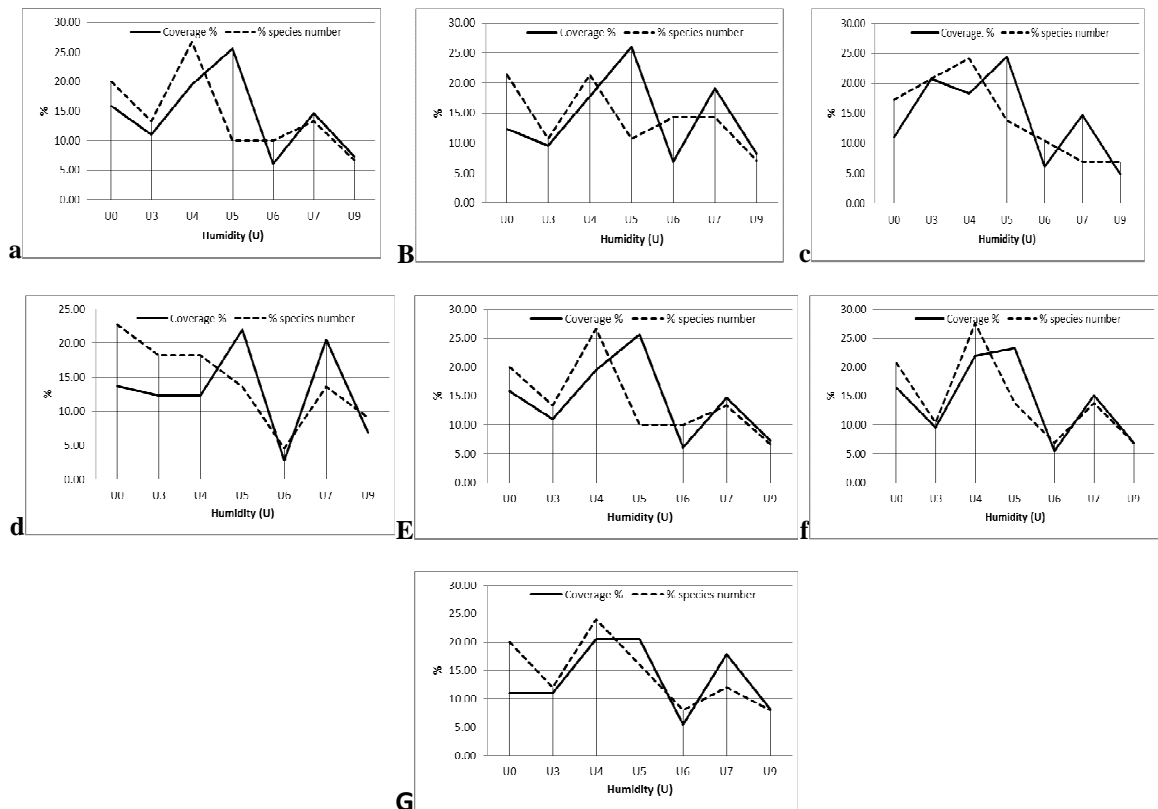


Figure 7. Influence of fertilisation on the ecological spectre for humidity (U) (a-V2; b-V2; c- V3; d-V4; e –V5; f-V6; g-V7)

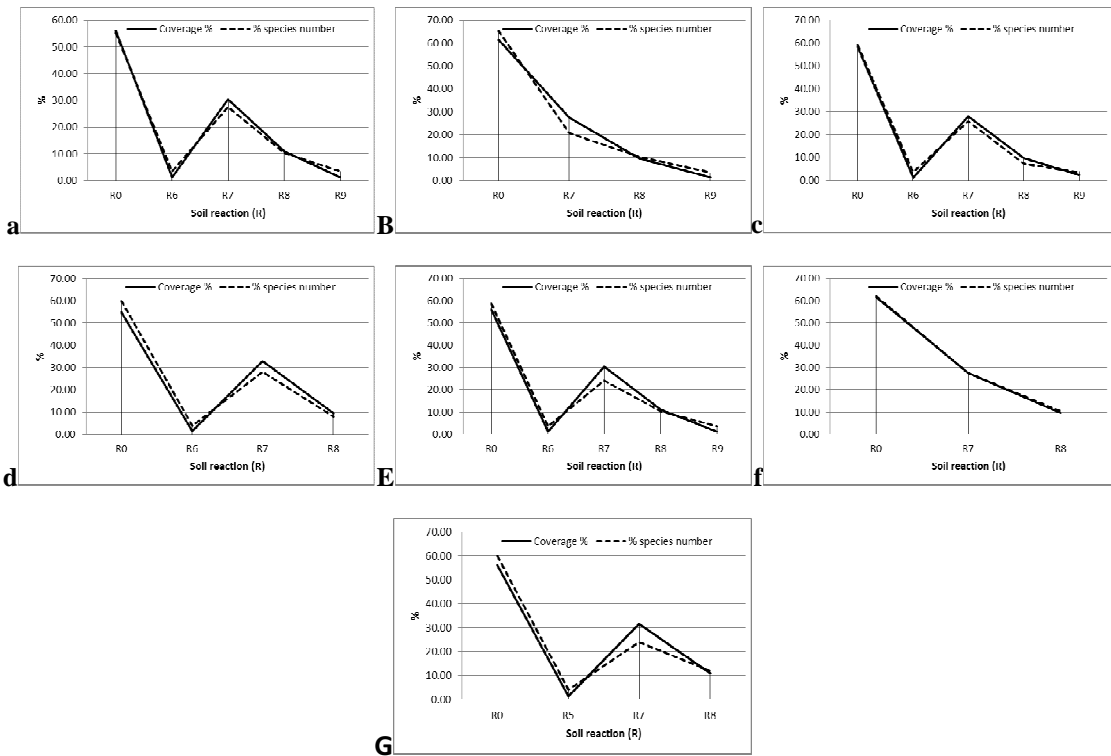


Figure 8. Influence of fertilisation on the ecological spectre for soil reaction (R) (a-V2; b-V2; c- V3; d-V4; e –V5; f-V6; g-V7)

Fertiliser supplies determinate an increase in nutrient availability for plants. In these conditions, only a few fast growing plant species can compete for light eliminating less competitive plants (PLANTUREX *et al.*, 2005). According to OBRATOV-PETKOVIĆ *et al.*, (2006) there is a correlation between hydrothermic conditions of the soil and the ecological indices of plants for moisture (F), light (L) and temperature (T).

CONCLUSIONS

The biodiversity is diminished by chemical fertilisation, the organic-mineral low doses maintaining this parameter close to the non-fertilised variant in the forest steppe grassland dominated by *Agropyron repens* and *Festuca arundinacea*. Regarding the ecological indexes, the greatest influence was evidence d in the case of light and soil reaction ecological spectres. It is recommended to be applied low fertilisation doses that will not affect the biodiversity and structure of the grassland vegetation.

ACKNOWLEDGEMENTS

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REFERENCES

- AGUIAR M.R. (2005): Biodiversity in Grasslands. Current changes and future scenarios, in Reynolds S.G. and Frame J. (2005): *Grasslands: Developments, opportunities, perspectives*, FAO and Science Publishers, Inc., p. 261-280.
- BEALS M., GROSS L., HARRELL S. (2000): *Diversity indices: Shannon's H and E*, <http://www.tiem.utk.edu/~mbeals/shannonDI.html>, consulted at 12.12.2010.
- DAGET P., POISSONET J. (1971): Une méthode d'analyse phytologique des prairies, Critères d'application, Ann. Agron., Volume 22, Number 1, pp. 5 – 41.
- ELLEMBERG, H. (1988): *Vegetation ecology of central Europe*, 4th edition. Cambridge University Press, Cambridge, UK, 731 p.
- JEANNERET P., HUGUENIN-ELIE O, BAUMGARTNER D., FREIERMUTH KNUCHEL R., GAILLARD G., NEMECEK T., WEIBEL P. (2007) Estimation of grassland management impact on biodiversity, *Grassland Science in Europe*. 12, p. 382-385
- KOVACS A. (1979): Indicatorii biologici, ecologici și economici ai florei pajiștilor. Redacția de propagandă tehnică agricolă, București, 50 p.
- OBRATOV-PETKOVIĆ D., I. POPOVIĆ, S. BELANOVIĆ, R. KADOVIĆ (2006): Ecobiological study of medicinal plants in some regions of Serbia, *Plant Soil Environ.*, Volume 52, Number 10, p. 459-467
- PAVLŪ V., GAISLER J., PAVLŪ L., HEJCMAN M. (2011): Cessation of cutting and fertilization and its effect on upland grassland, *Grassland Science in Europe*, Volume 16, pp. 404-406.
- PIERIK M., VAN RUIJVEN J., BEZEMER T.M., R.H.E.M. GEERTS, BERENDSE F. (2011): *Ecology*, Volume 92, Number 7, pp. 1393-1398.
- PLANTUREX,S., PEETERS, A., MCCRACKEN, D. (2005): Biodiversity in intensive grassland: Effect of management, improvement and challenges, *Agronomy Research*, 3 (2) : 153-164.
- SAMFIRA I., MOISUC A., SĂRĂȚEANU V., MARUȘCA T., HĂRMĂNESCU M., POPESCU C., HERBEI M. (2011): *Elemente metodologice aplicate în cercetarea pajiștilor*, Editura Mirton, Timișoara, 270 p.
- VÎNTU V., SAMUIL C., SÎRBU C., POPOVICI C.I., STAVARACHE M. (2011): Sustainable Management of *Nardus stricta* L. Grasslands in Romania's Carpathians, *Notulae Botanici Horti Agrobotanici*, Volume 39, Number 2, pp. 142-145.

ANIMAL VULNERABILITY AND THE NECESSITY OF PROTECTING THEM

COMAN ȘTEFAN, PETROMAN IOAN, PETROMAN CORNELIA, DUMESCU F., PAICU D.,
AVRMESCU DANIELA, BLEJA C., BELA ANGELA

Banat's University of Agricultural Sciences and Veterinary Medicine Timisoara
Faculty of Farm Management
Calea Aradului, nr. 119, Timisoara
i_petroman@yahoo.com

ABSTRACT

In Romania, there are at least 14 animal species represented by 123 animal breeds and pure lines listed on the List of animal genetic resources in critical state, threatened, or vulnerable. Though these animal species need to be protected, their conservation has not been supported financially. These categories of vulnerable animals are represented by: 13 sheep breeds, 19 fish species and breeds, 2 goat breeds, 2 swine breeds, 4 goose breeds, 61 chicken breeds and pure lines, 7 turkey populations, 7 duck breeds, the Romanian buffalo, and a bovine breed, the *Sură de stepă*.

Keywords: animal protection, vulnerability, animal species

INTRODUCTION

Animal breeding plays an important role in the world's economic life since it supplies foods indispensable to human nutrition. Animal breeding contributes, together with vegetal production, to the development of our entire agriculture, to the increase of labour productivity and economic efficiency, thus contributing both **directly** (production of foods with high biological value: meat, milk, eggs, etc.) and **indirectly** to the development of the agricultural economy (DECUN AND KRUTSCH, 2001, NEAGU, CULEA AND PETROMAN, 2007).

Animals still play an important role in households supplying part of the mechanical energy necessary to work the land, despite the development and the diversification of the mechanised tools (DECUN AND KRUTSCH, 2001).

The animal breeding sector undergoes a very difficult period because of the high price of cereals and oil plants, because of the low prices farmers get for their produce from the processing industries, because of the high costs of meeting European legislation concerning the environment, the animal welfare and protection, the biosecurity, and other constraints that cannot be traced in the legislation of our main competitors on the world market (DECUN AND KRUTSCH, 2001, O.E.C.D. 2010, Hotărârea de Guvern nr. 739 din 20 aprilie 2010) To note the negative impact of the high prices of the European commercial networks that have resulted in a decrease of the consumption of meat and meat produce.

MATERIAL AND METHOD

Due to the biological value of the meat from domestic breeds, we need to take protection measures for the vulnerable animal species to preserve their valuable genes.

To prepare the scientific paper we used the data published in the List of animal genetic resources in critical condition, endangered and vulnerable, developed by the Ministry of Agriculture.

In this paper, we aim at presenting the most valuable domestic animal breeds and lines and the solutions to adopt to preserve vulnerable animal species now that more and more countries focus on biological agriculture. These animal species with a high degree of adaptability and resistance to disease can be a valuable genetic material for the improvement of some production features of the commercial lines and hybrids whose main production (the meat) no longer has the organoleptic features values by the consumers.

RESULTS AND DISCUSSION

In Romania, there are still valuable genetic resources that need to be preserved through measures taken by the authorities. There are numerous animal species threatened by different levels of vulnerability, among which the following:

- **threatened animal populations** are represented by 101-1,000 females:
 - the *Gât Golaș de Transilvania* chicken (*Gallus gallus domesticus* L.), with 996 pure mother-specimens;
- **critically endangered or extinct animal populations** have less than 100 females:
 - 2 sheep breeds (*Ovis aries* L.): Polwarth (128 females) and Belgian Suffolk Cullard (57 females);
 - 22 chicken breeds (*Gallus gallus domesticus* L.) among which: Anvers Chicken (30 females), New-Jersey (27 females), Dwarf Phoenix (45 females) (*Figure 1*), American Dwarf (15 females), Vonwerk (15 females), Dwarf Welsummer (45 females), Dwarf Yokohama (30 females);
 - the Bazna pig, with 79 reproduction adult boars
 - *Sura de stepă* (185 - heads), the oldest domestic bovine breed: if, until the half of the 19th century, it dominated the grasslands all over Romania, nowadays there are only 51 females at the Bovine Research-Development Station in Dancu (Iași County), at the Grassland Research-Development Station in Jucu (Cluj County), and at a farm in the Ialomița County (*Figure 1*):



Figure 1. The *Sură de stepă* cow

- **vulnerable animal populations** are represented by 1,000-5,000 females:
- buffalo (*Bubalus bubalis* L.) (total in Romania – 433 heads from which 228 females in the Braşov County);
- the White Banat Goat (*Capra aegagrus hircus* L.) (603 females), the Carpatian Goat (3097 females);
- the Karakul sheep (*Ovis aries* L.) (3091 - heads);
- the Australian Merino (113 - heads), the Cluj Merino (114 - heads) (*Figure 2*), the Palas Merino (6138 - heads), the Stavropol Merino (1432 - heads), the Suseni Merino (1011 - heads), and the Transylvanian Merino (2396 - heads) (*Figure 2*) (*Ovis aries* L.):

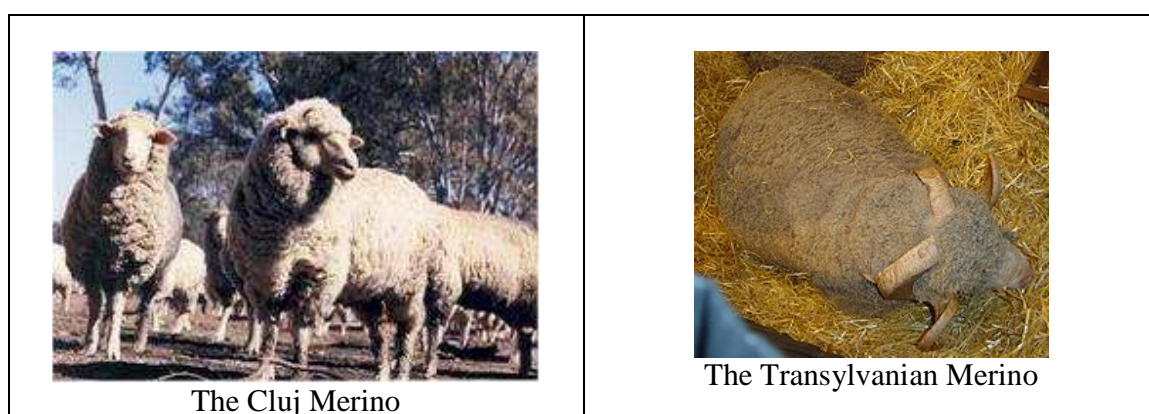


Figure 2. The Transylvanian Merino and the Cluj Merino

- the Raţca sheep (Wallachian with corkscrew-like horns) (*Ovis aries* L.), bred for thousands of years in the Banat area only, is represented nowadays by only 2,371 females (*Figure 3*):



Figure 3. The Raţca sheep

- the Black-headed *Țigaie trane de Teleorman* (*Ovis aries* L.) (3,382 - heads) (Figure 4);



Figure 4. The Black-headed *Țigaie de Teleorman*

- the Rusty Țigaie (1434 - heads) (*Ovis aries* L.);
- fishes: the common carp (*Cyprinus carpio* L.), tench (*Tinca tinca* L., Eurasian spoonbill (*Platalea leucorodia* L.), Beluga sturgeon (*Huso huso* L.), starry sturgeon (*Acipenser stellatus* L.), wels catfish (*Silurus glanis* L.), zander (*Sander lucioperca* L.), Northern pike (*Esox lucius* L.), etc. Fish species is represented by 36,720 heads;
- the Mangalița pig (548 females), whose fat used to be the main ingredient of the Sibiu salami;

CONCLUSIONS

As for the state subsidies to support the National programme concerning the conservation, characterisation, collection, and use of critically endangered, threatened, vulnerable, and unsafe animal genetic resources, we need to mention that the animal species no longer taken into account in nowadays Romania are honeybees, silk worms, fishes, and small fur animals. Moreover, private animal breeders are compelled to register if they wish to be part of the programme. Through the new system, farmers will receive about 200 Euros per bovine, which, in poultry, means about 12 RON per capita. Comparatively, until new measures are taken, the subsidy was 50 RON/capita of poultry and now it is 45 RON/capita of poultry. We need to take measures to supply state subsidies for the conservation, characterisation, collection, and use of critically endangered, threatened, vulnerable, and unsafe animal genetic resources.

REFERENCES

- DECUN M., KRUTSCH H. W. (2001): Vulnerabilitatea și protecția animalelor, Editura Mirton, Timișoara
- NEAGU IULIANA, CULEA C., PETROMAN I. (2007): Creșterea animalelor, Editura Eurostampa, Timișoara
- PETROMAN I. (2007): Managementul sistemelor de creștere și exploatare a animalelor, Editura Eurostampa, Timișoara,
- *** - O.E.C.D. (2010) *Challenges for Agricultural Research*. O.E.C.D. Publishing. Online: <http://dx.doi.org/10.1787/9789264090101-en>
- *** - Hotărârea de Guvern nr. 739 din 20 aprilie 2010

EMERGENCY SITUATIONS IN SOIL POLLUTION BY ANIMAL WASTES

COMAN ȘTEFAN, PETROMAN IOAN, PETROMAN CORNELIA, MARIN DIANA, AVRAMESCU DANIELA, BELA ANGELA, HEBER LOREDANA, BLEJA C.

Banat's University of Agricultural Sciences and Veterinary Medicine Timisoara
Faculty of Farm Management
Calea Aradului, nr. 119, Timisoara
i_petroman@yahoo.com

ABSTRACT

The analysed indices were identical during the entire research period, and so were the measurement methods used in the laboratory (pH, total humus, total nitrogen, mobile phosphorus, potassium). The evolution of the soil pollution by animal wastes from the farm animals in the Arad area point out a high level of soil pollution because of the low values of the pH, of the low soil bonitation scores, of the secondary compaction in the first genetic horizon. After a poultry farms ceases to operate, soil pollution persists, with a slight tendency to decrease naturally.

Keywords: management, emergency situation, pollution, soil, animal wastes

INTRODUCTION

Increasing pollution worldwide, critical ecological accidents in the 1970s, and the oil crisis, deforestations and desertification have resulted in more and more literature on the “global issues” human civilisation is confronted with in the second decade of the 3rd Millennium. These issues have a considerable impact on social life: not solving them prevents us from approaching and solving other issues worldwide and ask, more than ever, for a global solution.

The main cause of biodiversity loss (DUMESCU 2006, DUMESCU 2007, PAICU, PETROMAN AND COSTACHE 2010, PLATON 1997) are the **changes of natural habitat** because of the intensive agricultural production systems, of the construction and extractive industries, of the over-exploitation of forests, oceans, rivers, lakes and soils, of the foreign invasive species, of pollution, and of climate changes worldwide. Biodiversity should be conserved worldwide, since it generates, on one hand, goods and services directly usable by the human socio-economic system, and, on the other hand, it maintains ecological processes at local, regional, and global levels. Only 17% of the habitats and species assessed have a favourable conservation status, most ecosystems being no longer able to supply optimal services qualitatively and quantitatively such as crop pollination, clean air and water, controlling floods and erosions, etc. In addition, about 25% of the European animal species (mammals, amphibians, reptiles, birds, and butterflies) are threatened, and 88% of the fish reserves are overexploited or extinguishing.

To **stop biodiversity loss**, we can rely on the following arguments and motivations:

- economic motivations: potential use of animal species as a source of food, medicines, or raw materials in biotechnology;
- scientific aspect: interrelations between the different components of the ecosphere and the possibility of understanding how it works;

- aesthetic aspect: irreversible loss of some unique forms of life, of some categories of ecosystems and landscapes, is equivalent of human expertise and horizon loss;
- ethical considerations: negation of the prerogatives of the human species of destroying other animal species and support for the right to existence of all forms of life;
- **degradation of land and desertification** (DUMESCU 2008, HELD 2004) as a result of the complex interaction between global climate and anthropic factors are critical climate issues that affect the ability of using sustainably land areas. To support international conventions, scientific activity analyses the trends, results, and dynamics of the phenomenon and the development of strategies, methods, and instruments for a better management of the environment. We should also encourage the constructive dialogue between scientists and decision-makers or their representatives.

MATERIAL AND METHOD

To establish the level of soil pollution around the animal farms in the Arad County, we monitored the results in analyses bulletins issued by the institutions habilitated to supervise environmental factors through specific methods or we made analyses in specialised laboratories such as that of the Arad Agency for Environmental Protection.

Soil sampling points at the basis of our analysis of soil evolution under the impact of animal waste pollution and of soil and agro-chemical characterisation indices is located in the area of animal waste pits.

We compared our results with results of other researchers who carried out research in the reference area.

RESULTS AND DISCUSSION

Animal farms have left behind, after ceasing to operate, **environmental effects** consisting of large amounts of animal wastes which, if not valorising as organic fertilisers, **pollute the soil and the waters and generate discomfort because of the foul smell**. We refer to the pig farms in Arad – Ceala, Felnac Semic, Nadlac, Şicula, and Cermei, as well as the poultry farms in Arad and Vladimirescu. Pollution caused by these animal farms is the result of hydraulically removed animal wastes or of animal wastes mixed with water resulting in large amounts that cannot be valorised as fertilisers and that are stored in basins, on the soil, or reach the water courses. In addition, this type of animal wastes, unlike bovine wastes, is not agreed as organic fertiliser because of its negative impact on the soil and crops.

The animal farm in Vladimirescu is located outside the locality, on the DN 7 Arad – Deva, in an area that is expected to turn into a residential area. The industrial, administrative, and utility buildings were built before 1990. The ex-poultry farm had a total useful area of **6,500 m²** and it was made up of 3 chicken houses, 2 administrative buildings, heating system, and animal wastes pits.

We used laboratory analyses, analytic data, and measurements made during the period 1992-2010. These data cover both the period **the farm operated** (1992-1994), and the period **the farm ceased to operate and store animal wastes**. Taking into account these

aspects, we consider the data extremely significant both for the assessment of the soil pollution level and for the later evolution of the soil processes in the research areas.

General Characterisation of the Characteristic Soil Type

In the research area, there is a wide variety of soils, from typical gleyic soils to mollic alluvial or mollic-cambic soils, or to anthropic proto soils. In the research area, the largest area is covered by the typical anthropic proto soil, poorly gleyed, on fluvial, clayish-argylous-dusty deposits representative for the area described below.

According to the Romanian System of Soil Taxonomy, anthropic proto soil is part of the unevolved and little evolved soil categories at the debut of their formation and development with an incomplete differentiated profile, with poorly contoured, and unclearly defined genetic horizons. These soils have, in general, a gross texture with a low gleysation level. Sometimes, they can be slightly salinised.

Presentation of physico-chemical and geo-morphological features of the analysed soil

Soil type:

- Typical anthropic proto soil, poorly gleyed on fluvial deposits, clayish-argylous-dusty;
 - soil genetic horizons: Am 0-28 cm, A/D 28-50 cm, and D 50-78 cm.
- Texture classes: clayish-sandy in the first horizon, clayish-sandy-dusty in the second horizon and sandy in the third horizon (fluvial sands).
- Nutrient supply status:
 - in general, humus content is moderate to very well supplied;
 - phosphorus supply is moderate;
 - potassium supply is good to very good.

Table 1. Not potentialised mean bonitation scores (calculated according to the methodology developed by the Soil and Agro-chemistry Institute in Bucureşti)

Reference years	1992	1992	1994	1995	1996	1997	1998	1999	2000
Mean bonitation score	0	0	2	-	-	4	6	5	7
Soil quality class (*)	X	X	X	-	-	X	X	X	X

Reference years	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Mean bonitation score	7	8	8	14	14	19	19	25	26	28
Soil quality class (*)	X	X	X	IX	IX	IX	IX	VIII	VIII	VIII

*soil quality classes according to the agricultural land bonitation methodology (on a scale from I to X)

Evolution of the soil pollution level by animal wastes from animal farms

Analysing physical and chemical data as well as the evolution of the bonitation scores of the agricultural lands in the research area, we can note the following significant aspects:

- during the period of intense activity of the animal farm (1992-1994), there was a **high level of soil pollution** (soil quality class - X) represented by the low values of the pH, of the bonitation scores (0-2), strong secondary compaction at the level of the first genetic horizon;
- after the farm **ceased to operate** (after 1994), **soil pollution persisted**, but there was a slight tendency to natural improvement favoured by the relatively abundant precipitations that resulted in pollutant percolation on the soil profile

- and, subsequently, their significant diminution, this situation continued until 2004 when land was part of a higher quality class (soil quality class - IX) ;
- **soil quality improvement level is directly proportional with time lapse:** at present, the bonitation score values (25-28) and the quality class was VIII, were comparable with those of lands in similar soil areas,

CONCLUSIONS

At present, there is a tendency to climax in soil evolution, with a low pollution level, but there are still traces of pollutants in the soil, which points to a high level of pollution in the past, depollution being a long-lasting phenomenon. There is also translation of the soil pollution (a phenomenon that is slow at present) to the pollution of the water table with nitrites: the most affected is the upper horizon (a phenomenon activated in the second part of the interval).

We estimate that in the future the phenomenon of nitrite migration towards lower horizons will activate.

REFERENCES

- DUMESCU F. (2006):, Evaluarea impactului asupra mediului, Editura Risoprint, Cluj Napoca
- DUMESCU F. (2007): Managementul mediului și dezvoltarea durabilă, Editura Eurostampa, Timișoara
- DUMESCU F. (2008): Managementul mediului la lucrările de prospectare și exploatare a minereurilor radioactive din județul Arad, Studia Universitatis „Vasile Goldiș” Arad, seria științe economice, nr. 20, vol. I.
- HELD D. (2004): Transformări globale, Editura Polirom, Iași
- PAICU D., PETROMAN I., COSTACHE I. (2010): Enviromental protection by the implementation by Romania of the Seveso european directive. Case study of the major accidents effects on the industrial site Archim from the Vladimirescu locality, Lucrări științifice, vol. XII (3), Editura Agroprint, Timișoara
- PLATON V. (1997): Protecția mediului și dezvoltarea economică, Editura Didactică și Pedagogică, București

POPULATION DYNAMICS OF COMMON THRIPS IN MARIGOLD CROP

CRISTINA ZEPĂ CORADINI, VALERIU TABĂRĂ, LAVINIA MICU, ROXANA ZEPĂ BEJAN,
RENATO CORADINI

University of Agricultural Sciences and Veterinary Medicine of Banat Timișoara
No.119; Aradului Street; Timisoara; Romania;
cristina.coradini@yahoo.com

ABSTRACT

Damages produced by the pest insects can be very big, thus care must be taken about some aspects concerning the incidence in samples, dynamics and evolution of one of the most important insect pests of the flowers, such as Thysanoptera. Due to the relatively high incidence of *Thrips tabaci* in the samples collected from the experimental field of marigold, the species presented a real economic importance. To obtain a high production and superior quality it was necessary to choose the best moment for treatments by applying in function of population dynamics of those pests. In case of population dynamics of adults and larva of *Thrips tabaci* from the crop of *Calendula officinalis* L., the maximal values in all local populations taken in study were in increase in the second decade of June, and reached the maximum level in the third decade of June. It was followed by an obvious decrease in July - their number started to decrease to the end of the collecting period, until the second decade of August, thanks to the end of vegetation period of the flowers. In function of population dynamics, the best time for applying treatments in the crop flowers was during the period 15.06.2011- 26.06.2011.

Key words: *Thrips tabaci*, *Calendula officinalis* L., population, evolution

INTRODUCTION

Cropped in the oldest times by Egyptians, Greeks, Hindus, Arabs, marigolds begun to be arisen in the European gardens later, beginning with the XIIth century. Firstly, it was known as ornamental flower, afterwards it was appreciated by its curative qualities, as medical plant (GONCEARIUC, 2000). Therapeutic properties of marigolds were known and used in popular medicine of some peoples. The species was chosen in many European countries, such as Germany, England, Netherlands, France both as medicamentary and alimentary ingredient, thanks to its aroma and special flavor offered to culinary products, but especially to its reduced price compared to the relatively expensive oriental condiments,. The medical plants had an important role in our popular medicine. The profound knowledge of medical plants, including the marigold, its extended usage became wide-spread in the second half of the last century. Lots of people are interested in its crop, thanks to its therapeutic qualities based on the complex of active biological substances (BRÂNZILĂ, 2005). The health status of the plants represented the main way of increasing yield and the accumulation of the active principles in the medical plants.

Tobacco thrips (*Thrips tabaci*) is a major pest, the attack by its larvae and adults diminishing the flower production in a great measure. The tobacco thrips proved to be the most dangerous pest among the thrips of Europe in the last years, which attacked more important plants of economic point of view (ANDJUS AND TRDAN, 2005). During few years of thrips investigation in Europe, the tobacco thrips was discovered in more crop plants and in the natural flora. According to several authors, it was discovered in over 200 plant species from 30 botanic families (RASPUDIĆ AND IVEZIĆ, 1999). The Russian author DYADECHKO (1977) mentioned that the number of host plants could hit 400 species. *Thrips tabaci* is spread very much also in Romania, and appeared in the drought years for the insect development, causing great damages to the crop plants.

In the eastern part of Romania, MUNTENAȘU (2006) studied the structure and dynamic of identified thrips populations at Bârlad's greenhouses during 2004–2005, under the aspect of development stages (monthly), evolution cycles and density on different flower plants (*Dianthus caryophyllus*, *Begonia* sp., *Nerium oleander*, etc.). However, in the western part of the country there were few investigations of that insect, thus the work proposed to emphasize some experimental data about thrips population dynamics in the medical plants crop. The knowledge of population dynamics particularities of thrips, contributed to determine the best moment of applying treatments for an integral control of that pest in marigold crop.

MATERIAL AND METHOD

To make investigations on population dynamics of Thysanoptera, the experimental field was placed to Didactic Base of USAB from Timisoara.

Conditions of collecting samples

In the experimental year 2011, monitoring thrips populations from the marigold crop were made at an interval of 3-4 days, beginning with 11th June and ending with 21st August, during all the marigold vegetation period. Thus, the probes on the plants were made during 10 weeks. The 20 samples were collected in the morning between 08:00-09:00 hour when the temperature was between 18-26 °C and the humidity was 60-74%, or in the evening around 20:00 hour, because of the high temperatures. For the population analysis of thrips adults and larvae from the flower crop, the method of plant organ jarring was applied which presented samples to analyze. The entomological material collected from the flowers was made from a number of 30 plants, put in 3 repetitions, 10 plants/repetition, the jarring made from a number of 30 flowers/repetition, 30 flowers/plant.

Preparation and preservation of entomological material

After collecting insects in carrier bags, those were killed with acetone. The selection of the entomological material by the binocular loupe was followed by its preserving. The samples were introduced in alcohol (70%) bottles and labelled with the cropping date. For gathering, preparation, preservation and the determination of the collected material, the following materials were used: microscopes, binocular eyeglasses, simple eyeglass, lamellae, blades, preparation pins, pincers, paper envelopes, glass wand, fixing solutions, chloroform, acetone, 70% ethyl alcohol, ether, 50% diluted acetic acid, distilled alcohol, Swan liquid, xylol, Canada balm, etc. After the collected material was preserved, observations were made at the microscope to determine where was only the *Thrips tabaci* species present.

RESULTS

The study of population dynamics of thrips collected from the experimental field showed both the adults and larvae of *Thrips tabaci*.

Incidence of the pest thrips adults in the *Calendula* crop samples

From the investigations made in the year 2011 on *Thrips tabaci* adults there was observed a constant and significant presence of tobacco thrips in the samples. The adults' appearance was signaled for the first time on the 11.06.2011. The thrips were always found

in flowers before they were found on leaves, this was in accordance with the results obtained by HIGGINS AND MYERS (1992a, b) in S.U.A.. From *Table 1* it can be observed that the highest number of adults (590) was collected on the 29th of June. This was not in accordance with WELLS *ET AL.* (2002), which monitored tobacco thrips populations during the early spring at four locations in south Georgia, determined dynamics and found the biggest number of collected adults on the 21st of May. BOSCO AND TAVELLA (2010) in Italy, found the maximum mean values in September, this difference is probably due to the different climatic conditions.

Table 1. *Thrips tabaci* adults collected from the experimental field, Didactical Base of USAB Timisoara, 2011

Collection date	Total number of adults of <i>Thrips tabaci</i>	Sample mean $\bar{x} \pm s_x$
11. 06. 2011	188	62.66 ± 11.02
15. 06. 2011	269	89.66 ± 16.17
19. 06. 2011	275	91.66 ± 6.23
22. 06. 2011	363	121.00 ± 16.23
26. 06. 2011	420	140.00 ± 12.37
29. 06. 2011	590	196.66 ± 45.78
02. 07. 2011	556	185.33 ± 22.84
05. 07. 2011	480	160.00 ± 36.96
09. 07. 2011	469	156.33 ± 19.40
12. 07. 2011	393	131.00 ± 29.17
16. 07. 2011	370	123.33 ± 19.12
20. 07. 2011	274	91.33 ± 20.06
24. 07. 2011	210	70.00 ± 21.04
28. 07. 2011	136	45.33 ± 0.72
01. 08. 2011	105	35.00 ± 2.50
05. 08. 2011	93	31.00 ± 1.70

The smallest number of adults was collected on 05.08.2011 with a number of 93 specimens. The biggest number of adult thrips was collected on the 29th of June. It was on average 196.66±45.78 per sample and on the 02nd of July 185.33±22.84 per sample. A relatively low number of specimens was collected in the third decade of July, having an average between 91.33±20.06 and 45.33±0.72 specimens/sample. The high average values of adults/sample emphasized the pest's importance due to its incidence during all the period of observation.

The population dynamics of *Thrips tabaci* adults from the *Calendula* crop

From *Figure 1* it could be observed that population dynamics of *Thrips tabaci* adults presented a maximum of specimens on 29.06.2011, and a minimum of specimens on 05.08.2011.

From 11.06.2011 there could be observed a continuous increase of insect number collected until 29.06.2011. The number increased from an average of 62.66±11.02 specimens/sample to an average of 196.66±45.78 specimens/sample. It could also be observed that from the 29th of June the thrips number decreased until the 05th of August, from an average of 196.66±45.78 specimens/sample to 31.00±1.70 specimens/sample. Population dynamics of *Thrips tabaci* adults of the marigold crop presented maximal values in the third decade of June and in the first decade of July with a maximum on the 29th of June 2011, followed by an obvious decrease until the end of the collecting period.

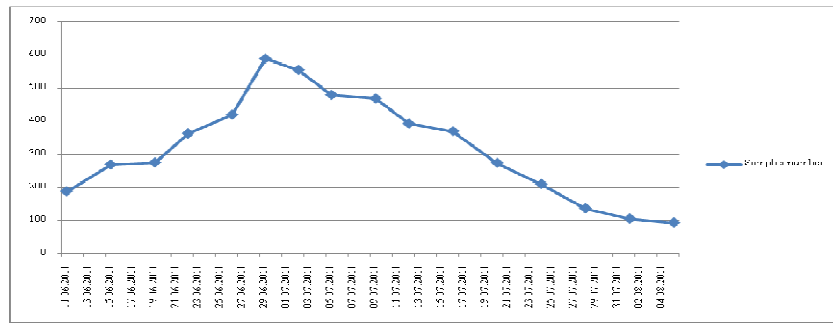


Figure 1. Population dynamics of *Thrips tabaci* adults collected in the experimental field from Didactical Base of USAB of Timisoara, 2011

Incidence of the pest thrips larvae in the *Calendula* crop samples

From the investigations made in the year 2011 on *Thrips tabaci* larva it can be observed that during the period 11.06.2011-05.08.2011 the most reduced number of species was registered on 29.06.2011 (Table 2). The average number of specimens oscillated between 23.00 ± 0.47 and 109.33 ± 26.71 .

Table 2. *Thrips tabaci* larvae collected from the experimental field of Didactical Base of USAB Timisoara, 2011

Collection date	Total number of larvae of <i>Thrips tabaci</i>	Sample mean $\bar{x} \pm s_x$
11.06.2011	79	26.33 ± 7.33
15.06.2011	109	36.33 ± 3.03
19.06.2011	116	38.66 ± 10.47
22.06.2011	179	59.66 ± 7.63
26.06.2011	233	77.66 ± 5.53
29.06.2011	328	109.33 ± 26.71
02.07.2011	296	98.66 ± 17.50
05.07.2011	256	85.33 ± 5.05
09.07.2011	250	83.33 ± 4.58
12.07.2011	212	70.66 ± 12.79
16.07.2011	211	70.33 ± 9.03
20.07.2011	162	54.00 ± 6.61
24.07.2011	125	41.66 ± 5.98
28.07.2011	122	40.66 ± 0.72
01.08.2011	99	33.00 ± 1.70
05.08.2011	69	23.00 ± 0.47

From the data obtained there could be observed an average of 109.33 ± 26.71 larvae/sample. Besides, a number of 196.66 ± 45.78 adults/sample had demonstrated once again the pest's importance thanks to its high incidence in the samples of the year 2011.

The population dynamics of *Thrips tabaci* larvae from the *Calendula* crop

The data presented in Figure 2 showed that from 29th of June the larva number was in decrease, arriving to 69 species/sample in the last day of collecting, in 05th of August. Also, it could be observed that in the first days of collecting, from 11th to 26th of June the number of insects collected had tripled, arriving to a number from 79 to 233 specimens. From 02.07.2011 until 24.07.2011 the larva number decreased from 98.66 ± 17.50 specimens/sample to 41.66 ± 5.98 specimens/sample, so its number reduced to half. From

29.06.2011 its number was in a continual decrease until the last day of collecting, 05.08.2011, when it registered the smallest number of larvae. In the function of population dynamics the best time of applying treatments was during the period 19.06.2011-22.06.2011.

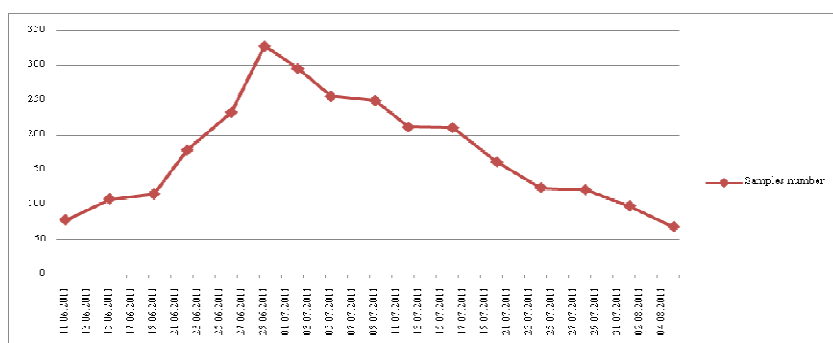


Figure 2. Population dynamics of *Thrips tabaci* larvae collected in the experimental field from Didactical Base of USAB Timisoara, 2011

In the case of both *Thrips tabaci* larvae and adults, the biggest number of specimens was registered on 29.06.2011, and the smallest number of specimens collected was registered on 05.08.2011 (Figure 3).

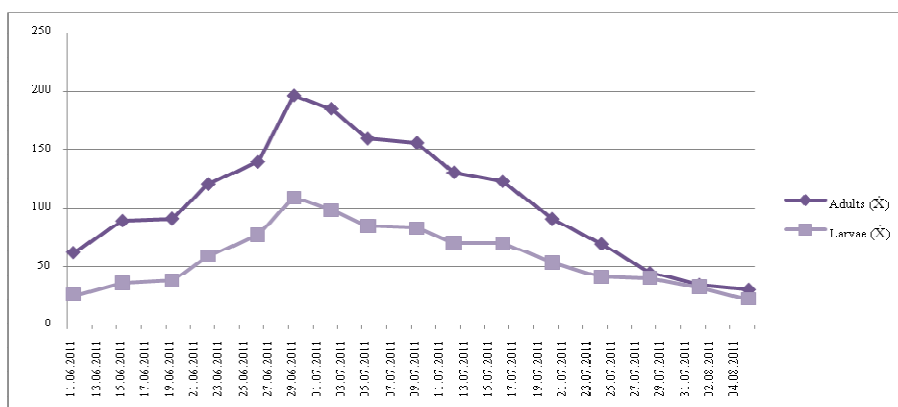


Figure 3. Population dynamics of thrips larvae and adults collected in the experimental field from Didactical Base of USAB Timisoara, 2011

Analyzing the dynamics of thrips specimens totally identified in collected samples from the experimental field of Didactical Base of USAB Timisoara, we can emphasize the great economic importance of these pests and their major role in quality and quantity depreciation of the flower crops.

CONCLUSIONS

The incidence and dynamics of the pest thrips adults in the samples

From the total of *Thrips tabaci* adults collected from the flower crop the maximum of specimens was collected on 29.06.2011 with an average of 196.66 ± 45.78 specimens/sample. The minimum number of collected adults was registered on 05.08.2011 with an average of 31.00 ± 1.70 specimens/sample. The specimen number collected gradually increased from 11.06.2011 until 29.06.2011 when the biggest number of species was registered, followed by an obvious decrease until the end of the collecting period.

The incidence and dynamics of the pest thrips larvae in the samples

The larva number from marigold crop, in 2011, increased beginning with the first decade of June until the third decade of the same month. Afterwards it decreased beginning with the first decade of July, the decrease continued until the first decade of August when the smallest number of collected specimens was registered. From the investigations made in 2011 in marigold crop on *Thrips tabaci* larvae, we determined that during the period 11.06.2011- 05.08.2011 the most reduced number of specimens was registered on the last day of collecting, and the highest number of specimens, was registered on 29.06.2011, the same that in the case of adults. The best time of applying treatments was during the period 19.06.2011-22.06.2011 before the adult and larva population decreased in an obvious way.

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REFERENCES

- ANDJUS, L., TRDAN, S., (2005): Štetne vrste Tripsa (*Thysanoptera*) U Zaštićenom prostoru. Biljni lekar/Plant Doctor - Godina XXXIII, Broj 1, Beograd, 57-62 p.
- BOSCO, L., TAVELLA, L., (2010): Population dynamics and integrated pest management of *Thrips tabaci* on leek under field conditions in northwest Italy. *Entomologia Experimentalis et Applicata*. Volume 135, Issue 3, pages 276–287.
- BRÂNZILĂ, I., (2005): Studiul privind influența unor elemente tehnologice asupra producției și calității ei la *Calendula officinalis* L.. Teză de doctorat, Chișinău, Republica Moldova.
- DYADECHKO, N.P., (1977): Thrips or Fringe-Winged Insects (*Thysanoptera*) of the European Part of the USSR. New Delhi, 1-344 p.
- GONCEARIUC, M., (2000): New gene sources of *Calendula* L.. *Acta Phytotherapica Romanica*, Anul 6, No. 1-2, p. 11-13.
- HIGGINS, C.J., MYERS, J.H., (1992a): Sex ratio patterns and population dynamics of western flower thrips (*Thysanoptera: Thripidae*). *Environmental Entomology*, 21: 322-330.
- HIGGINS, C.J., MYERS, J.H., (1992b): Western flower thrips (*Thysanoptera:Thripidae*) in greenhouse: Population dynamics, distribution on plants and associations with predators. *J. Econ. Entomol.* 85: 1891-1903.
- MUNTENAȘU, M., (2006): Biologia, ecologia și combaterea principalelor specii dăunătoare în serele floricole de la Bârlad-Vaslui. Teză de doctorat, Iași.
- RASPUDIĆ, E., IVEZIĆ, M., (1999): Biljke domaćini i nalazišta resičara *Thrips tabaci* Lindeman 1888 (*Thysanoptera, Thripidae*) u Hrvatkoj. *Entomologia Croatica*, 4:1-2, 57-62 p.
- WELLS, M. L., CULBREATH, A. K., TODD, J. W., CSINOS, A. S., MANDAL, B., MCPHERSON, R. M. (2002): Dynamics of Spring Tobacco Thrips (*Thysanoptera: Thripidae*) Populations: Implications for Tomato Spotted Wilt Virus Management. *Environmental Entomology*. 31(6):1282-1290.

LAND USE, MORPHOMETRIC CONDITIONS AND LAND DEGRADATION THROUGH EROSION IN SOUTHERN TRANSYLVANIA. CASE STUDY: CÂLNIC RIVER BASIN

MARIOARA COSTEA¹, GLIGOR CIORTEA²

University of Sibiu, Romania

¹Department of Ecology and Environmental Protection

² Department of Agricultural Sciences, Food Industry and Environmental Protection

Sibiu 550012 Dr.Ion Rațiu, 5 - 7.

marioara_costea@yahoo.com; gligor.ciortea@ulbsibiu.ro

ABSTRACT

The current geomorphologic processes are a form of land degradation. This is accomplished by mechanical removal of the alteration layer and soil layer as a result of the action of rainfall (splash erosion, rill erosion), of concentrated flow and of gravitational processes. These are conditioned by natural factors like: type of rock, geological structure, relief morphometry and modeling agent. However, the natural processes action is enhanced and complemented by anthropic intervention in the riverbeds and interfluvial surfaces and slopes, through the specific activities of forest and agricultural use. To assess the role of land use in shaping of slopes and land susceptibility to erosion we related the distribution of erosion forms on the Câlnic basin with different types of land use (arable land, vineyards, grassland, wood and built – up area). The potential of degradation through erosion was investigated in this basin, analyzing the morphometric indicators which facilitated the erosion process (elevation, slope, aspect and curvature of surface) and the land use.

Key words: land use, morphometry, erosion, land degradation, Câlnic basin, Transylvanian Depression

INTRODUCTION

The concept of "land degradation" is very complex and may be approached by several areas of research: geomorphologic, pedologic or/and agronomic degradation. Current geomorphologic processes are among the causes of land degradation and of qualitative and quantitative soil loss. These may be considered as risk phenomena given that they cause economic loss, land use change, removal of large areas of land from the agricultural use. In Europe and worldwide, efforts are made to record, monitor and mitigate environmental risks, especially those related to erosion, resulting in a series of research programs. The issue of slope erosion has been addressed recently internationally (RENARD et al, 1996; BONARI, DEBOLINI, 2010; KNIJFF, 2000) and in Romania (MOTOC et al. 1975, MOTOC, MIRCEA, 2005 etc.). The ICPA has conducted national surveys of this type.

MATERIAL AND METHOD

The surveyed area is part of the sub-mountainous depression located at the contact of the Southern Carpathians with the Transylvanian Depression. Since the submountainous depression area situated to the north of Cindrel Mountains is very large (over 70 km length) and analysis at this scale would be subjective, we proposed a detailed analysis on a representative basin of this contact area. The analysis covers a small area (31.5 km²), but its features are found in other river basins of sub-mountainous depressions.

Câlnic River is a left tributary of the Secaşul Mare River in the Apold Depression, downstream to Miercurea Sibiului, and its source area is on the Gârbovei Hills. The geological features are reflected in the pattern of relief and in morphometry. Steps relief lower in altitude from south to north: submountain hills, glacis, terraces and common meadow of Secaşul Mare and Câlnic River. Moreover, submountainous hills, glacises and terrace fronts have a high potential for degradation imposed on geology. Badenian, Sarmatian and Pannonian deposits consisting of sandstone, gravel, marls, clays and sands and the lack of vegetation provides extremely high morphodynamic potential to the slopes. Above these substrata there are quaternary deposits (gravels, sands, loamy deposits etc.). In these circumstances, the aggressiveness of precipitation and flow associated with human activities and land use are active factors of land degradation.

The meteorological-climatic conditions influence the modeling of the relief through the prolonged regime of precipitations in spring – summer period. In July it reaches the maximum multiannual monthly value of precipitations (70.4 mm in Sebeş) and then falls until February to the minimum value (19.7 mm in Sebeş). Significant for the modeling intensity are: the alternation the periods characterized by increasing precipitation with those of intense drought from the autumn months especially in the depression area. (COSTEA, 2005). Under these circumstances the declivity and the insulation of grassy or vegetationless slopes with favourable exposure cause the forming of deep cracks in the hill area, these being later overtaken by precipitations or snow melting water.

Methodology

Our study is based on GIS techniques. In order to achieve the DEM has been used ArcGIS 9.2. software packages. The topographic base used was the map of Military Topographic Institute of Bucharest, edition 1982, scale 1: 25 000. It was updated on the based on orthophotoplans and on field observations. Based on digital terrain model were determined morphometric indicators: hypsometry, declivity, aspects, curvature respect horizontal and vertical planes (COSTEA *et.al.*, 2011). These indicators are most often used in geomorphology to indicate potential slope imbalances generated by surface and concentrated flow. The relation between surface morphology and potential of degrading through erosion and land use was determined descriptively and statistically by means of the distribution of erosion forms and processes according to individual types of land use, classes of altitude, slope, and aspect of the surface. Using GIS techniques, based on topographical maps, the orthophotomaps and our own observations on site the distribution map of erosion forms (rill, ravine, gully) and the land use map were developed.

RESULTS AND DISCUSSIONS

Land Use and its Role in Morphodynamic

The sub-mountainous area is suitable for habitation and agriculture, which generated a high anthropic pressure. This was possible due to the favorable relief and climate conditions, the rich water network, the high accessibility. The Câlnic basin is developed between 260 – 723 m altitude (*Fig. 1*). The depression sector occupies more than 75% of the entire basin. Development in altitude of the basin (over 400 m) is reflected in the distribution of settlements and in the use of land. There are two rural settlements (2% of basin surfaces): Câlnic, situated in the alluvial plane between 325 – 350 m altitude and Deal, a hill settlement situated on the north versant of Zapodia Hill between 525 and 595 m altitude. This is also the altitudinal limit of permanent settlements in the analyzed basin. Under 400 m altitude, are developed the alluvial plain and the terraces of the Secaşul Mare

river and the terrace glacises, with a predominantly agricultural use. The Gârbova Hills are in the south, where the predominant use is growing, pastoral and forestry.

The cultivable land occupies 30% of the total basin area, pastures and grasslands 37%, the vineyard and orchard 19 % and the forests 12 % (Fig. 2). Forestry spontaneous vegetation on the hills in the south part of Câlnic basin or natural hayfields on the slopes in inferior basin have undergone significant changes through deforestation and reclamation (CIORTEA, 2005). The major changes were made during the previous centuries when important forest areas were replaced by grassland and arable land. Nowadays, the most important changes in land use have been introduced by legislation through restitution of land in private propriety (Laws 18/1991; 169/1997; 1/2000, 247/2005). The exercise of ownership rights and the limited financial possibilities of a predominantly rural and aging population have led to land fragmentation and often inappropriate administration. The mosaic character of land-use categories, the different types of land use and agricultural practices are, for the entire basin area, active factors in triggering slope processes. A negative impact to the slope dynamic equilibrium it has dividing land into small lots, the creating of roads and paths access to them, and abandoned farmland or engaging in farming techniques incompatible with the soil, geologic underground or slopes typology.

Relief Morphometry as Favorable or Restrictive Conditions

In the Apold Depression, where is situated the analyzed basin, these processes developed on autochthonous basins of inferior order (Câlnicul, Gârbova, Reciul, Dobârca, Apoldul) contribute to the fragmentation of the Secaşul Mare river terraces and the degradation of piedmont glacis at the foot of the Cindrel Mountains (COSTEA, 2005). The slope processes generated by pluvial denudation dominate: superficial erosion due to raindrop and rainsplash erosion, rill erosion, gullying, torrential erosion. The processes of erosion, transport and accumulation also take place along the Câlnic valleys. The analysis of the morphometric particularities provides us valuable data on the evaluation of the erosion processes through the outline of dispersion or drainage concentration areas and those of predominant erosion or deposition. In order to highlight these aspects, we have resorted to GIS applications and to indices of the plan form curvature and profile curvature.

Basin *hypsomety* shows an uneven distribution of altitude steps. The steps between 300 and 400 m and 400 and 500 m occupy the largest areas (over 80% of the basin). The share of other hypsometric levels is reduced, the smallest area being occupied by the altitudinal step over 700 m (Fig. 1). This distribution reflects on land use, by the predominance of crops at about 300-400 m on slightly inclined surfaces of glacises, and flat areas of the terraces of the Secaşul Mare river. The high humidity of the plains Secaşul Mare and Câlnic River plains Great restrict land use to hayfields. Forest areas occupy upper slopes and ridges, concentrated mostly in the altitude range 400-500 m. Forest development is maximum, on the Reciu - Dâlma ridge. On the interfluve to the left of Câlnic river, the forest is not very developed. Sporadically, disseminate between 350 and 450 m of altitude there are vineyards and plum orchards. In the southern part of the basin, they extend across the hypsometric step of 500-600 m near the rural settlement Deal. Their extension is facilitated by the low inclination of the interfluve between the Câlnic and Valea Lungă rivers, and the climate with frequent influences of the Föhn. The base of the slopes, i.e. the lower half is used as pasture. Grasslands widespread on the hypsometric range of 400 to 600 m and up to 650 m in the source area of the Câlnic River and its tributary Valea Lungă river. In terms of land degradation, the highest concentration of the forms of erosion is in the pasture area. Forms have dimensions of length and depth indicating increased erosion. The erosion distribution map indicates a high density of drainage channels, ravines and gullies in this altitudinal range.

The *slope* is a morphometric indicator which influences the intensity and frequency of the erosion degradation processes (Fig. 3). Moreover, the slope is involved in land use, the angle size favoring or restricting certain types of use.

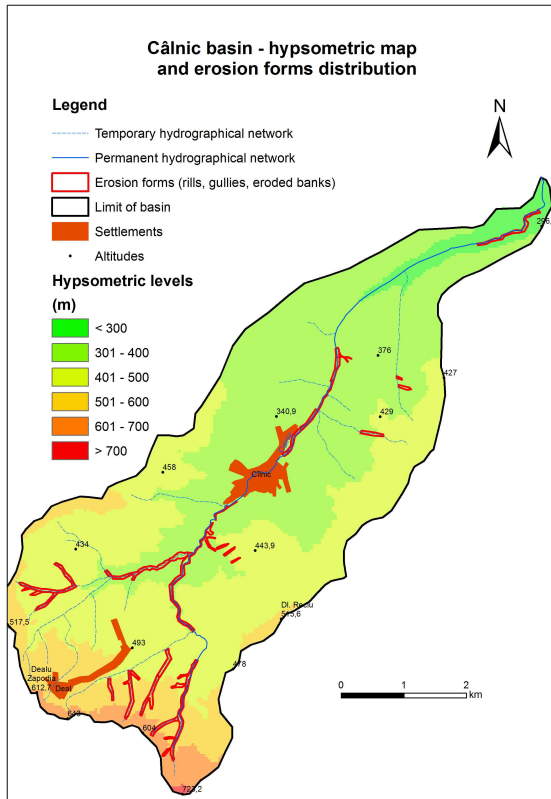


Figure 1. Hipsometric map

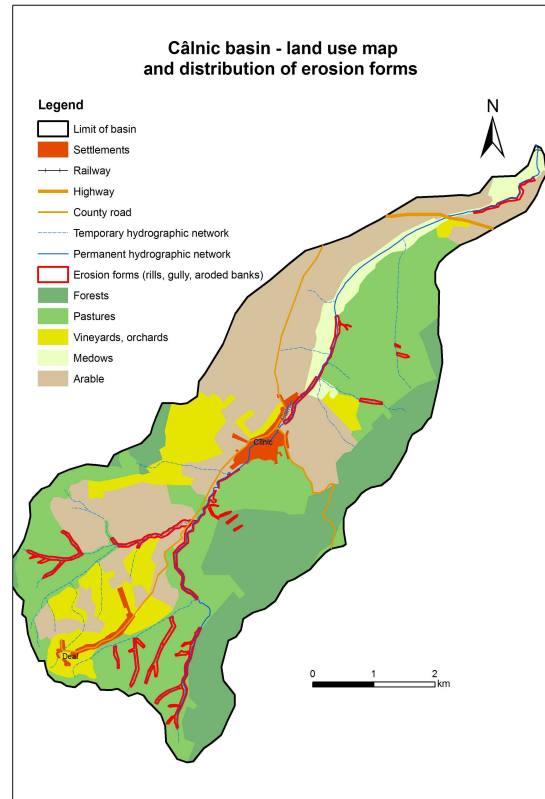


Figure 2. Land use map

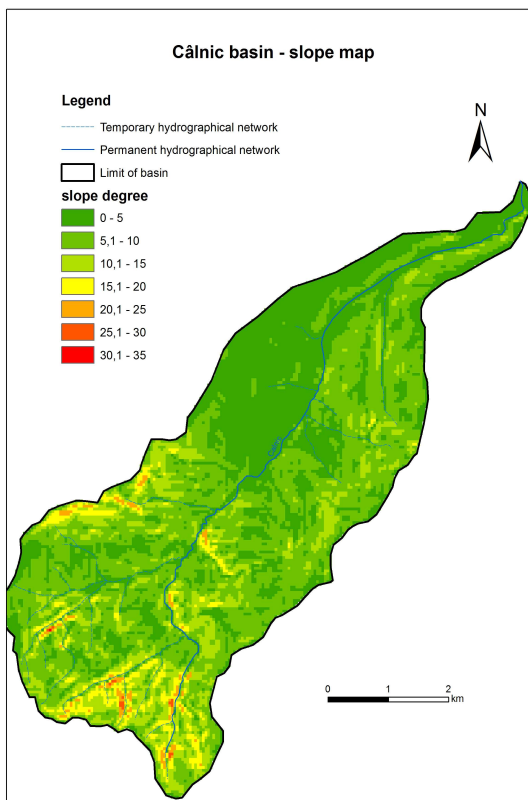


Figure 3. Slope map

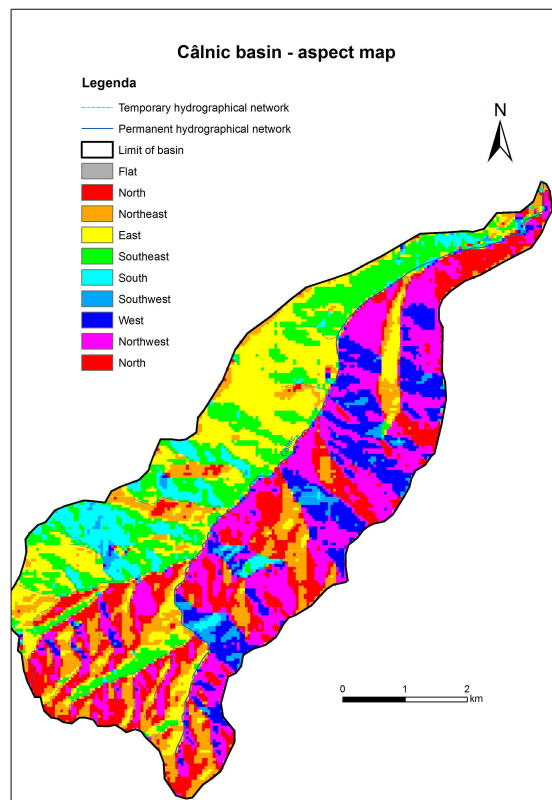


Figure 4. Aspect map

In the Călnic River basin, the slopes slightly exceed 30°, the maximum slope being 31.4°. The most frequent are the slopes ranging between 0 and 5° (35.2%) and 5 - 10° (45.6%). They are found in meadows, on the Secaşul Mare River terraces, on the terrace glacises, used as arable land or grassland, and on top of interfluves, area which is used as pasture or forest. Medium slopes ranging between 10 and 15°, occupy 14.2% of the area and are found on the versants in the lower half and on the contact glacis. These slopes are favorable to fruit growing and viticulture. Vineyards and orchards occupy the versants with slopes below 10° (2 - 10°) and are fragmented by a network of temporary valleys. Steep slopes occupy smaller areas: 4% between 15 to 20° and 1% over 25°. They are located on the versants of the foothills - the Zapodia Hill strongly fragmented by gullies, ravines, ravine streams which form the source basin of the Călnic river. The highest density of the forms of linear erosion is found on slopes exceeding 15°. The change in land use has led to accelerated erosion and land degradation. The phenomenon is also indicated by the toponym "Între Pâraie", (in English, "Between Streams") which shows a high density of forms of linear erosion. Steep slopes are encountered on the left side of the Călnic river at the top of the versant in the Sfânta Forest. Forest use in these sectors, however, is a factor of stability of versants. The forest water consumption impacts upon the flow control, reducing the amount of water drained from surface and the erosion intensity. **Versant exposure** is clearly influenced by the SW-NE orientation and the mostly northern exposure of the Călnic River basin and the high fragmentation, especially in the upper basin (Fig. 4). Predominant are shaded and partially shaded versants (66.85% of the basin area). The most frequent are the versants with a north-western exposure (19.4%), followed by those with an eastern (17.35%), northern (16.2%), north-eastern (13.3%), Western (10.63%) exposure. Of the versants with favorable exposure, the most numerous are those with a south-eastern (14.4%), eastern (10.63%) and southern (5.95%) exposure. South-western versants and flat areas occupy each about 2%. Despite the lower proportion of sunny and partly sunny areas, the versants are mostly used for crops, viticulture and horticulture. This usage is mainly due to the low inclination, which facilitates the reception of a higher quantity of sunlight, irrespective of exposure. Viticulture is present on versants with different exposure (E, SE, NW, W, S, SW), precisely because of the favorable slope, but it prevails on sunny and partly sunny versants. Forest use does not depend on versant exposure. Thus, forests are spread on top of the interfluves. With respect to the relation between slopes and land degradation through erosion, semi-shaded and shaded versants are the most affected by this phenomenon. This is explained by the higher moisture in the soil and the substrate on these versants, by the higher stability of soil aggregates and the higher infiltration capacity on the versants with a warmer microclimate (SANCHIS *et al.* 2008).

CONCLUSIONS

Following the analysis previously made we can synthesize the conclusions. Land use depends on the altitude, except for vineyards and orchards. Arable land decreases with altitude, and grassland and forested areas increase with the altitude. Forests are extended on ridges and upper versants and are compact. The increase of slopes determines the decreases of the arable land area, and the wider the area occupied by pastures and hayfields. The last are located on versants with moderate to high slopes, which facilitate degradation through erosion under the circumstances of the pastoral use and rainfall surplus. Versant exposure influences land use less than inclination. Even in the case of vineyards which require favorable exposure, this condition is not met. Vineyards and orchards are

scattered across the area, on low and moderate slopes with different exposures, but are still prevalent on sunny and semi-sunny slopes. The connection between land use and erosion risk is weaker in the lower basin and stronger in the upper basin. The mostly degraded areas are in the south of the basin in the Gârbova Hills, at an altitude between 450 and 600 m, where in the late eighteenth century forests were cleared in order to extend the grazing area. There is also a strong connection between altitude and slopes and the erosion risk. The forms of erosion are more common in higher elevations, on moderate slopes and steep slopes and shaded and semi-shaded versants.

The impact of geomorphologic processes on land is becoming more pronounced, resulting in a series of disturbances on the versants and damage in agriculture and forestry. Under such circumstances, an integrated approach to land degradation, a good inter-institutional collaboration and responsible involvement of specialized agencies are required. All development plans regardless of scale (local, regional, inter-county etc.) must observe the principles of sustainable development and be based on assessment and monitoring to reduce the impact of land degradation on the environment, the economy and the society.

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REFERENCES

- BONARI, E., DEBOLINI, M. (2010): Agricoltura e erosione del suolo in Toscana. Felici Editore, Siena. 169 p.
- CIORTEA, G. (2005): Îmbunătățirea pajiștilor de munte. Edit. Universității „Lucian Blaga”, Sibiu, 165p.
- COSTEA, M. (2005): Bazinul Sebeșului. Studiu de peisaj. Edit. Universitatii "Lucian Blaga", Sibiu, 300 p.
- COSTEA, M., GIUȘCĂ, R., CIOBANU, R. (2011): Geomorphologic Risk Modelling of the Sibiu Depression Using Geospatial Surface Analyses. In, Thakur, J.K.; Singh, S.K.; Ramanathan, A.; Prasad, M.B.K.; Gossel, W. (Eds.) Geospatial Techniques for Managing Environmental Resources Springer & Capital Publishing Company, 1st Edition. pp. 119 – 139.
- KNIJFF, J.,M., VAN DER, JONES, R.,J.,A., MONTANARELLA, L., (2000): *Soil Erosion Risk. Assessment in Italy*. European Comission, Joint Research Centre and European Soil Bureau Rapport. 54 p.
- MOTOC, M., MIRCEA, S. (2005): Evaluarea factorilor care determină riscul eroziunii hidrice in suprafață, Edit. Bren, București. 60 p.
- MOȚOC, M., MUNTEANU, S., BĂLOIU, V., STĂNESCU, P., MIHAI, GH. (1975): Eroziunea solului și metode de combatere. Edit. Ceres, București.301 p.
- RENARD, K. G., FOSTER, G. R., WEESIES, G. A., MCCOOL, D. K. and YODER, D. C. (coords) (1996): Predicting soil erosion by water: a guide to conservation planning with the Revised Universal Soil Loss Equation (RUSLE). U. S. Department of Agriculture Handbook, Number 703. 384 p.
- SANCHIS, S.M.P., TORRI, D., BORSELLI, L., POESEN, J. (2008): Climate effects on soil erodibility. Earth Surface Processes and Landforms, Number 33 (7). 1082 – 1097.

TECHNOLOGICAL ASPECTS OF PRODUCING BIRD'S FOOT TREFOIL (*Lotus corniculatus* L.) SEEDS

TEODOR CRISTEA, AUREL LĂZUREANU, GHEORGHE CÂRCIU,
SIMION ALDA, ALIN DOBREI

Banat's University of Agricultural Sciences and Veterinary Medicine Timișoara
Faculty of Horticulture and Silviculture
Department of Silviculture
Calea Aradului, nr. 119, Timișoara.
cristeateodor@yahoo.com

ABSTRACT

The species *Lotus corniculatus* L., commonly named bird's-foot trefoil, is a very important perennial legume, widely spread in both Romania and abroad, being the basis for meadow and hay-making fields mixtures in the mountain and plain areas. Ensuring high-quality seeds in sufficient amounts from the cultivars with high biological value implies the development of the seed production activity and the maintenance of biological value of existing cultivars. In this paper, the authors aim at pointing out the effect of some insecticides on bird's-foot trefoil thrips (*Odontothrips loti* H.) as well as the impact of different cut methods on seed yield in bird's-foot trefoil. All insecticides used in the control of bird's-foot trefoil thrips increased mean seed production per ha compared to the control: among them, Sinoratox 1.5 l/ha proved to be the best. As for the bi-factorial trial in which we tested different cutting methods in combination with different insecticides to control bird's-foot trefoil thrips, the best proved to be the cutting method in which we used the desiccant Reglone 1 l/ha (163.66 kg/ha).

Keywords: *Lotus corniculatus* L., *Odontothrips loti* H., control, cutting methods, seed yield

INTRODUCTION

Bird's-foot trefoil is widely spread in Romania: it grows on almost all ecological areas of permanent grasslands, from the Black Sea littoral to the Alpine area (VARGA, 1998).

Though nowadays it covers smaller pure cultivation area than alfalfa (*Medicago sativa* L.) and red clover (*Trifolium pratense* L.), there are no sufficient amounts of seeds. These seeds are sometimes indispensable in complex seed mixtures destined to temporary meadows and to improve permanent meadows in the hill and mountain areas. From this point of view, the widest areas are in Transylvania, Moldavia and northern Oltenia (BĂRBULESCU, 1991).

Extending bird's-foot trefoil into cultivation on wider areas in Romania is hindered by the difficulty of producing seeds compared to alfalfa and to red clover. Seed yields are generally low (100-150 kg/ha) not because of the biological potential of the species, but because of the high degree of dehiscence of the pods during seed maturation and to the lack of a national, scientifically organised system of seed production (DRAGOMIR, 2005).

In this paper, the authors point out the effect of some technological elements on seed production in this species with a view to increase seed production both quantitatively and qualitatively.

We did this by pointing out the effect of some insecticides used in the control of bird's-foot trefoil thrips (*Odontothrips loti* H.) and by establishing the optimal cutting method.

Literature shows that, besides pod dehiscence, another cause that decreases seed production in this crop species is the attack by bird's-foot trefoil thrips (*Odontothrips loti* H.) on floral organs, attack resulting in flower abortion. Our research was meant to identify the most efficient insecticide in the control of this pest.

As for the cutting method, the final goal of this research was to find the best cut method that increases seed production both quantitatively and qualitatively taking into account that upon maturity bird's-foot trefoil has a high degree of dehiscence resulting in a quick, considerable loss of seeds.

MATERIAL AND METHOD

The trial was set at the Grassland Research-Development Station in Timisoara, on the plots destined to research, on a brown eumesobasic soil with low acidic reaction $\text{pH} = 5.6$ and very good phosphorus supply ($\text{P} = 66.7$), medium potassium supply ($\text{K} = 158$ ppm), very low humus content ($\text{H} = 1.66\%$) and very low nitrogen supply ($\text{I}_\text{N} = 1.57$).

In this paper, we present only mean results for the three trial years.

The biological material we used was the *Livada* bird's-foot trefoil cultivar.

The trial that tried to point out the most efficient insecticides in the control of bird's-foot trefoil thrips was of the mono-factorial type, set after the randomised block method with 3 replicates and 6 variants (18 plots). The total area was 252 m^2 , with some of the plots measuring 14 m^2 . After the setting of the trial and after the maintenance works and the first mow, we applied the treatment against bird's-foot trefoil thrips. The application of the insecticides meant to establish the best chemical control of the pest done upon floral bud inception (July 1-10). In order to establish the control degree, we counted the insects with a metrical frame before and after applying the insecticide. The results were processed statistically by the variance analysis. Harvesting was done manually and data were processed statistically and interpreted with the variance analysis method.

The trial variants were: V_1 – Not treated (control); V_2 – Decis 0.3 l/ha; V_3 – Fastac 0.3 l/ha; V_4 – Fury 0.3 l/ha; V_5 – Sinoratox 1.5 l/ha; V_6 – Hostaquick 0.3 l/ha.

The trial that was meant to establish the best bird's-foot trefoil seed cut method was a bi-factorial one, set in the field after the subdivided plot method, on an area of $9,000 \text{ m}^2$.

The trial factors were: factor A – cut method: a_1 – no turning the swath; a_2 – turning the swath; a_3 – desiccation with Reglone 1 l/ha; factor B – insecticide: b_1 – not treated (control); b_2 – Sinoratox 1.5 l/ha; b_3 – Fastac 0.3 l/ha; b_4 – Fury 0.3 l/ha.

The trial was organised in 3 replicates, each replicate having 3 graduations of the factor A – cut methods, each of the graduations having 4 variants of the factor B – protection substances. Each variant corresponded to a plot of 250 m^2 (5 m x 50 m), the size chosen corresponding to the size of the harvesting equipment (the entire trial was carried out in production conditions).

After setting the trial and after applying the first maintenance works and the first mow, we applied the treatments against bird's-foot trefoil thrips – using the insecticides under study – when the crop was in the stage of floral bud inception.

Upon pod maturing (50-60% of the pods are brown), we harvested as follows:

- In the variant a_1 – no turning the swath, the plants were cut with a wind rover early in the morning to avoid seed shedding after cutting. After 3 days of drying, the plants were threshed directly from the field with a Fortschritt E-514 combine.
- In the variant a_2 – turning the swath, the plants were cut with a wind rover early in the morning, the second day they were turned with a mechanical rake, and the third day they were threshed with a Fortschritt E-514 combine.
- In the variant a_3 – desiccation with Reglone (1 l/ha), we applied the desiccant Reglone manually with a Vermorel apparatus, and the third day we threshed directly from the field with a Fortschritt E-514 combine.

In all three variants, seed recovery was done in the combine bunker, from the mixing spindle. The seeds obtained after threshing were sun-dried until their moisture content was 10%, after which they were selected with a Petkus selector. Data were processed statistically and interpreted by the variance analysis method.

RESULTS

Literature supplies little information on the efficiency of the different cutting methods and for pest control in bird's-foot trefoil seeds, they are equally scarce.

Mean results concerning the impact of the protection substance on bird's-foot trefoil seed yield during the research interval are shown in *Table 1*.

Table 1. Impact of the plant protection substance on bird's-foot trefoil seed yield

Variant	Yield (kg/ha)	Difference (kg/ha)	Relative yield (%)	Significance
V ₁ – (control) Not treated	323.33	-	100.00	Control
V ₂ – Decis 0.3 l/ha	484.66	161.67	150.00	XXX
V ₃ – Fastac 0.3 l/ha	524.33	201.00	162.16	XXX
V ₄ – Fury 0.3 l/ha	396.99	73.66	122.78	XXX
V ₅ – Sinoratox 1.5 l/ha	567.99	244.66	175.67	XXX
V ₆ – Hostaquick 0.3 l/ha	456.66	133.33	141.23	XXX

DL 5% = 3.26 kg/ha; DL 1% = 4.64 kg/ha; DL 0.1% = 6.72 kg/ha

In the variants in which we applied the plant protection substances under study we obtained very significant differences in yield compared to the control (not treated). The best result was achieved with the variant V₅ – Sinoratox 1.5 l/ha in which the difference in yield was of 244.66 kg/ha, followed by the variant V₃ – Fastac 0.3 l/ha with a difference in yield of 201 kg/ha. On the contrary, in the variant V₄ – Fury 0.3 l/ha, the difference in yield was only 73.66 kg/ha compared to the control (not treated).

Table 2 shows the impact of the chemical treatments on the bird's-foot trefoil thrips per m².

Table 2. Impact of the chemical treatments on the bird's-foot trefoil thrips/m²

Variant	Thrips/m ² before treatment	Thrips control/m ²	Control rate (%)	Difference	Significance
V ₁ – (control) Not treated	37.66	0.00	0.00	0.00	Control
V ₂ – Decis 0.3 l/ha	37.33	32.33	86.60	32.33	XXX
V ₃ – Fastac 0.3 l/ha	33.33	29.99	89.97	29.99	XXX
V ₄ – Fury 0.3 l/ha	35.66	25.99	72.88	25.99	XXX
V ₅ – Sinoratox 1.5 l/ha	35.33	33.66	95.27	33.66	XXX
V ₆ – Hostaquick 0.3 l/ha	35.66	27.99	78.49	27.99	XXX

DL 5% = 1.53 thrips/m²; DL 1% = 2.17 thrips/m²; DL 0.1% = 3.15 thrips/m²

Analysing *Table 2*, we can see that in all variants in which we used chemical treatments the differences compared to the control are very significant. The best result was achieved with the variant V₅ – Sinoratox 1.5 l/ha with a control percentage of 95.27%, followed by the variants V₃ – Fastac 0.3 l/ha with 89.97% and V₂ – Decis 0.3 l/ha with 86.60%. On the contrary, the variant V₄ – Fury 0.3 l/ha recorded a control percentage of only 72.88%.

The trial concerning the application of the different cutting methods in parallel with the application of different insecticides aimed at finding the best harvesting technology and the best insecticide in the control of bird's-foot trefoil thrips.

The impact of factor A – cutting methods – on bird's-foot trefoil seed yield is shown in *Table 3*.

Table 3. Impact of the cutting method on bird's-foot trefoil seed yield

Cut method	Yield (kg/ha)	Difference (kg/ha)	Relative yield (%)	Significance
a ₁ – Not turning the swath	145.75	-	100.00	Mt
a ₂ – Turning the swath	123.75	-22.00	84.90	000
a ₃ – Desiccation Reglone 1 l/ha	163.66	17.91	112.28	XXX

DL 5% = 0.91 kg/ha; DL 1% = 1.51 kg/ha; DL 0.1% = 2.83 kg/ha

Mean results show that the best cutting method is the one in which we used desiccation with Reglone 1 l/ha, followed by the not turning the swath method.

Table 4 shows mean results from the point of view of the impact of the factor B – protection substances – on bird's-foot trefoil seed yield.

Table 4. Impact of the protection substance on bird's-foot trefoil seed yield

Variant	Yield (kg/ha)	Difference (kg/ha)	Relative yield %	Significance
b ₁ – Not treated (control)	117.99	-	100.00	Mt
b ₂ – Sinoratox 1.5 l/ha	167.44	49.44	141.91	XXX
b ₃ – Fastac 0.3 l/ha	152.44	34.44	129.19	XXX
b ₄ – Fury 0.3 l/ha	139.66	21.66	118.36	XXX

DL 5% = 1.31 kg/ha; DL 1% = 1.80 kg/ha; DL 0.1% = 2.45 kg/ha

In the case of the protection substances also there are very significant differences between trial variants and the control variant: the best variant proved to be b₂ – Sinoratox 1.5 l/ha, followed by the variants b₃ – Fastac 0.3 l/ha and b₄ – Fury 0.3 l/ha.

The interaction between factor A – cutting methods for the same graduation of the factor B – protection substance – is shown in Table 5. Mean results over the 3 trial years allowed us to draw the conclusion that all the combinations between variant a₃ – desiccation with Reglone 1 l/ha – and the variants b – insecticides – result in very significant increases in yield: to note the combination a₃b₂ (desiccation with Reglone – Sinoratox 1.5 l/ha) with an increase in yield of 30.66 kg/ha.

Table 5. The interaction between factor A – cut methods for the same graduation of the factor B – protection substance

Cut method	Protection substance	Yield (kg/ha)	Variant	Difference (kg/ha)	Relative yield %	Significance
a ₁ – Not turning the swath	b ₁ – Not treated	114.66	-	-	100.00	Control ₁
	b ₂ – Sinoratox	167.00	-	-	100.00	Control ₂
	b ₃ – Fastac	157.66	-	-	100.00	Control ₃
	b ₄ – Fury	143.66	-	-	100.00	Control ₄
a ₂ – Turning the swath	b ₁ – Not treated	103.66	a ₂ b ₁ -a ₁ b ₁	-11.00	90.40	000
	b ₂ – Sinoratox	137.66	a ₂ b ₂ -a ₁ b ₂	-29.33	82.43	000
	b ₃ – Fastac	133.32	a ₂ b ₃ -a ₁ b ₃	-24.34	84.56	000
	b ₄ – Fury	120.33	a ₂ b ₄ -a ₁ b ₄	-23.33	83.76	000
a ₃ – Desiccation with Reglone 1 l/ha	b ₁ – Not treated	135.66	a ₃ b ₁ -a ₁ b ₁	20.99	118.31	XXX
	b ₂ – Sinoratox	197.66	a ₃ b ₂ -a ₁ b ₂	30.66	118.35	XXX
	b ₃ – Fastac	166.33	a ₃ b ₃ -a ₁ b ₃	8.66	105.49	XXX
	b ₄ – Fury	154.99	a ₃ b ₄ -a ₁ b ₄	11.33	107.88	XXX

DL 5% = 2.16 kg/ha; DL 1% = 3.05 kg/ha; DL 0.1% = 4.40 kg/ha

The comparison between the factor B – protection substances – for the same graduation of the factor A – cut methods – is shown in Table 6. Analysing data shown in Table 6, we can see very significant differences in yield in the combinations of cutting methods and plant protection substances.

Table 6. Comparison between the factor B – plant protection substances – for the same graduation of the factor A – cutting methods

Cut method	Protection substance	Yield (kg/ha)	Variant	Difference (kg/ha)	Relative yield (%)	Significance
a ₁ – Not turning the swath	b ₁ – Not treated	114.66	-	-	100.00	Control
	b ₂ – Sinoratox	167.00	a ₁ b ₂ -a ₁ b ₁	52.33	145.64	XXX
	b ₃ – Fastac	157.66	a ₁ b ₃ -a ₁ b ₁	43.00	137.50	XXX
	b ₄ – Fury	143.66	a ₁ b ₄ -a ₁ b ₁	28.99	125.29	XXX
a ₂ – Turning the swath	b ₁ – Not treated	103.66	-	-	100.00	Control
	b ₂ – Sinoratox	137.66	a ₂ b ₂ -a ₂ b ₁	34.00	132.79	XXX
	b ₃ – Fastac	133.32	a ₂ b ₃ -a ₂ b ₁	29.66	128.61	XXX
	b ₄ – Fury	120.33	a ₂ b ₄ -a ₂ b ₁	16.66	116.08	XXX
a ₃ –Desiccation with Reglone 1 l/ha	b ₁ – Not treated	135.66	-	-	100.00	Control
	b ₂ – Sinoratox	197.66	a ₃ b ₂ -a ₃ b ₁	62.00	145.70	XXX
	b ₃ – Fastac	166.33	a ₃ b ₃ -a ₃ b ₁	30.67	122.60	XXX
	b ₄ – Fury	154.99	a ₃ b ₄ -a ₃ b ₁	19.33	114.24	XXX

DL 5% = 2.27 kg/ha; DL 1% = 3.11 kg/ha; DL 0.1% = 4.24 kg/ha

The highest difference in yield compared to the control was in the combination a₃b₂ (desiccation with Reglone and Sinoratox 1.5 l/ha) 62 kg/ha, followed by the combination a₁b₂ (not turning the swath and Sinoratox 1.5 l/ha), 52.33 kg/ha and by the combination a₁b₃ (not turning the swath and Fastac 1.3 l/ha), 43 kg/ha.

CONCLUSIONS

Results of research concerning the production of bird's-foot trefoil (*Lotus corniculatus* L.) seed allow us to draw the following conclusions of particular practical importance:

- All studied insecticides used to control bird's-foot trefoil thrips (*Odontothrips loti* H.) resulted in an increase of the mean production of seed per ha compared to the control (not treated), particularly the insecticide Sinoratox 1.5 l/ha.
- As far as pest control is concerned, the best results were again after application of the insecticide Sinoratox 1.5 l/ha.
- As for the bi-factorial trial in which we tested different cut methods in combination with different chemicals used in the control of bird's-foot trefoil thrips, the best cutting method was the one in which we used the desiccant Reglone 1 l/ha (163.66 kg/ha).
- All the substances used to control bird's-foot trefoil thrips proved efficient, particularly the insecticide Sinoratox 1.5 l/ha which resulted in the highest increases in yield compared to the control (41.91 %).
- The different levels of seed production in the two types of trial, i.e. between 323.33 kg/ha and 567.99 kg/ha in the crop harvested manually and between 114.66 kg/ha and 197.66 kg/ha in the crop harvested mechanically show that it is very difficult to reach the genetic potential of seed production in bird's-foot trefoil.

REFERENCES

- BĂRBULESCU C. et al. (1991): Cultura pajiștilor și a plantelor furajere, Ed. Didactică și Pedagogică, București.
- DRAGOMIR N. (2005): Pajiști și plante furajere, Tehnologii de cultivare, Ed. Eurobit, Timișoara.
- VARGA P. et al. (1998): Ameliorarea plantelor furajere și producerea semințelor, Ed. Lumina.

THE DOMINATION OF MEDICAL TREATMENTS' BUDGET ON THE HUNGARIAN NATIONAL PROGRAM FOR BEEKEEPING

*TAMÁS, CSÁKI¹; ÉVA, KRISTÓF²

1: Szent István University, Institute for Wildlife Management
Gödöllő H2100 Páter Károly St. 1. *csaki.tamas@gmail.com

2: Hungarian Beekeepers Federation (OMME)
Budapest H1094 Viola St. 50.

ABSTRACT

The Western honey bee, *Apis mellifera*, is the most important animal pollinator in agriculture worldwide and apiculture provides full or additional family income with a considerable market for bee products used as food, pharmaceuticals and medical products. More importantly honeybees are key pollinators native to Europe and have great impact for many agricultural crops and conservation of natural plant diversity. Since we joined the European Union the Hungarian Beekeepers Federation manages the budget of grounded by the 797/04 and 1234/07 EC directives. According to the 47/2010 (XII 31) VM regulation our National Program of beekeeping controls the supporting system for multiple reimbursement applications. In the six year average data of this program between the types of requests occurs a clear dominance for budgets connected to medical treatment which is a symptomatic treatment but no solution to unravel factors which are responsible for increased colony losses.

Keywords: Honey bees, National Program, monitoring system, medical treatment

INTRODUCTION

Honey bees (*Apis mellifera*) are key pollinators in Europe and have great impact for many agricultural crops and for conservation of natural plant diversity. Therefore, the economic value of honey production plays only a minor role compared to the economic value of honey bees as pollinators in agriculture (MORSE AND CALDERONE, 2000). For European crops it was estimated that 84% of crop species depend at least to some extent upon animal pollination, with honey bees being the most important animal pollinator (WILLIAMS, 1994). The direct value of the produced honey is about 140 million EUR, but the total added crops due to pollination services has estimated 14,2 billion EUR in 2005 in the EU. In light of the decline of wild insect pollinators the importance of managed beekeeping is greater today than ever. In the last years extensive colony losses have been observed in many parts of the world. Concerning the role of pathogens, there is no question that the global health of honey bees is at risk, threatened by parasitic mites (*Varroa destructor*, *Acarapis woodi*, *Tropilaelaps spec.*), fungi (*Nosema spec.*, *Ascosphaera apis*), bacteria (*Paenibacillus larvae*, *Melissococcus plutonius*), viruses. "Disappeared" colony phenomenon has got the name of Colony Collapse Disorder (CCD) which resulted in huge honey bee losses in the USA and elsewhere (COX--FOSTER ET AL., 2007; OLDROYD, 2007; VAN ENGELSDORP ET AL., 2007), as well as massive colony losses in Spain since 2006 attributed to *Nosema ceranae* (HIGES ET AL., 2006; HIGES ET AL., 2008) and has been extensively analyzed since. However, winter losses of honeybees seemed to be increasing everywhere, and resulted in decline of managed honeybee population. The losses are thought to be multifactorial and the different sampling systems used. Nosemosis being present in bee colonies worldwide may have many negative effects on the colony and cause heavy economic losses in apicultures.

MATERIAL AND METHOD

Honeybee experts in the USA and Europe formed networks to collect more exact data to identify factors that seem to be not only multifactorial, but interact with individual situations by countries. The European concerted action was designed in 2008 as a COST action FAO 803 by the name of „Prevention of honeybee COLony LOSses” (COLOSS). The Working Group 1 (WG1) of the COLOSS epidemiological unit developed a detailed self-administrated questionnaire to collect exact data on losses. The first results were published recently (VAN DER ZEE ET AL., 2012) with the analyzed information from 12 countries in 2009 and 24 countries in 2010. According to the survey the mean losses varied between 7-22 % in 2009 and 7-30 % in 2010 winter. An important finding was that for all countries which participated in 2009, winter losses were found to be substantially higher in 2010. Beekeepers in the majority of the countries who reported disappeared colonies experienced higher winter losses compared with beekeepers that experienced winter losses but not reported disappeared colonies. The same was noticed in the USA where survey responders had lost an average 38.4 % of their colonies in 2011 (VAN ENGELSDORP ET AL., 2012). According to Hungarian Beekeepers Federation (OMME) but accounts for 10% of Europe’s total annual honey production and 60% of total annual locust honey however Hungary covers only 0.9 % of the territory the continent. Information flow in this sector on national level is closed in a triangle with the regional associations, the national consultant network and the national sanitary network. Hungary has one of the most developed sanitary network with more than 900 inspectors. 80% of the Hungarian beekeepers are members of the Hungarian Beekeepers Federation, which is coordinating the national consultant network, where each county is supported by its own consultant. Besides, more than 100 regional developed local associations have monthly meetings. Since we joined the European Union the Hungarian Beekeepers Federation manages the budget of grounded by the 797/04 and 1234/07 EC directives. According to the 47/2010 (XII 31) VM regulation our National Program of beekeeping controls the multiple types of opportunities grant application.

RESULTS

Note that more than 50% of the budget is devoted for medical defense against Varroa mites, and the requests are always higher than the available financial framework. This trend of over requesting can also be observed about the applications for maintaining the number of colonies, the population size per operations, which is shown in a 6 year average. This was practically used for a financial support for requeening (purchase for mated/unmated queens and queen cells) (*Table 1*). The major impact on the distribution process is that colony health problem is notified by the beekeepers and losses are reported systematically. There is a tendency that the losses are replaced with intensive breeding, multiple hive splits colonies originating from the same apiary, preferably with nuclei made from the lost or purchased stock from other operations. Therefore the number of hives is increasing despite of the number lost hives (i.e. dead, queen less ore collapsing stage) (*Figure 1*). In response to these losses the National Program created a monitoring study on general bee health and environmental exposures. The aim of this project was to unravel factors which are responsible for increased colony losses. The overall idea was to collect in advance colony data and samples of bees and hive products from colonies and chemical materials accruing in the vicinity of the apiaries in order to use them later for a retrospective explanation of colony mortality. Part of this program is to inform the member

beekeepers of the OMME through yearly issues. The budget for this program is utilized for 100% (Table 1). Only one year out of six year period was containing in practice to monitor the occurrence of nosemosis in Hungary. Two types of microsporidian parasites *Nosema apis* (ZANDER, 1909) and *Nosema ceranae* (HIGES ET. AL., 2006) are causing nosemosis disease in honey bees. Ever since the technique for the measurement of the level of nosema disease is always a question for qualitative and quantitative diagnostic methods. Infection of live honey bees can only be diagnosed through the detection of parasites in the ventriculus. The traditional methods for detecting *Nosema* spp. infections in honey bees still needs standardized methods for measurement and evaluation for the colony health (MEANA ET. AL, 2010). Since the presence of *N. ceranae* in Hungarian colonies was proved in 2008 (TAPASZI ET AL. 2009) nosemosis may appear in all four seasons (14) in Hungary as well. However there was always a need for not just to detect but to measure the incidence of *Nosema* disease. To examine the infection level of nosemosis there are two main types of sample processing system. Composite samples of bees (usually 25 bees) from each selected colonies are examined for an average spore number (MOELLER, 1956; CANTWELL, 1970), while the more laborious individual examination is indicating the percentage of infected bees (BAILEY, 1953;). Since any intervention in a colony's life may cause stress for a certain period, we have to consider whether it was justified and it was worth. Decision would be easy in aware of the level of infection in colony level, and use this parameter has been used to evaluate the need for treatment.

Table 1. The average budget structure of the six year operation of the Hungarian National Program for Beekeeping

Source: OMME (2006-2011)

Type of support	Reimbursement	Utility	Over requesting
Operation of the Advisors' Network	12%	87%	
Coordination for beekeeping academics	2%	81%	
Disseminations of theoretical knowledge and events	5%	73%	
Social visits at demonstration apiaries and operations	1%	70%	
Medical treatment against Varroa mites	58%	100%	113%
Alternative treatment against Varroa mites	2%	70%	
Identification systems for hives and beekeeping equipments	3%	79%	
Instruments and other devices for migration	10%	94%	
Chemical and physical analization of honeys	2%	80%	
Maintaining the number of colonies, the population size per operations	6%	100%	108%
Research on Nosema pathology and opportunities for treatments	0,19%	39%	
Setup and operation of phenological and meteorological monitoring network for honey flows	1%	49%	
Monitoring study on general bee health and environmental exposures	1%	93%	
Instruments and other devices for harvesting honey	3%	85%	
Uniform jars and packing	0,47%	83%	
SUM		93%	

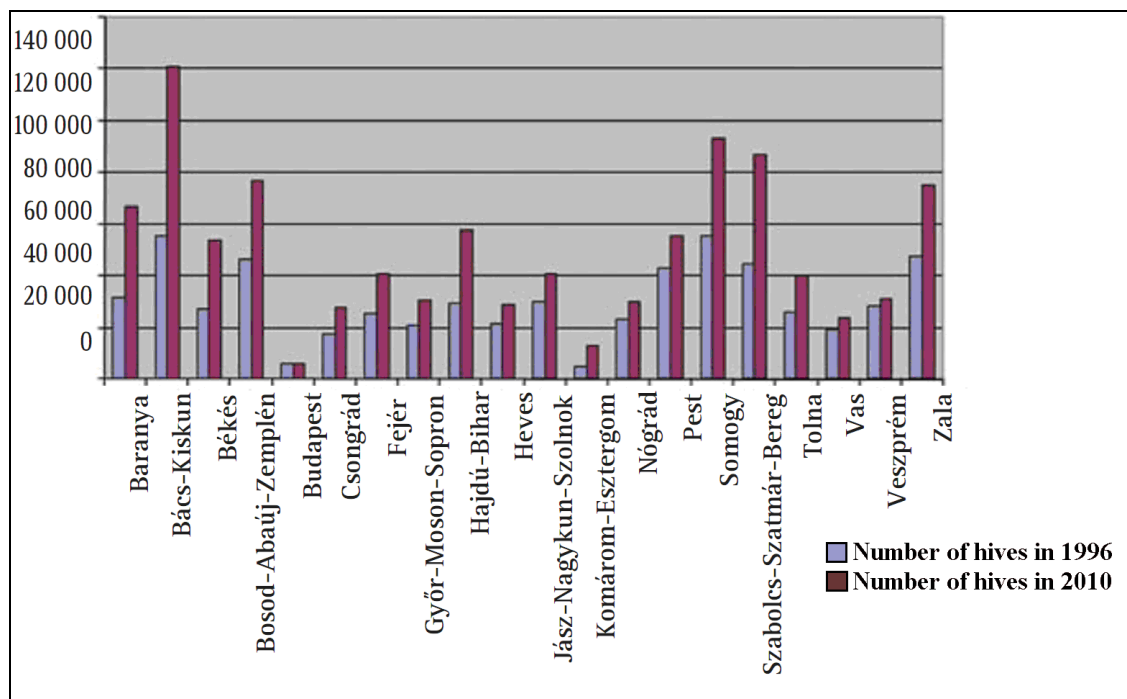


Figure 1. Changes in the number of hives in the counties between 1996 and 2010

Source: OMMÉ MONITORING STUDY ON GENERAL BEE HEALTH AND ENVIRONMENTAL EXPOSURE (2010)

CONCLUSIONS

According to numerous literatures there is a clear need for practical and financial effort for identification of the key agents in the background of the colony collapses. In the six year average data of the National Program shows that the budgets connected to medical treatment are dominating. Only 1% of the total budget is offered for health studies and especially *Nosema* studies is more under the supporting level compare to its' importance. Most of the studies are adapting sample collection protocols without clear reliability however the qualitative results are very much influenced by the sampling techniques. The sole presence of the agents in the bees does not necessarily mean that they cause significant health problems. Therefore there is a clear need to investigate the quantitative connections between the presence of the agents in bees both in individual and on colony level.

ACKNOWLEDGEMENTS

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REFERENCES

- BAILEY L., (1953) The transmission of nosema disease. *Bee World*, 34, 171-172.
 CANTWELL G. E. (1970)-Standard methods for counting nosema spores. *Am. Bee J.* 110: 222-223.

- COX-FOSTER D.L., CONLAN S., HOLMES E.C., PALACIOS G., EVANS J.D., MORAN N.A., QUAN P.-L., BRIESE S., HORNIG M., GEISER D.M., MARTINSON V., VANENGELSDORP D., KALKSEITN A.L., DRYSDALE L., HUI J., ZHAI J., CUI L., HUTCHISON S., SIMONS J.F., EGHOLM M., PETTIS J.S., LIPKIN W.I. (2007) A metagenomic survey of microbes in honey bee colony collapse disorder, *Science* 318, 283–287.
- HIGES M., MARTIN R., MEANA A. (2006) *Nosema ceranae*, a new microsporidian parasite in honey bees in Europe, *J. Invertebr. Pathol.* 92, 93–95.
- HIGES M., MARTÍN-HERNÁNDEZ R., BOTÍAS C., GARRIDO BAILÓN E., GONZÁLEZ-PORTO A.V., BARRIOS L., DEL NOZAL M.J., BERNAL J.L., JIMÉNEZ J.J., GARCÍA PALENCIA P., MEANA A. (2008) How natural infection by *Nosema ceranae* causes honey bee colony collapse, *Environ. Microbiol.* 10, 2659–2669.
- MEAD R., R.N. CURNOW, A.M. HASTED (2002): *Statistical Methods in Agriculture and experimental Biology*. 3rd Edition, Texts in Statistical Science, Chapman & Hall/CRC. 472. p.
- MOELLE, F.E., (1956) The behavior of nosema infected bees affecting their position in the winter cluster. *J. Econ. Entomol.* 49 (6), 743-745.
- MORSE R.A., CALDERONE, N.W. (2000) The value of honey bee pollination in the United States, *Bee Culture* 128, 1–15.
- OLDROYD B.P. (2007) What's killing American honey bees? *PLoS Biology* 5, e168.
- VANENGELSDORP D., UNDERWOOD R., CARON D., HAYES J. (2007) An estimate of managed colony losses in the winter of 2006-2007: A report commissioned by the apiary inspectors of America, *Am. Bee J.* 147, 599–603.
- WILLIAMS I.H. (1994) The dependences of crop production within the European Union on pollination by honey bees, *Agric. Zool. Rev.* 6, 229–257.
- ZANDER, E., (1909) Tierische Parasiten als Krankheitserreger bei der Biene. *Münchener Bienenzeitung* 31, 196–204.

GRAPHICAL CHEMICAL FINGERPRINTS OF PARSLEY, DILL, AND LOVAGE LEAVES

DESPINA -MARIA BORDEAN¹, AURICA BREICA BOROZAN¹, MIHAELA POPA¹, DRAGOS NICA¹,
NICOLETA FILIMON², LUMINITA PIRVULESCU¹, SIMION ALDA¹, MARINEL PASCA¹

¹Banat's University of Agricultural Sciences and Veterinary Medicine, 300645 Timișoara 119,
Calea Aradului, Romania;

²West University of Timisoara, 300223 Timisoara, 4 Blvd. V. Parvan, Romania;
despina.bordean@gmail.com

ABSTRACT

The aim of this study is to emphasize the use of thermo gravimetric water content and trace metals analysis to identify the *chemical graphical fingerprints of parsley, dill and lovage leaves*. Copper, zinc, manganese, iron, nickel and lead have normal concentration values that are not of any risk to human health. Cobalt, chromium and cadmium were not detectable in all studied samples. The water and present trace metals contents associated with mathematical models permits the identification of characteristics specific to the studied vegetable leaves as well as the graphical chemical fingerprints. The study is revealing similar distribution pattern.

Keywords: leafy vegetables, moisture dehydration process, trace metals content, mathematical models, graphical chemical fingerprints

INTRODUCTION

Dark-green leafy vegetables are probably the most concentrated source of nutrients among all basic aliments of our diet. They are a rich source of water and minerals (including iron, calcium, potassium and magnesium). The most commonly used leaves as herbs, green vegetables, and spices in Romania are parsley, dill and lovage.

Parsley (*Petroselinum hortense*) is a species of *Petroselinum* in the family *Apiaceae*, native to the central Mediterranean region, and widely cultivated as an herb, a spice and a vegetable. It is an herbaceous plant vegetable with high strain, cultivated for root systems and its aromatic leaves, used in feed and in folk medicine (EUROPLUSMED, 2006). Parsley is one of the richest nutrients factory of the nature, containing high amounts of minerals and phenol compounds. Phenol compounds found in parsley include various phenolic acids, caffeic acid (SHAN ET AL., 2005), minor amounts of quercetin and luteolin, and extremely high levels of apigenin (JUSTESEN AND KNUTHSEN, 2001). Like other members of the *Apiaceae* family, parsley also contains polyacetylenes, which are toxic to fungi, bacteria and some cancer cells, and have anti-inflammatory and anti-platelet aggregating activity as well.

Dill (*Anethum graveolens*), depending on where it is grown, is either a perennial or annual herb, originated within an area around the Mediterranean and the South of Russia (GRIEVE, 2011). Like parsley, dill is rich in vitamins and minerals, and contains a large amount of chlorophyll. In addition, dill has a high antioxidant activity, and contains very high levels of quercetin (48–110 mg/100 g fresh weight), kaempferol (16–24 mg/100 g fresh weight) and isorhamnetin (5–72 mg/100 g fresh weight) (ZHENG AND WANG, 2001; JUSTESEN AND KNUTHSEN 2001).

Lovage (*Levisticum officinale*) is a tall perennial plant, from the genus *Levisticum*, in the family *Apiaceae* (PIMENOV AND LEONOV, 1993). Lovage is closely related to plants such as

dill, parsley, angelica, carrot and celery, and shares their characteristic aromatic scent and flavor (THE HERBAL RESOURCE, 2006). Lovage appears to have low to moderate levels of phenolic and antioxidant activity, but very high levels of quercetin (170 mg/100 g fresh weight) and some kaempferol (7 mg/100 g fresh weight) (ZHENG AND WANG, 2001; JUSTESEN AND KNUTHSEN 2001).

The aim of the present study is to identify the chemical graphical fingerprints of parsley, dill, and lovage leafs by using the dehydration process, to establish their trace metal content and to find the best methods for preserving them.

MATERIAL AND METHODS

Samples collection and preparation

Parsley, dill and lovage leaves were harvested in Timisoara (Timis county, Romania), from a few house gardens. All samples were separated and rinsed in distilled water to wash off potential impurities. Next, about 5 grams of each sample were used for determining water content using thermo-gravimetric method. The rest of the samples were rinsed again in distilled water to wash off dust and potential air pollutants. Then, the leaf samples were oven dried at 105°C to constant weight. The dried samples were crushed with a mortar (Isolab SL-1372) and stored at room temperature ($t = 22^{\circ}\text{C}$) before analysis. The trace metal content in vegetable leaves was carried out in HNO_3 solution resulted from leaves ash digestion (LACATUSU, 2008). Each sample solution was prepared with diluted HNO_3 (0.5N) and analyzed by flame atomic absorption spectrometry (FAAS). All analyses were performed in our laboratory (Food Analysis Research Test Laboratory, Banat's University of Agricultural Sciences and Veterinary Medicine from Timisoara, Romania)

Reagents and solutions

Double distilled water (spectroscopic pure) was used for the preparation of reagents and standards. All chemicals were trace metal grade (Suprapur). The concentrated nitric acid (65%, $\rho = 1.39 \text{ g/cm}^3$) was purchased from Merck KGaA (Darmstadt, Germany) and used to prepare the digestion solutions (0.5 N HNO_3).

Statistical analysis

The data were analyzed using two specialized statistical packages: MVSP 3.1 and PAST 2.14 (HAMMER ET AL., 2001).

RESULTS AND DISCUSSIONS

Moisture content (%) was determined using Sartorius semi-micro analytical thermo balance. This analytical balance allows monitoring of the dehydration process by continuous weighing during the evolution process. The measuring accuracy is 0.1% for samples with a mass greater than $> 1\text{g}$ and 0.02% for those larger than 5g.

Both moisture and trace metal content (copper, zinc, manganese, iron, cobalt, chromium, cadmium, nickel and lead) were taken into account to identify chemical and graphical fingerprinting. This task was achieved by using FAAS method and statistical analysis programs, i.e. MVSP 3.1 and PAST 2.14.

The dehydration process is presented in *Figure 1*.

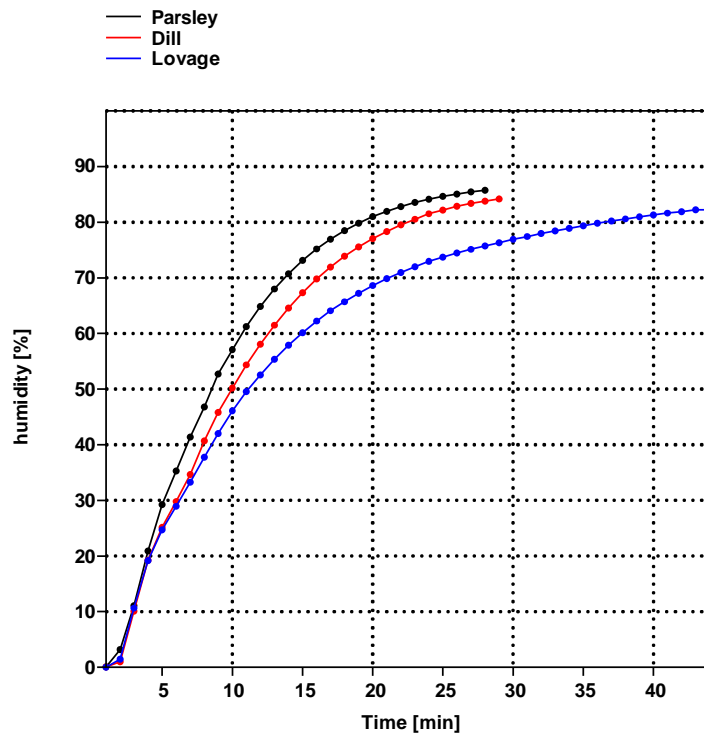


Figure 1. Moisture dehydration process.

The detected moisture contents are 85.73% for parsley, 84.16 % for dill and 82.23 % for lovage. These results are in accordance with USDA National Nutrient Standard Reference Database (USDA, 2006) values, which reveal for parsley 87.71 g water/100 g edible portion and for dill 85.95 g water/100 g edible portion.

The moisture graphical fingerprints are presented in *Figure 2*. It can be seen that parsley is much better preserved by drying method (continuous function - a) than by freezing procedure (multivariable linear function - b). In contrast, it is advisable to preserve dill by freezing procedure (multivariable linear function - b), whereas lovage can only be preserved in salt (long time dehydration process – 43 minutes for 5 g leaves).

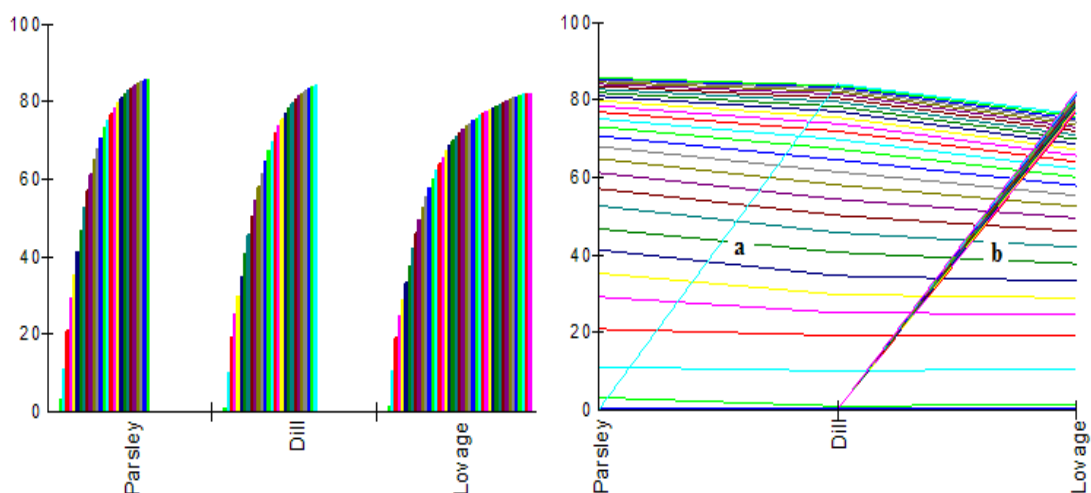


Figure 2. Moisture Graphical Fingerprint of Parsley, Dill and Lovage.

The mineral composition of samples (mg kg^{-1} fresh matter) is shown in *Figure 3*. Each value in the graphics is an average of 3 replicates. The levels of studied metals are within the normal concentrations and did not pose any threat to human health. Cobalt, chromium and cadmium are not represented in the graphical figures (see *Figure 3*) because their levels were not detectable.

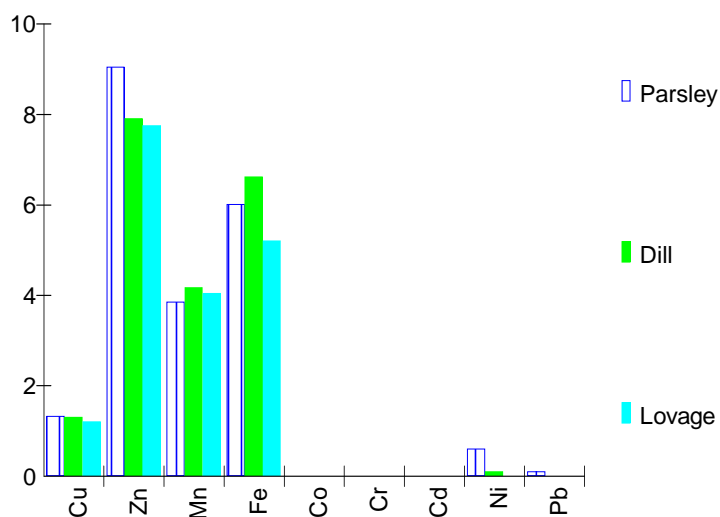


Figure 3. Trace metals composition of Parsley, Dill and Lovage leaves.

The trace metals values for parsley are in accordance to USDA National Nutrient Standard Reference Database (USDA, 2006) - 0.149 mg Cu, 1.07 mg Zn, 0.160 mg Mn, 6.2 mg Fe/100 g edible portions. According to USDA (2006) dill contains 0.146 mg Cu, 0.91 mg Zn, 55 mg Mn and 6.59 mg Fe/100 g edible portions. Our results did not exceed the safe limits of trace

metals in leafy vegetables (mg kg^{-1}) as established by FAO/WHO: Cu - 40.00, Pb - 5.00, Cd - 0.30 (CODEX ALIMENTARIUS COMMISSION, 1995).

Figure 4 presents the area representation of trace metals distribution which is permitting to obtain the trace metals fingerprints of the studied samples.

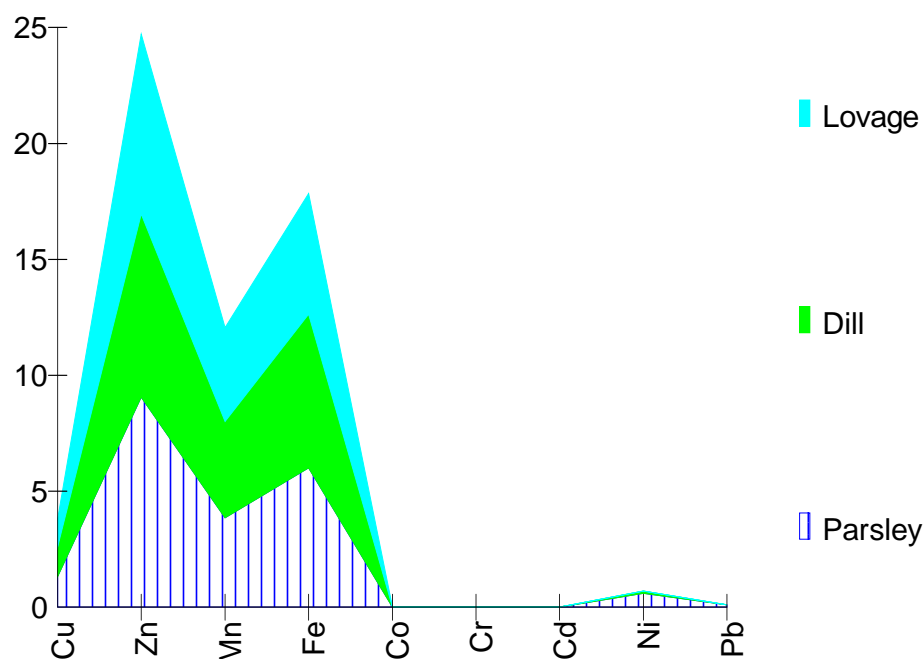


Figure 4. Trace metal Fingerprint of Parsley, Dill and Lovage samples.

CONCLUSIONS

The moisture contents - 85.73% for parsley, 84.16 % for dill and 82.23 % for lovage, are in accordance with the USDA National Nutrient Standard Reference Database values (USDA, 2006). Our results provide new information about lovage and complement data that are missing in the USDA database. A plant chemical fingerprinting requires the determination of a large number of elements but using adequate models we can obtain the needed graphical chemical fingerprints. Such information is extremely valuable for food processing industries because it reduces the amount of work, i.e. less chemical analysis. The moisture graphical fingerprints can be used to identify the best preservation methods for leafy vegetables.

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REFERENCES

- CODEX ALIMENTARIUS COMMISSION (1995): Joint FAO/ WHO Expert Committee for Food Additives and Contaminants (JEFCA). Discussion Paper on Lead (CX/FAC 95/18), March 1995,
- EUROPLUSMED (2006-): Euro+Med PlantBase - the information resource for Euro-Mediterranean plant diversity. Published on the Internet
<http://ww2.bgbm.org/EuroPlusMed/>
- GRIEVE, M. (2011): "Dill". *A Modern Herbal*. Botanical.com. Retrieved 2011-12-21.
- "Dill Weed". *Our spices*. Olde Thompson Inc. 2010. Retrieved 2011-12-21.
- HAMMER, Ø. HARPER, D.A.T. RYAN, P.D. (2001): PAST: Paleontological Statistics Software Package for Education and Data Analysis. *Palaeontologia Electronica*, Volume 4. Number 1. 9pp.
- JUSTESEN, U. KNUTHSEN, P (2001): Composition of flavonoids in fresh herbs and calculation of flavonoid intake by use of herbs in traditional Danish dishes. *Food Chemistry*, Volume 73. Number 2. pp: 245-250.
- LACATUSU, R. LACATUSU, A.R. (2008): Vegetable and fruits quality within heavy metals polluted areas in Romania. *Carpathian Journal of Earth and Environmental Science*, Volume 3. pp: 115–129.
- THE HERBAL RESOURCE (2006): Lovage - Side Effects and Health Benefits. Published on the Internet. <http://www.herbal-supplement-resource.com/lovage-herb.html>
- PIMENOV, M.G. LEONOV, M.V. (1993): *The Genera of the Umbelliferae*. Royal Botanic Gardens, Kiew.
- SHAN, B. CAI, Y.Z. SUN, M. CORKE, H. (2005): Antioxidant Capacity of 26 Spice Extracts and Characterization of Their Phenolic Constituents. *Journal of Agricultural and Food Chemistry*, volume 53. Number 20. pp: 7749-7759.
- USDA (2006). National Nutrient Database for Standard Reference Release 19. In, Agricultural Research Service. [booklet_herbs_foodreport.pdf](#).
- ZHENG, W. WANG, S.Y. (2001): Antioxidant Activity and Phenolic Compounds in Selected Herbs. *Journal of Agricultural and Food Chemistry*, Volume 49. Number 11. pp. 5165- 5170.

VEGETABLES, FRUITS, HONEY AND POLLEN, A NATURAL SOURCE OF ZINC

DESPINA -MARIA BORDEAN¹, IOSIF GERGEN¹, AURICA BREICA BOROZAN¹,
DRAGOS NICA¹, ROXANA POPESCU², SIMION ALDA¹,
LUMINITA PIRVULESCU¹, DIANA MOIGRADEAN¹

¹Banat's University of Agricultural Sciences and Veterinary Medicine,
300645 Timișoara, 119 Calea Aradului, Romania;

²"Victor Babes" University of Medicine and Pharmacy,
300041 Timisoara, 2 Eftimie Murgu Plaza;
despina.bordean@gmail.com

ABSTRACT

This work aimed to evaluate zinc content in six common vegetables (parsley, carrot, dill, onion, cucumber and beans), three common fruits (apples, raspberry and dog rose), bees honey and pollen. Determination of zinc content in soil, raw vegetables and fruits, as well as in bees honey and pollen from local apiaries were carried out by FAAS. All experiments and analyses were performed in triplicate. Overall, the highest zinc concentration was found in the leaves (carrot 48.07 mg kg⁻¹, parsley 46.62 mg kg⁻¹, dog rose leaves 36.13 mg kg⁻¹) and beans crops (41.26 mg kg⁻¹). According to our study the highest content occurs in the plants of the *Apiaceae* Family and in *Rosa canina* leaves.

Keywords: zinc, vegetables, crops, bee's honey and pollen, principal component analysis

INTRODUCTION

Zinc, like all metals, is a natural component of the Earth's crust and an inherent part of our environment (INTERNATIONAL ZINC ASSOCIATION, 2002). This microelement enters into the composition of more than three hundred enzymes and proteins, which are involved in all major metabolic processes (HARMANESCU ET AL., 2007). Therefore, zinc is an essential mineral of "exceptional biologic and public health importance" (HAMBIDGE AND KREBS, 2007). Deficiency of zinc affects about two billion people in the developing world and is associated with many diseases (PRASAD, 2003). The World Health Organization Report 2002 have regarded zinc deficiency as one of the leading causes of illness and disease in low-income countries, and have ranked it 5th among the leading 10 risk factors (INTERNATIONAL ZINC ASSOCIATION, 2002).

Petroselinum crispum L., the parsley, is a commonly grown culinary and medicinal herb that is often used in domestic medicine (i.e., nursing, medicine, and other healing practices associated with the home environment) as a natural vitamin and mineral supplement (CHEVALLIER, 1996).

Daucus carota sativus L., the carrot, is a root vegetable. The most commonly eaten part is the taproot. Although the greens are also edible parts, they are rarely eaten by humans and sometimes used as aromatic spice (CHEVALLIER, 1996).

Anethum graveolens L., the dill, is a very high source of minerals: Calcium: 1784 mg, Potassium: 3308 mg, Zinc: 3.3 mg (DUKE AND AYENSU, 1985). The commonly parts eaten by humans are the leaves and the seeds.

Allium cepa L., the onion, is the most widely cultivated species of the genus *Allium* (BREWSTER, 1994). This vegetable accumulates very low content of zinc in the roots (DUKE AND AYENSU, 1985).

Cucumis sativus L., the cucumber, is a common ingredient of salads, being valued mainly for its crisp texture and juiciness (HEDRICK, 1919). This vegetable is very watery, with little flavour (DREWNOWSKI AND GOMEZ-CARNEROS, 2000), and contains a low amount of zinc - 0.20 mg (USDA NUTRIENT DATABASE, 2012).

Phaseolus vulgaris L., the common bean, is an herbaceous annual plant with high content of potassium and zinc (USDA NUTRIENT DATABASE, 2012).

Malus domestica Mill., the apple, is one of the most widely cultivated tree fruits. Apples are one of the healthiest fruits due to their high vitamin content (USDA NUTRIENT DATABASE, 2012).

Rubus idaeus L., the raspberry, contains significant amounts of polyphenol antioxidants (e.g., anthocyanin pigments) which can provide protection against several human diseases. The total zinc content of the raspberries is 0.52 mg/100 g fresh weight (GEORGE MATELJAN FOUNDATION, 2012).

Rosa canina, also known as the Dog rose, is a variable climbing wild rose species native to Europe, northwest Africa and western Asia (LIM ET AL., 2005).

MATERIAL AND METHODS

The study was performed on plants of the families *Apiaceae*, *Cucurbitaceae*, *Alliaceae*, *Fabaceae* and *Rosaceae* (Table 1) as well as on bee's honey and pollen samples. All samples were collected from west part of Romania (Banat County).

Table 1. Analyzed plants samples

Crt. No.	Family	Plant Latin Name	Plant Common Name	Studied parts
1.	<i>Apiaceae</i> or <i>Umbelliferae</i>	<i>Petroselinum crispum</i>	Parsley	roots, leaves
2.		<i>Daucus carota sativus</i>	Carrot	roots, leaves
3.		<i>Anethum graveolens</i>	Dill	leaves
4.	<i>Alliaceae</i>	<i>Allium cepa</i>	Onion	roots
5.	<i>Cucurbitaceae</i>	<i>Cucumis sativus</i>	Cucumber	fruits, leaves
6.	<i>Fabaceae</i>	<i>Phaseolus vulgaris</i>	Beans	fruits
7.	<i>Rosaceae</i>	<i>Malus domestica</i>	Apples	fruits, skin
8.		<i>Rubus idaeus</i>	Raspberry	fruits, leaves
9.		<i>Rosa canina</i>	Dog rose	fruits, leaves

Samples collection and preparation

Soil

Soil and plant samples were collected from the same sites. Soil sampling was done to a depth of maximum 20 cm. Honey and pollen samples were tapped 500 m away from the apiary location. The soil samples were dried for two days and then passed through a sieve to remove the potential soil impurities. The surface soil samples were analyzed using the procedure recommended by LINDSAY AND NORVEL (BORDEAN D-M, 2006).

Plants and fruits

All samples were washed off with double distilled water to remove dust and air pollutants. Then, the plants and fruits were cut in small slices and were oven dried at

105°C to constant weight. After that, the dried samples were ground and stored at room temperature till analysis.

Honey Bees

The honey bees samples were prepared for Zn content analysis using the method of TANANAKI CHRISOULA (45°C, 55 °C , 65 °C, 75 °C for 1, 6, 24 and 48 hours) optimized by DESPINA BORDEAN (45°C, 65 °C, 75 °C, 100 °C for 1, 6, 12 and 12 hours) (BORDEAN D-M, 2006).

Bee’s Pollen

Zinc from bee pollen samples was analyzed after dry burning of 10 g in the quartz capsules at 650°C, for 4 hours.

Analytical determinations

After complete burning, 0.5 N nitric acid solution was added up to 50 mL. The solutions obtained were used for the determination of total zinc content in samples. Flame Atomic Absorption Spectrometry (FAAS) was conducted in Food Analysis Research Test Laboratory at Banat’s University of Agricultural Sciences and Veterinary Medicine from Timisoara, Romania. The standard solutions (1000 mg/L) were analytical grade from Riedel de-Haen Laboratory (Seelze, Germany), whereas only ultra pure nitric acid (65%, ρ = 1.39 g/cm³, Merck KGaA, Darmstadt, Germany) was used to prepare the digestion solutions. All solutions were prepared using deionized water. Analyses of zinc content were carried out by FASS in air/acetylene flame (model ContrAA-300, Analytik-Jena device). The device working parameters (air, acetylene, optics and electronics) were adjusted for maximum absorption of Zn. Acetylene was of 99.99 % purity. All analyses were performed in triplicate and only the mean values were taken into account.

Statistical analysis

The data were statistically analyzed using two statistical packages: MVSP 3.1 and PAST 2.14 (HAMMER ET AL., 2001).

RESULTS AND DISCUSSIONS

The zinc composition of the studied samples (mg kg⁻¹ fresh matter) is presented in *Figure 1*. Each value in the graphic is an average of 3 replicates.

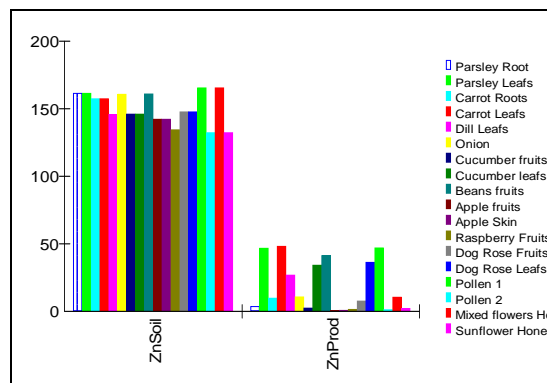


Figure 1. Zn content in ZnSoil and in ZnProd

ZnSoil- contend of Zn in soil samples; ZnProd- contend of Zn in vegetables, fruits, honey and pollen.

It was found that soil samples present similar Zn profiles whereas the products samples reveal variations of Zn concentration (as shown in *Figure 1* and *Figure 2*).

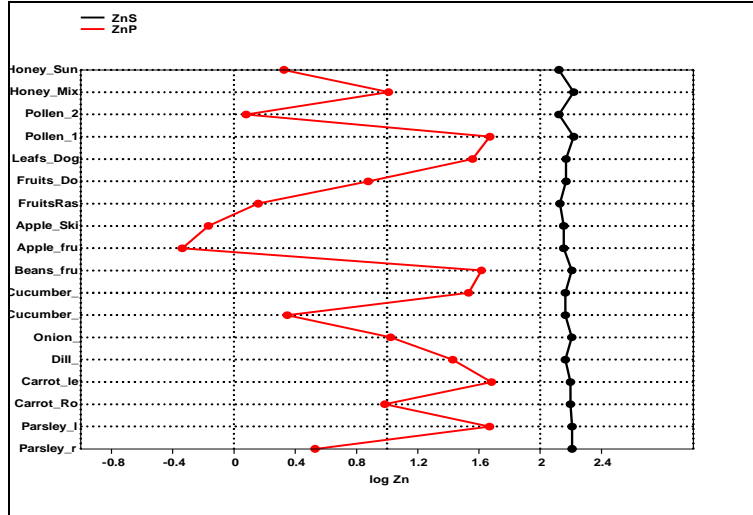


Figure 2. Logarithm of Zn content in soil and studied products

ZnS- contend of Zn in soil samples; ZnP- contend of Zn in vegetables, fruits, honey and pollen.

The Principal Components Analysis of the data presents the levels to which the accumulation of Zn in the product samples was influenced by the Zn soil content (*Figure 3*).

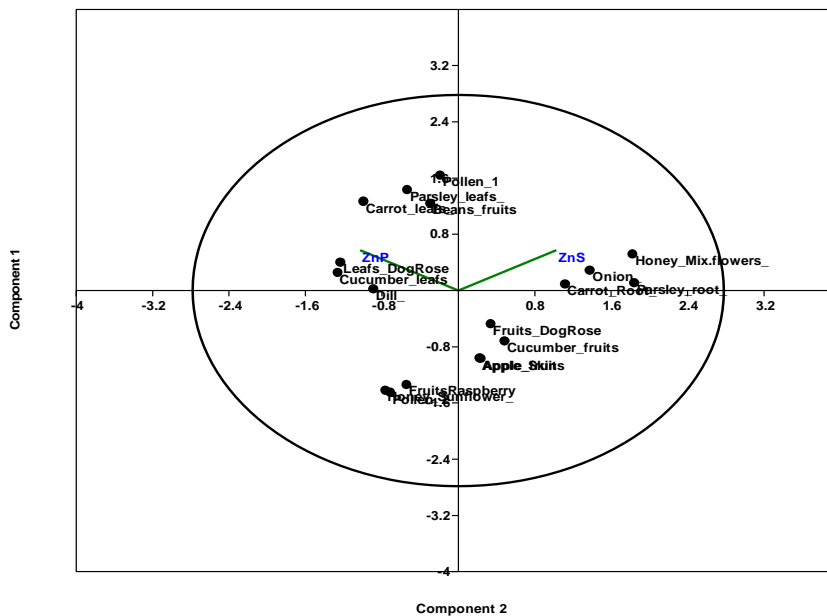


Figure 3. Graphical representation of PCA scores for soil and studied products

As shown in *Figure 3*, the highest accumulation of Zn have occurred in leaves (carrot, parsley, Dog Rose, cucumber and dill) followed by pollen 1, onion and mixed flowers honey.

CONCLUSIONS

The highest content of zinc occurs in the leaves of the *Apiaceae* Family, in *Rosa canina* (*Rosaceae*) and in the fruits of *Phaseolus vulgaris* (*L.*), *Fabaceae* Family. Compared with the reference in soil, the values were lower than the maximum allowable limits (MAL) for Zn, excepting the mixed flowers honey (10.22 mg kg⁻¹ honey) where the value have exceeded the national maximal limit (5 mg kg⁻¹ honey). The mentioned products (carrot, parsley, Dog Rose, cucumber, dill, pollen and honey) are recommended to be consumed as high sources of zinc.

REFERENCES

- BORDEAN, D–M (2006): PhD Thesis, USAMVBT Library.
- BREWSTER, J.L. (1994): Onions and other vegetable alliums. 1st Edition, CAB International. Wallingford, UK. 432 p.
- CHEVALLIER, A (1996): The Encyclopedia of Medicinal Plants. DK Publishing, London. <http://www.scribd.com/doc/63444070/Andrew-Chevallier-The-Encyclopedia-of-Medicinal-Plants>
- DREWNOWSKI, A., GOMEZ-CARNEROS, C. (2000). Bitter taste, phytonutrients, and the consumer: a review. *American Journal of Clinical Nutrition*, Volume 72. Number 6. pp: 1424-1435.
- DUKE, J.A., AYENSU, E.S. (1985): *Medicinal Plants of China*. Reference Publications, Inc. 705 p.
- GEORGE MATELJAN FOUNDATION (2012): Raspberries Raspberries. In-depth nutrient analysis. <http://whfoods.org/genpage.php?tname=nutrientprofile&dbid=23>
- HAMBIDGE, K.M., KREBS, N.F. (2007): Zinc deficiency: a special challenge. *Journal of Nutrition*, Volume 137. Number 4. pp: 1101-1105.
- HAMMER, Ø., HARPER, D.A.T., RYAN, P.D. (2001): PAST: Paleontological Statistics Software Package for Education and Data Analysis. *Palaeontologia Electronica*, Volume 4. Number 1. 9pp.
- HARMANESCU, M., BORDEAN, D.M., GERGEN, I. (2007): Heavy metals contents of bee's pollen from different locations of Romania. *Lucrări Stiintifice Medicina Veterinara, Timisoara*, Volume XL. pp: 253-260.
- HEDRICK, U.P. (1919): *Sturtevant's Edible Plants of the World*. The Southwest School of Botanical Medicine. pp: 230-233. http://www.swsbm.com/Ephemer/Sturtevant's_Edible_Plants.pdf
- INTERNATIONAL ZINC ASSOCIATION (2012): *World Health Report 2002* (WHO). <http://www.znoxide.org/environment.html>.
- LIM, K.Y. WERLEMARK, G., MATYASEK, R., BRINGLOE, J.B., SIEBER, V., EL MOKADEM, H., MEYNET, J., HEMMING, J. ET AL. (2005): Evolutionary implications of permanent odd

polyploidy in the stable sexual, pentaploid of *Rosa canina* L. *Heredity*, Volume 94. Number 5. pp: 501–506.

PRASAD, A.S. (2003): Zinc deficiency: Has been known of for 40 years but ignored by global health organizations. *British Medical Journal*, Volume 326. Number 7386. pp: 409–410.

USDA NUTRIENT DATABASE (2012): <http://search.nal.usda.gov/nalsearch/result-list/fullRecord/>

EFFECTS OF DIFFERENT BUD DENSITY ON THE MYCORRHIZAL COLONISATION OF GRAPEVINE IN THE KUNSÁG WINE REGION

DONKÓ ÁDÁM¹ – ZANATHY GÁBOR² - ERŐS-HONTI ZSOLT³ - GÖBLYÖS JUDIT⁴ -
BISZTRAY GYÖRGY DÉNES⁵

¹PhD student, BCE SZBI, Department of Viticulture, H-1118. Budapest, Villányi út 29-43., adam.donko@uni-corvinus.hu; ² associate professor, BCE SZBI, Department of Viticulture; ³ assistant lecturer, BCE KTK, Department of Botany and Soroksár Botanical Garden; ⁴ doctoral candidate, BCE SZBI, Department of Viticulture; ⁵ professor, BCE SZBI, Department of Viticulture

ABSTRACT

Mycorrhizal symbiosis has an important role for the grape: it helps the water - and nutrient uptake, as well as the avoidance of biotic and abiotic stresses. During our investigation carried out on stocks grown in Szigetcsép (Kunság wine region), we studied the effects of different bud load on the degree of mycorrhizal colonisation. The vineyard (Gál Vineyard and Winery in Szigetcsép) is on sandy soil with low nutrient content, thus the mycorrhizal colonisation have a great importance in this area. For the estimation of endomycorrhizal colonisation, fine roots of the grape cultivar 'Kékfrankos' were stained with anilin-blue, and investigated under light microscope. Our results show significant difference of the mycorrhizal colonisation in our experiments, however, further studies are needed in other wine regions for general conclusions to be drawn.

Keywords: endomycorrhiza, grape, bud load

INTRODUCTION

Mycorrhizal symbiosis, namely the mutualistic interaction between a fungus and the root of a vascular plant, is also formed by the grape among a variety of other species. This symbiosis is necessary for the optimal and healthy development of the plants.

The mycorrhiza forming ability of grape was first recorded by Stahl in 1900 (POSSINGHAM and OBBINK, 1971). Grape establishes endomycorrhizal interaction, i.e. the hyphae penetrate the cell wall of the root cells, and invaginate the cell membrane. Within the cells of the host plant, a dichotomously-branching hyphal endings, so-called arbuscules and storage hyphal endings (vesicles) develop. The establishment of arbuscules considerably increases the nutrient translocation surface (interface) between the hypha and the root cell, so it facilitates the transfer of nutrients between them (SCHREINER, 2005). Therefore, the effectiveness of the endomycorrhizal interaction is revealed by not the degree of the colonization (i.e. the number of the hypha living within the roots), but the number of arbuscules observed in the colonized root fragments (PINKERTON et al., 2004, SCHREINER 2005). However, the nutrient uptake of mycorrhizal plants is also influenced by the soil characteristics, the soil cultivation method and the nutrient supply. Especially in case of nutrient deficiency and poor soil condition, is mycorrhizal colonization of considerable importance (RYAN and GRAHAM 2002).

In case of sufficient phosphorous supply, the carbohydrate demand of the mycorrhiza is not proportional to the benefits offered by the fungus. Therefore, the degree of mycorrhizal colonization is lower here compared to the soils with phosphorous deficiency (BAUMGARTNER, 2003). The yield also considerably influences the arbuscule number: in

an investigation on the rootstock effect, the varieties with lower yield (e.g. 101-14 Mgt) proved to have more arbuscules (thus more intensely functioning mycorrhizae) than those with higher yields (e.g. Teleki-Fuhr SO4). The latter kinds of rootstocks use usually more carbohydrates to yield ripening, so there are fewer carbohydrates available for the mycorrhizal fungus (SCHREINER, 2003). Intensive defoliation reduced the number of arbuscules, in parallel with the decreased level of carbohydrate assimilation (PINKERTON et al., 2004).

MATERIALS AND METHODS

The Kunság wine region – where Szigetcsép is located – is the largest wine region of Hungary. Similarly to the whole wine region, the area is covered with sandy soil; the climate is continental with hard colds in the winter and also in early spring. The summer is usually hot, with drought periods.

The experiment was carried out in the Gál Vineyards and Winery. The investigated variety was Kékfrankos, grafted on Teleki 5 C rootstocks. The samples were collected from vines with two several bud loads (low bud load: 4 bud/m²; high bud load: 11 bud/m²). After two vegetation periods, in the autumn and winter of 2010-2011, the bud load was unified: 8 bud/m² in each row, according to the practice of the company.

During the autumn of 2010 and the spring of 2011, 16 samples were taken per every treatment. The root samples were cleaned and conserved in ethanol (70%). The samples were cut in 1 cm pieces. 30 samples per treatment were stained with anilin-blue, and investigated under light microscope according to the method of MCGONIGLE (1990) and SCHREINER (2003). If in the sample arbusculum, vesiculum, or hypha was found, we counted it as colonised. Moreover, we counted the number of the arbuscules, and subsequently we determined the arbuscular % of the samples. Leaf element content was analyzed in the labor of Corvinus University of Budapest, Research Institute for Viticulture and Oneology, Kecskemét. Data were analyzed by One-way-Anova, using Pasw Statistics 18.

RESULTS AND DISCUSSION

In case of the 11bud/m² load, in 2010, the number of arbuscules was significantly lower than in case of the 4bud/m² load (*Figure 1*). Our results agree with the observations of SCHREINER (2003): when the stocks were loaded to a heavier extend, they used more assimilate to supply the bunches and to develop a larger canopy, so there was less carbohydrates available for the mycobiont. The results of GÁL (2011) at the same study area showed, that the average yield was 2, 16 kg/m² in case of the 4 bud/m² load, and 4, 59 kg/m² in case of the 11 bud/m² load. In the same time, the results of the leaf analyses (*Table 1*) did not show any significant differences between the treatments, so the differing colonization level could not be caused by the different element content of the leaves. The minor load could be more advantageous for the grape, because the water and nutrient use was presumably equal, therefore the colonization of roots was more intense.

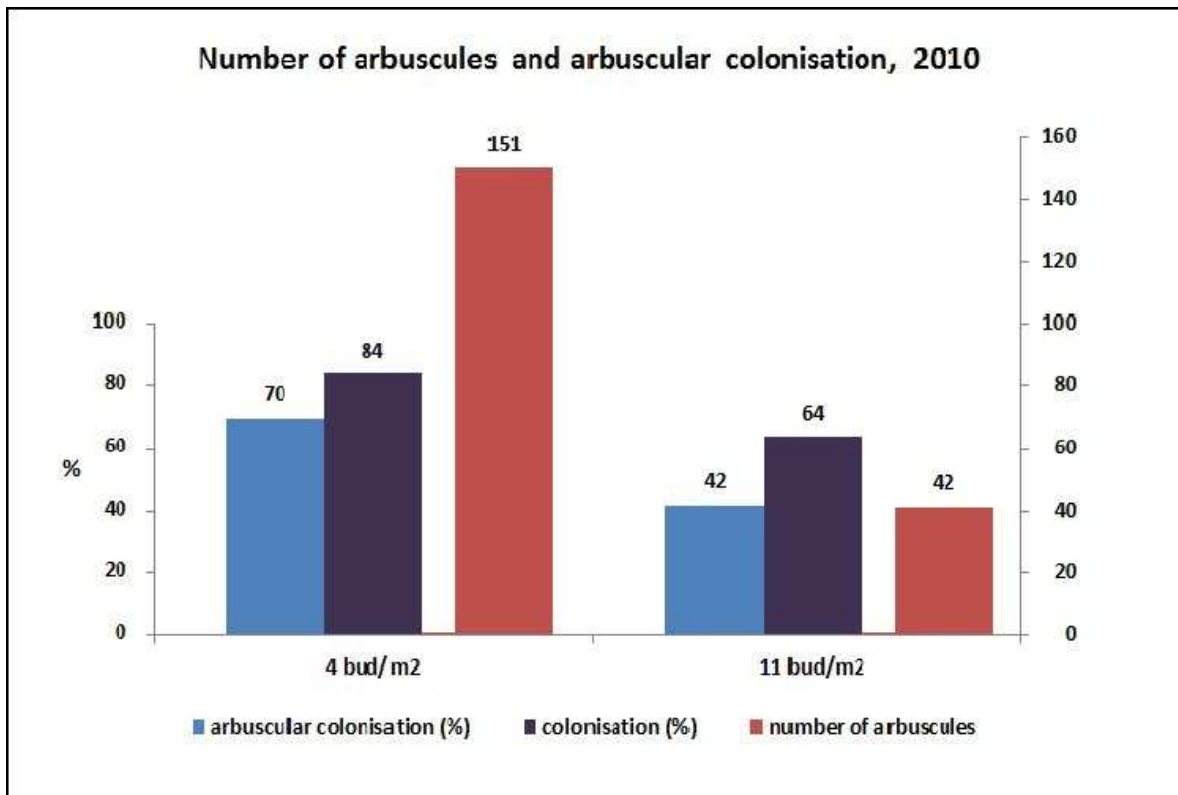


Figure 1. The effect of bud load on the mycorrhizal colonisation of Kékrankos variety (Szigetsép, 2010)

Table1. Leaf element content of the grapes with different bud load (Gál, 2011)

Nutrient	4 bud/m ²		11 bud/m ²	
	2009	2010	2009	2010
N	1,74	1,98	1,70	1,94
P	0,13	0,139	0,109	0,129
K	1,02	1,36	0,897	1,04
Ca	4,11	2,77	4,41	2,96
Mg	0,361	0,285	0,346	0,287

In the next season, the bud load of the grapes was uniformly adjusted to 8 bud/m². This means that in the year of 2011, on those stocks where the bud load was previously 4 bud/m², the load was doubled, while in case of the other treatment, the load was somewhat reduced. On the stocks of each treatment we counted more arbuscules and observed higher % of colonization in spring, than in the autumn, similarly to the results of SCHREINER-LINDERMANN (2005). In the two vegetation periods, the overloaded stocks may have

utilized the majority of their stored nutrients, which is important for the grape. Consequently, the reason for the elevated number of the arbuscules might be the fact that the modified bud load increased the need of a more intensely working endomycorrhizal interaction. Since the excess of transport between the mutualistic partners is revealed by the area of the interface (SCHREINER, 2005), this led to the formation of more arbuscules within the roots. The mentioned problem would be especially important in an arid soil deficient in nutrients, where endomycorrhiza have a more significant role for the host plants (RYAN and GRAHAM, 2002).

All the mentioned effects are more pronounced in case of the previously more intensely loaded (11 bud/m²) stocks. On these, both the arbuscular colonisation and the number of arbuscules was almost the double that of the other (previously 8 bud/m²) treatment (*Figure 2*). Besides, the number of arbuscules in the 11 bud/m² treatment was significantly different between 2010 and 2011. Nevertheless, the difference between the endomycorrhizal colonisation of the two treatments decreased, thus we can observe a tendency toward an equalized endomycorrhizal status as a result of unifying the bud load. However, in spring the colonization level of the formerly to 4 bud / m² loaded stocks was still higher.

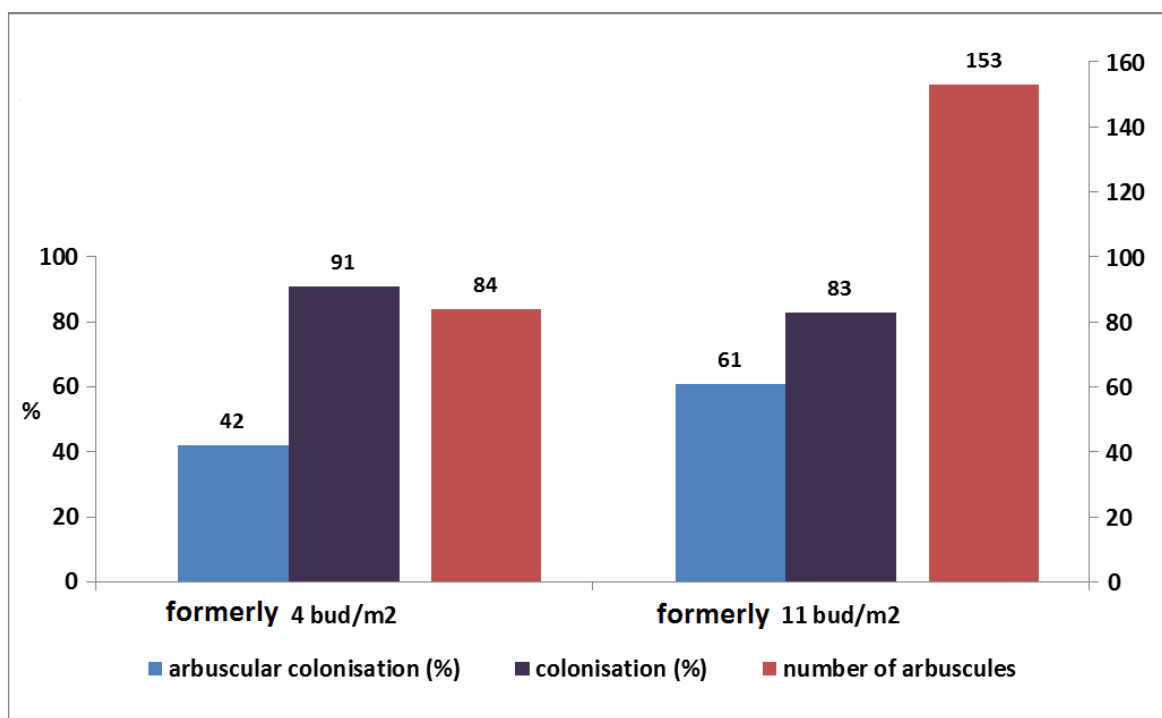


Figure 2. Mycorrhizal colonisation of following unifying bud load to 8 bud/m² 2011.

Our results on Kékfrankos grape variety show that the enhancing of the bud load leads to the decrease of mycorrhizal colonisation. This is in accordance with other researchers results, who have also found that the rootstocks of higher yield had less intensely colonized roots in terms of the arbuscule number, while in case of the varieties of lower yields, higher arbuscule proportion was observed (SCHREINER, 2003). Root colonization may also

be affected by intense defoliation, because it results decreased carbohydrate assimilation and lower arbuscules number (PINKERTON et al., 2004).

This phenomenon was observed not only in the investigation on the bud load effect, but also in the samples which were taken after the subsequent pruning, where we found significantly different arbuscule numbers in case of the 11 bud/m² load treatments. The difference was manifested in the higher degree of colonization too, but in accordance with the results of SCHREINER (2005), the change in the number of arbuscules was significantly higher.

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REFERENCES

- BAUMGARTNER, K., SMITH, R.F., AND BETTIGA, L. (2005): Weed control and cover crop management affect mycorrhizal colonization of grapevine roots and arbuscular mycorrhizal fungal spore populations in a California vineyard. *Mycorrhiza*. 15. 2: 111-119.
- CLARK, R.B., AND ZETO, S.K. (2000): Mineral acquisition by arbuscular mycorrhizal plants. *J. Plant Nutr.* 23:867-902.
- GÁL, Cs. (2011): A rügyterhelés hatása a Kékfrankos fajta vegetatív és generatív teljesítményére, fagykárosodásának mértékére, valamint borának minőségére Szigetcsépen. Szakdolgozat. Budapesti Corvinus Egyetem, Szőlészeti Tanszék, Budapest
- MARSCHNER, H. (1997): Mineral nutrition of higher plants. Academic Press, London
- MCGONIGLE, T.P., MILLER, M.H., EVANS, D.G., FAIRCHILD, G.L., AND SWAN, J.A. (1990): A new method which gives an objective measure of colonization of roots by vesicular-arbuscular mycorrhizal fungi. *New Phytol.* 115:495-501.
- PINKERTON, J.N., SCHREINER, R.P., IVORS, K.L., AND VASCONCELOS, M.C. (2004): Effects of *Mesocriconea xenoplax* on *Vitis vinifera* and Associated. *Mycorrhizal Fungi. Journal of Nematology* 36 (3):193–201.
- POSSINGHAM, J.V., OBBINK, J.G. (1971): Endotrophic mycorrhiza and the nutrition of grape vines. *Vitis* 10:120-130.
- RYAN, M.H. AND GRAHAM, J.H. (2002): Is there a role for arbuscular mycorrhizal fungi in production agriculture. *Plant Soil*, 244: 263-271.
- SCHREINER, R.P. (2003): Mycorrhizal Colonization of Grapevine Rootstocks under Field Conditions. *Am. J. Enol. Vitic.* 54:3:143-149. p.
- SCHREINER, R.P. AND LINDERMAN, R.G. (2005): Mycorrhizal Colonization in Dryland Vineyards of the Willamette Valley, Oregon. *Small Fruits Review*, Volume 4, 3: 41 – 55. p.
- SCHREINER, R.P. (2005): Mycorrhizas and mineral acquisition in grapevines. In.: Christensen LP., Smart DR. *Proceedings of the Soil Environment and Vine Mineral Nutrition Symposium*. American Society for Enology and Viticulture, Davis, 49.-60. p.
- SCHREINER, R.P. (2005B): Spatial and temporal variation of roots, arbuscular mycorrhizal fungi, and plant and soil nutrients in a mature Pinot Noir (*Vitis vinifera* L.) vineyard in Oregon, USA *Plant and Soil* 276. 1-2: 219–234.p.
- SMITH, SE, READ, DJ. (1997): *Mycorrhizal Symbiosis*. 2nd ed. Academic Press London. 605 pp.

A STUDY OF FATTY ACID COMPOSITIONS IN PORK MEAT AND FAT UNDER THE ASPECT OF A HEALTHY HUMAN DIET

MIRUNA DORNEA, NICOLETA MATEOC-SÎRB, GORUN LAURA

Banat's University of Agricultural Sciences and Veterinary Medicine, Timișoara, Calea Aradului 119, 300645, Timișoara, Romania
kasha_1@yahoo.com

ABSTRACT

Mangalita is a rustic pork breed which is mainly grown for meat and lard. Its history starts in the beginning of the 19th century, when Mangalita populations appeared and spread in various European Countries as Slovakia, Hungary, Romania and also Austria and Germany. Unfortunately, the breed suffered a rapid decline by the end of World War II, becoming close to extinction in the 1970's. In the past 20 years conservation programs were started in countries like Hungary and Germany, and recently Romania, which resulted in a numeric rise of the Mangalita populations. The purpose of the present paper is to analyse and compare various studies made on the quality of meat and lard coming from this breed, under the aspect of the fatty acid composition, respectively the proportion of unsaturated fatty acids versus saturated fatty acids. The paper also aims to emphasize the importance of the Mangalita breed conservation, not only in the context of ecological breeding, biodiversity and gene pool conservation, but also as a key breed in a healthier nutrition plan, as it is the only red meat that contains a high proportion of unsaturated fatty acids like Omega 3 and Omega 6, which are essential in human nutrition and help prevent a series of diseases, among which heart diseases and autoimmune disorders.

Keywords : Mangalita, conservation, unsaturated fatty acids, health, nutrition

INTRODUCTION

Mangalita is a rustic pork breed which is mainly grown for meat and lard. Its history starts in the beginning of the 19th century, when Mangalita populations appeared and spread in various European Countries as Slovakia, Hungary, Romania and afterwards Austria and Germany (HOGBERG, 2005). There are various hypothesis surrounding its origin, one of them stating that the breed originated from the *Sus Mediteraneus* wild pig, which was infused with asian swine breeds. The Mangalita populations suffered a rapid decline by the end of World War II, becoming close to extinction in the 1970's. In the past 20 years conservation programs were started in countries like Hungary and Germany, and recently Romania, which resulted in a numeric rise of the Mangalita populations.

Mangalita's features differ radically from other breeds and should be maintained in the future. The animals are calm and have a good accomodation capacity. They manifest a high indurance to stress and are resistant to diseases. Mangalita is well adapted for breeding in an extensive system because they act well in extreme climate conditions and can be held outside during winter. Their capacity to produce lard is excellent. The largest part of their body weight is represented by lard and fat. They transform nutrients with a minimum loss of energy. There are five color varieties: baris, blonde, red, black and swallow-belly. According to DNA testing the three varieties are actually different breeds. The Mangalita's head has a medium length when compared to the body. It has a wide forehead and the profile line is a bit convex. The ears cover 2/3 of the nose. The eye color is always brown. The length of the neck is medium and the one of the back is also medium if compared with meat breeds but shorter if compared with the withers height.

The proportion of saturated and unsaturated fatty acids contained by the fat is in favour of the unsaturated ones with long chains, which slow down the oxidation time. The meat is considered a delicacy and is used in producing the famous Serrano ham.

MATERIALS AND METHODS

The materials used in the present paper include various results of fatty acid analysis, which were realised by several Universities in Hungary and Romania, all done on the Mangalita breed, as well as a fatty acid analysis realised on the Great White pigs that were fed with Linseed, which was done by the Institute of Animal Health in Prague and the fatty acid analysis for grassfed cattle, sheep and pigs, conducted by the Department of Veterinary Sciences of Bristol University. All the fatty acid analysis was done by using the gas chromatography method. The paper compares results for fatty acid compositions of pig meat in comparison with cattle or sheep meat and also studies the differences in fatty acid proportions in Mangalita and other pork breeds, as well as in linseed fed pigs. The methods used include the collection and analysis of data, as well as processing it and creating the tables and charts with the use of Microsoft Word and Excel programs.

RESULTS

In the past years, mankind has become more aware of the nutritional value of the food it ingests. There is a tendency against excess red meat and animal fat consumption, as well as one against factory animal breeding.

The main form of fat in our bodies and diet is represented by tryglicerides, which provide energy and insulation, though a large trygliceride quantity in our blood can lead to health problems. Tryglicerides can be divided into saturated and unsaturated fatty acids. Saturated fats are considered the most detrimental to your health. They usually are solid at room temperature and are derived from animal products. When looking at their molecular structure, saturated fats contain the maximum number of hydrogen atoms (hence "saturated" with hydrogen atoms). Eating a diet high in these has been strongly correlated to heart disease. Unsaturated fats, on the other hand, are found in foods such as nuts, avocados, and olives. They are liquid at room temperature and differ from saturated fats in that their chemical structure contains double bonds. Additionally, studies have shown that unsaturated fats are also heart-healthy fats - they have the ability to lower LDL cholesterol and raise HDL cholesterol ("good" cholesterol). There are two forms of unsaturated fat - monounsaturated fat and polyunsaturated fat. The polyunsaturated fatty acids (PUFA) Omega 6 (gamma-linolenic acid) and Omega 3 (alpha-linolenic acid) play a very important role in our nutrition, as our body cannot synthesise them in its own, but can obtain them from food. They can be found in fat fish, fish oil, nuts, avocado and vegetable oil and studies have proven that they are effective in controlling blood clotting, protection against heart disease, autoimmune diseases and can also contribute to building cell membranes in the brain and lowering the LDL cholesterol level.

In 2007, J.D. WOOD et al. studied red meat quality by analysing the fatty acid composition of adipose tissue and muscle from pigs, sheep and cattle that were fed a grass diet. As seen in *Table 1* and *Table 2*, pigs have high levels of polyunsaturated fatty acids, including long chained ones. In both muscle and adipose tissue there is a higher quantity of

the major polyunsaturated fatty acid, the linoleic acid, as well as a higher level of arachidonic acid, an essential Omega 6 polyunsaturated fatty acid, beneficial for human health due to positive effects on metabolism and prevention of heart diseases.

Table 1. PUFA composition in adipose tissue (g/100g fatty acids)

PUFA	Pig	Sheep	Cattle
Linoleic acid	14.3	1.3	1.1
α linolenic acid	1.4	1	0.5
Arachidonic acid	0.2	-	-

Source: WOOD, et al. (2007)

Table 2. PUFA composition in muscle tissue (*longissimus dorsi*) (g/100g fatty acids)

PUFA	Pig	Sheep	Cattle
Linoleic acid	14.2	2.7	2.4
α linolenic acid	0.95	1.37	0.7
Arachidonic acid	2.21	0.64	0.63

Source: WOOD, et al. (2007)

In 2007, with the purpose of increasing the percentage of unsaturated fatty acids in the composition of pork meat and fat, the Institute of Animal Health in Prague has conducted a study on Great White pigs that were fed a finishing diet supplied with linseed, while previously being fed with concentrates. *Table 3* and *Table 4* depict the acid fatty composition change that was observed in the control group, fed a normal diet, and the experimental group, fed a linseed finishing diet.

Table 3. Fatty acid content in muscle tissue (g/100g of total fatty acids)

Fatty acid	Control group	Experimental group
Linoleic C18:2n-6	9.51	11.24
α -linolenic C18:3n-3	0.44	2.27
Arachidonic C20:4n-6	3.08	2.63

Source: VACLAKOVA - BECKOVA (2007 Institute of Animal Science Prague)

Table 4. Fatty acid content in backfat (g/100 g of total fatty acids)

Fatty acid	Control group	Experimental group
Linoleic C18:2n-6	9.18	10.87
α -linolenic C18:3n-3	0.87	4.90
Arachidonic C20:4n-6	0.21	0.17

Source: VACLAKOVA , BECKOVA (2007) Institute of Animal Science Prague

It can be observed that the linoleic and alpha linoleic acids are higher in the muscle tissue and backfat of pigs fed a finishing linseed diet. However, the experimental group shows a lower level of arachidonic acid, which is an essential Omega 6 polyunsaturated fatty acid.

In the past decade, various studies have been conducted on the fatty acid composition of meat and fat from several pork breeds, all fed the same diet. *Figure 1* reveals that the proportion of unsaturated fatty acids is higher in the case of the rustic Mangalita breed, respectively the Red Mangalita with 63.01 % unsaturated fatty acids and Blonde Mangalita with 60.45 %. The Duroc and Mangalita hybrids failed to provide a higher level of unsaturated fatty acids than the pure bred Mangalita pigs.

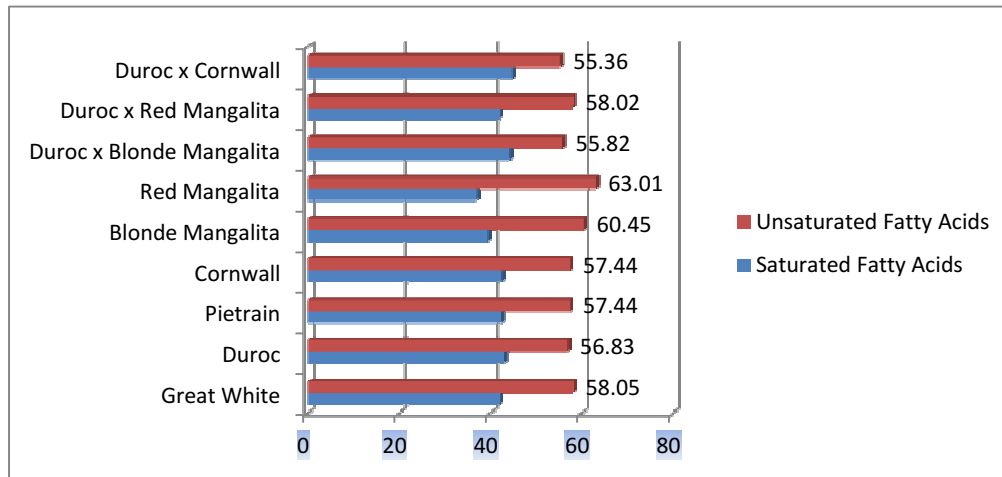


Figure 1. Unsaturated and saturated fatty acid proportions in various pork breeds

Source: LUGASI (2002), SZABO - FARKAS (2005)

CONCLUSIONS

The fatty acid analysis of pork, cattle and sheep muscle and adipose tissue reveals that pork meat from pigs fed with grass contains a higher level of polyunsaturated fatty acids. Moreover, pigs fed a finishing linseed diet also present a higher level of polyunsaturated fatty acids than pigs fed a linseed free diet.

The pure Mangalita pork breed meat and fat contains a higher level of unsaturated fatty acids than most modern pork breeds and modern pork breeds and Mangalita hybrids.

Red and Blonde Mangalita are perfect candidates for the type of meat that can revolutionise the current nutrition perception that red meat and animal fat have a negative impact on human health due to its high level of polyunsaturated fatty acids.

Mangalita is a rustic breed with high pretability for ecological breeding. Considering the fact that the level of linoleic, alpha linoleic and arachidonic acids are higher in pigs fed a grass diet than of pigs fed a diet based on concentrates and a finishing one enhanced with linseed, it has high potential for producing high levels of PUFA without linseed finishing diets, in an ecological breeding system.

Conserving the Mangalita breed is important not only under the aspect of biodiversity conservation and gene pool conservation, but also under the aspect of a healthy human diet, rich in polyunsaturated fatty acids, which can now be assimilated through meat as

well as vegetables, thus ensuring a balanced diet, which offers protection against heart diseases, blood clotting and immune disorders.

REFERENCES

- LUGASI, A. (2002) – Meat quality of different genotypes of pig, IX Allattenyesztesi napok, Debrecen, 453-456
- SZABO, P., FARKAS, T. (2005) – Fatty acid composition of the tissues of Mangalica and other pig genotypes, *Hungarian J. Animal Prod.*, 55, 293-311
- HOGBERG M. G. (2005) – Interrelationships of animal agriculture, the environment and rural communities, *J. Anim. Sci.* 83, 13-17
- WOOD, J.D., ENSER, M, FISHER, A.V., NUTE, G.R., SHEARD, P.R., RICHARDSON, R.I., HYTES, S.I., WASHINGTON, F.M. (2008) – Fat deposition, fatty acid composition and meat quality: A review, *Meat Science* 78, 343-358
- VACLAVKOVA, E., BECKOVA, R. (2007) – Essential fatty acid content in meat and backfat of pigs fed a linseed diet, *Arch Tierz* 50 Special Issue, 144-151

STATISTICAL EVALUATION OF HEAVY METAL CONTENT IN SOME CAPSICUM VARIETIES AVAILABLE ON THE ROMANIAN MARKET

DRAGOS NICA¹, FLORIN – NICOLAE CIOBANU¹, AURICA- BREICA BOROZAN¹, LUMINITA PIRVULESCU¹, SIMION ALDA¹, FILIMON NICOLETA², DESPINA-MARIA BORDEAN¹

¹University of Agricultural Sciences and Veterinary Medicine of Banat, 300645 Timișoara
119, Calea Aradului, Romania;

²West University of Timisoara, 300223 Timisoara, 4 Blvd. V. Parvan, Romania;
despina.bordean@gmail.com

ABSTRACT

The aim of this study is to emphasize the heavy metals content in seven capsicum varieties of capsicum of the specie *Capsicum annuum* L., available on the Romanian market. From the analyzed Capsicum fruit samples, three Capsicum assortments were cultivated in Romania and the other four were imported from Italy and Turkey. The studied heavy metals (copper, zinc, manganese, iron, cobalt, lead, nickel, cadmium and chromium) have normal concentration values that are not of any risk to human health. Cadmium is not detectable in all studied samples. The heavy metal content associated with statistical analysis programs permits the identification of characteristics specific to the origin of products and the graphical chemical fingerprint of the studied capsicum species. The chemical fingerprinting of a plant demands the determination of a large number of elements (DJINGOVA ET AL., 2004). The study is revealing similar distribution pattern.

Keywords: Capsicum species, heavy metals, PCA, CA, graphical chemical. fingerprints

INTRODUCTION

The genus *Capsicum* (Family: Solanaceae) contains five commonly cultivated species (*C. annuum* L., *C. frutescens* L., *C. chinense* Jacq., *C. baccatum* L. and *C. pubescens* and appear in many varieties. *Capsicum annuum*, one of the major species includes bell peppers, cayenne, paprika, and jalapeños (ANTONIOUS ET AL., 2010). Although many people consider them vegetables, peppers in the Capsicum family are actually a berry form of fruit (CAPSICUM-INFORMATION, web site).

Sweet peppers are grown in most countries of the world. Over the past five years, world production increased by 15% (2.9% annual growth CAGR), reaching 26.1 million tons. (A.C.S.A. REPORT, 2009). China is the World leader in sweet pepper production (14 million tons or 54% of world production), followed Mexico, Indonesia, Turkey, Spain and USA. Romania is ranked 19th in world's top importers of sweet peppers (A.C.S.A. REPORT, 2009). The study is presenting the identification of the graphical chemical fingerprint as well as the statistical evaluation to emphasize the origin of the vegetables based on the heavy metal content of the studied Capsicum species. The chemical fingerprinting of a plant demands the determination of a large number of elements (DJINGOVA ET AL., 2004). The study of the heavy metals has been chosen because, "heavy metals are extremely persistent in the environment; they are non-biodegradable and non thermo-degradable and thus readily accumulate to toxic levels" (SHARMA ET AL., 2007). Due to agriculture's increasing reliance on the application of chemicals, pollution of soils by heavy metals has become a concern that may cause a long-term risk on environmental and human health

(WONG et al., 2002). Soils are receptacles for heavy metals released from industrial activities, municipal wastes, water sludge, urban composts, road traffic, atmospheric deposits and chemicals used in agriculture (phosphate fertilizers, pesticides) and spread out into the environment (ADRIANO, 1986). Plant uptake is one of the main pathways through which heavy metals enter the food chain (ANTONIOUS ET AL., 2010). Elevated concentrations of heavy metals in edible plants could expose consumers to excessive levels of potentially hazardous chemicals. Accumulation of heavy metals varied between plant species (ANTONIOUS ET AL., 2007; MELO ET AL., 2007).

MATERIAL AND METHODS

Samples collection and preparation

Seven varieties of Capsicum were obtained from Timisoara (Romania) shop centers, the declared country of origin of the fruits being considered as specified on the product label. Three studied assortments are cultivated in Romania and the other four are imported from Italy and Turkey.

All the collected samples were washed with double distilled water to remove impurities and pollutants. After washing, fruits samples were oven dried at 90°C to constant weight. The dried samples were ground, passed through a 2 mm sieve and stored at room temperature before analysis. The heavy metals content in Capsicum fruits was carried out in HNO₃ solution resulted from fruit ash digestion (KHAN ET AL., 2008, LĂCĂTUȘU, 2008). Each sample solution was prepared with diluted HNO₃ (0.5N), made up to a final volume of 50 mL and analyzed by flame atomic absorption spectrometry (FAAS) in University Environmental Research Test Laboratory.

Reagents and solutions

Double distilled water (spectroscopic pure) was used for the preparation of reagents and standards. All chemicals were trace metal grade (Suprapur). Concentrate nitric acid (HNO₃ 65%), was obtained from Merck Germany. The working solutions were prepared by diluting the stock solutions to appropriate volumes.

Statistical analysis

The data were statistically analyzed using a statistical package MVSP 3.1.

RESULTS AND DISCUSSIONS

Chemical and graphical fingerprinting was realized taking into account the content of copper, zinc, manganese, iron, cobalt, lead, nickel, cadmium and chromium using FAAS method correlated with statistical analysis program MVSP 3.1. The mineral composition of the studied samples (mgKg⁻¹ dry matter) is presented in *Figure 1*. Each value in the graphics is an average of 3 replicates. The studied metals have normal concentration values that are not presenting any risk for human health. Cadmium is not represented on the graphical figures because in all cases was not detectable.

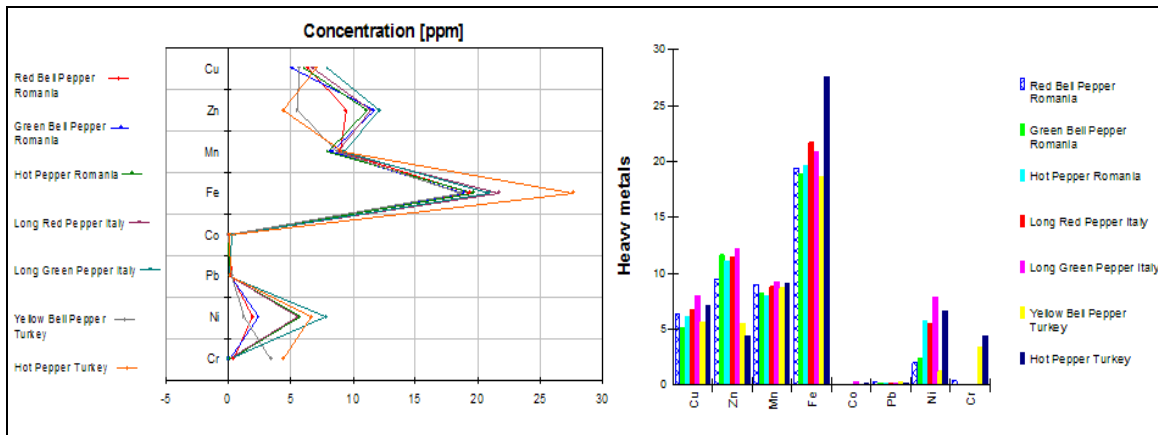


Figure 1. Graphical representation of FAAS mineral composition

Principal Components Analysis (PCA) allows an assessment of mineralogical content data corresponding to the samples of Capsicum species, using the square root of their transposed matrix (Figure 2).

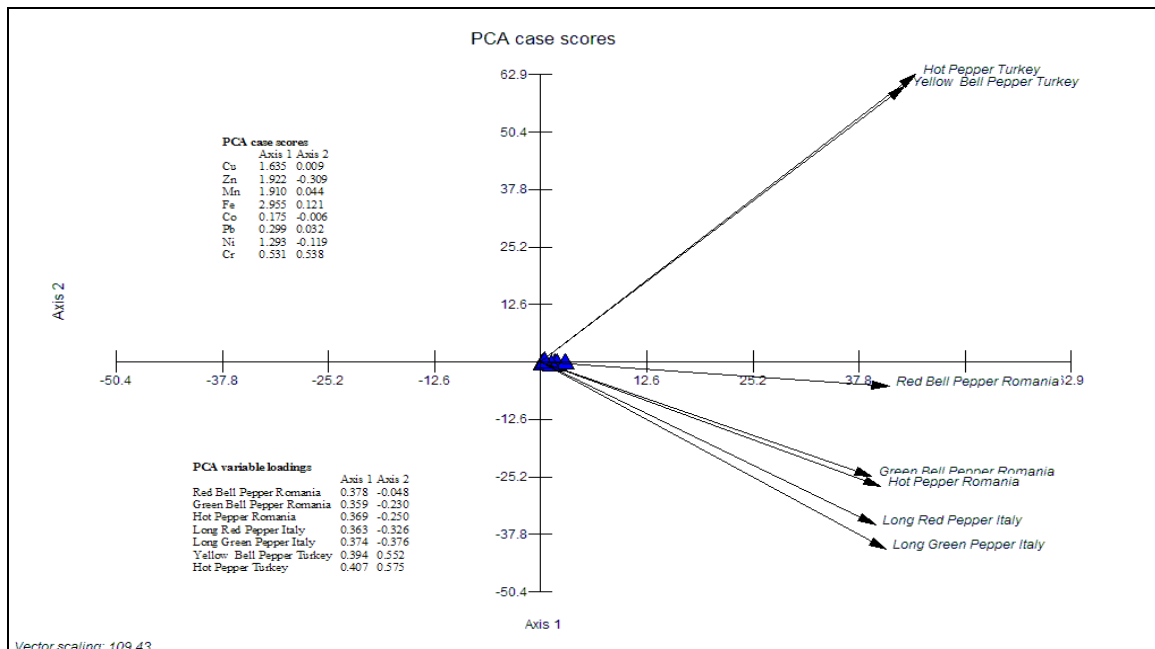


Figure 2. PCA joint-plot graphical representation

The joint-plot representation of the calculated case scores permits the identification of the declared origin of the analyzed Capsicum species. In quarter I, we can observe the vectors for the Capsicum varieties from Turkey and in quarter IV, the vectors for those with the declared country origin Romania (closer to the Axis 1) and the species from Italy (more centered vectors). The vectors are represented taking in consideration the heavy metal composition of the studied samples (Figure 2).

In Figure 3 we can identify the graphical chemical fingerprints of the trace metals. As we can observe the heavy metals content is having small variations between species but the profile that is revealing the fingerprint is similar (Figure 3). "Related plant species show similar distribution pattern!" (FRÄNZLE, S., MARKERT, B., 2000).

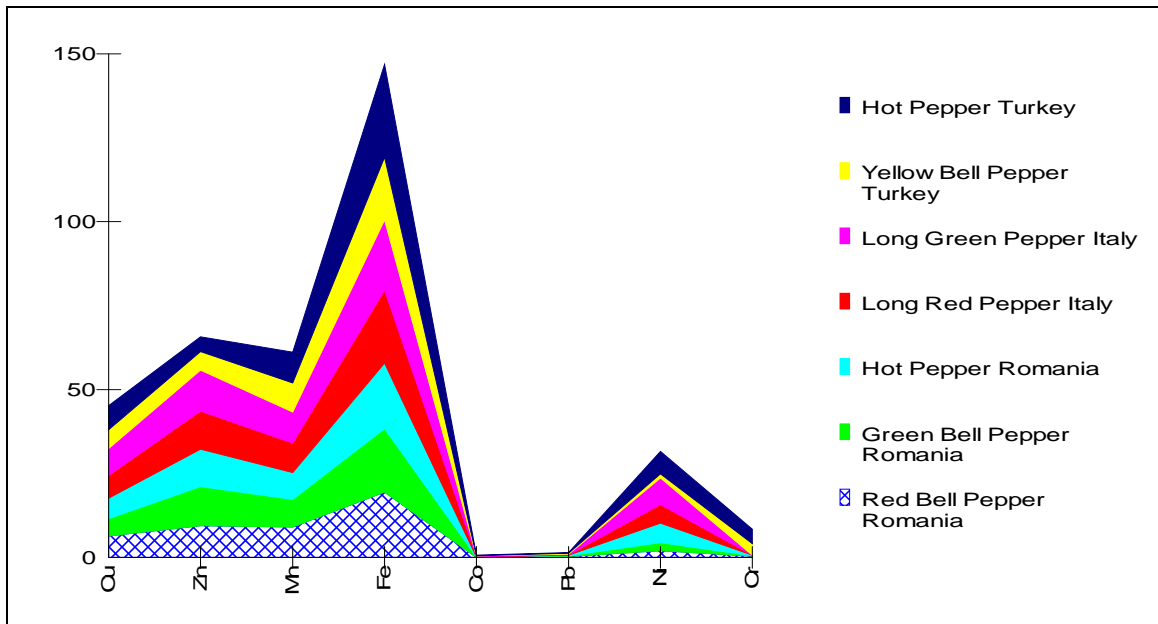


Figure 3. Trace Metals Fingerprints of Capsicum Species

The CA analysis presents the correlation between the analyzed samples and identifies the strength of correlation between the samples (*Figure 4*).

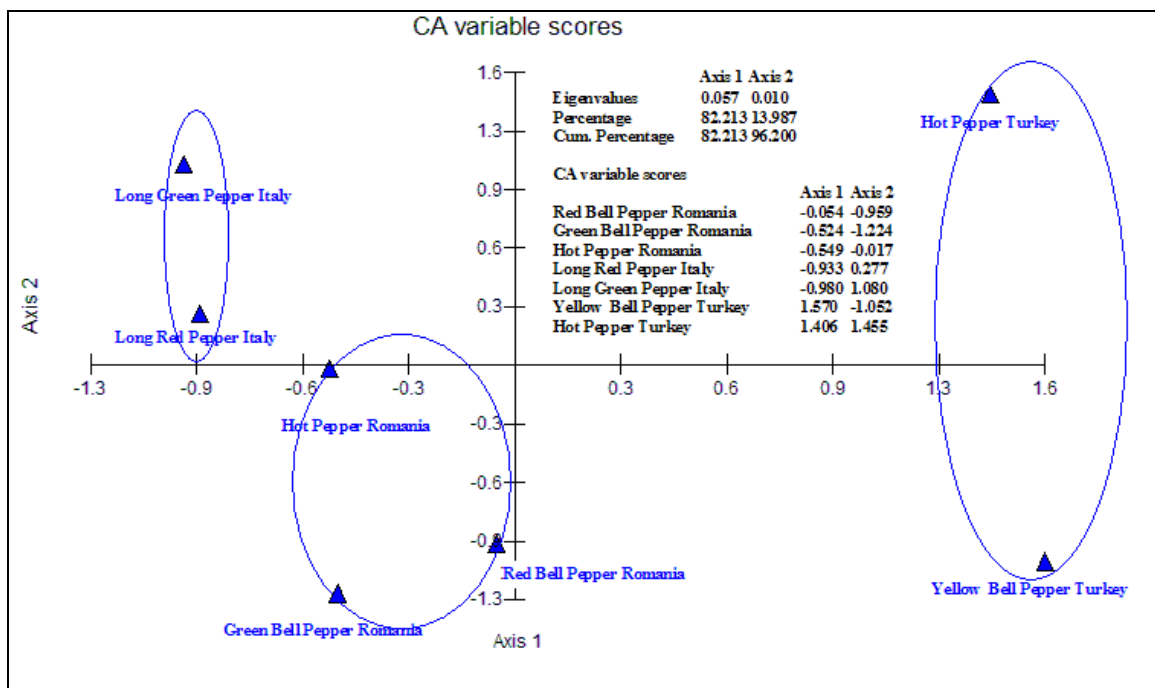


Figure 4. Graphical Representation of CA Variables Score

CONCLUSIONS

Mineral composition and chemical fingerprint can be used as fruit and vegetables quality markers for the cultivators, as well as for the processing food industries.

Graphical chemical fingerprint can be used to verify the declared origin of vegetables and fruits. PCA (*Figure 2*) and CA correlation analysis (*Figure 4*) allows highlighting

mineralogical components specific to each Capsicum species and country, separately, and permits the identification of the declared origin of used species and varieties.

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REFERENCES

- A.C.S.A. REPORT. (2009): Sweet pepper market in Romania. <http://www.acsa.md/public/files/produse/ardei/Ardei%20-%20Romania%20-%202009%20-%20Ro.pdf>.
- ADRIANO, D.C. (1986): Trace Elements in the Terrestrial Environment. Springer-Verlag, New York, pp: 533.
- ANTONIOUS, G. F., SNYDER, JOHN C., BERKE, TERRY AND JARRET, ROBERT L. (2010): Screening Capsicum Chinese fruits for heavy metals bioaccumulation. Journal of Environmental Science and Health, Part B, 45: 6. pp. 562 - 571. DOI: 10.1080/03601234.2010.493495, <http://ddr.nal.usda.gov/dspace/bitstream/10113/45166/1/IND44413518.pdf>.
- ANTONIOUS, G.F.; SNYDER, J.C. (2007): Accumulation of heavy metals in plants and potential phytoremediation of lead by potato, *Solanum tuberosum* L. J Environ Sci Health, Part-A, 42,. Pp. 811–816.
- CAPSICUM INFORMATION, <http://www.livestrong.com/article/147649-capsicum-information/#ixzz1nLQKUMzm>
- DJINGOVA, R., KULEFF, I., AND MARKERT, B. (2004), Ecological Research. 19. pp.3–11; <http://www.springerlink.com/content/glp1d1dhbntn8m2p>.
- FRÄNZLE, S., MARKERT, B. (2000). The biological system of the elements (BSE) — A brief introduction into historical and applied aspects with special reference on "ecotoxicological identity cards", for different element species (Fe, As and Sn), IAEA-TECDOC-1338, Portugal. http://www-pub.iaea.org/MTCD/publications/PDF/te_1338_web/t1338_part1.pdf
- KHAN, S., CAO, O., ZHENG, YM, HUANG, YZ, ZHU, YG. (2008): Health risks of heavy metals in contaminated soils and food crops irrigated with wastewater in Beijing, China. Environ Pollut. 152. pp. 686–692.
- LĂCĂTUȘU, R, LĂCĂTUȘU, AR. (2008): Vegetable and fruits quality within heavy metals polluted areas in Romania. Carpth. J. of Earth and Environmental Science. 3. pp. 115–129.
- MELO, W.J.; AGUIAR, P.; MELO, G.M.; MELO, V.P. (2007): Nickel in a tropical soil treated with sewage sludge and cropped with maize in a long term field study. Soil Biol Biochem, 39. pp. 1341–1347.
- SHARMA, RK, AGRAWAL, M., MARSHALL, F. (2007): Heavy metal contamination of soil and vegetables in suburban areas of Varanasi, India. Ecotoxicol. Environ. Safety. 66. pp. 258-266.

WONG, S.C.; LI, X.D.; ZHANG, G.; QI, S.H.; MIN, Y.S. (2002): Heavy metals in agricultural soils of the Pearl River Delta, South China. *Environ Pollution*, 119. pp. 33–44.

SNAIL SURVIVAL AS BIOINDICATOR OF CADMIUM CONTAMINATED SOILS UNDER SEMI-REALISTIC FIELD CONDITIONS

DRAGOS NICA¹, MARIAN BURĂ¹, IOSIF GERGEN¹,
DIANA MOIGRADEAN¹, ROXANA POPESCU², DESPINA-MARIA BORDEAN¹

¹ Banat`s University of Agricultural Sciences and Veterinary Medicine
300645 Timisoara, 119 Aradului Way

²”Victor Babes” University of Medicine and Pharmacy
300041 Timisoara, 2 Eftimie Murgu Plaza

despina.bordean@gmail.com

ABSTRACT

Juvenile brown garden snails (*Helix aspersa* Müller) were exposed to Cd-contaminated soils for 60 days under semi-realistic field conditions. The soils were contaminated with increasing concentrations of cadmium chloride (0–2900 mg kg⁻¹ Cd²⁺/solution CdCl₂). The snails were housed in terrariums and were fed exclusively with nettle leaves. The experiments were carried out in Timisoara on 1000 snails. The survival rates differed significantly for different Cd treatments. Only higher cadmium concentrations (> 1000 mg kg⁻¹ Cd²⁺/solution CdCl₂) had a significant influence on survival curves of snails exposed to Cd-contaminated soils. The maximal death rate reached 81.00±9.9% for snails exposed to soils contaminated with 2900 mg kg⁻¹ Cd /solution CdCl₂. We found dose-dependent survival rates, whereas the half maximal effective concentration was 1365 mg kg⁻¹ Cd²⁺/solution CdCl₂. Our results suggested that longer-term studies are required for assessing the real potential of snail survival rate as bioindicator of Cd-contaminated soils in field conditions.

Keywords: *Helix aspersa*, soil, cadmium, survival

INTRODUCTION

Cadmium (Cd) is the most dangerous pollutants among heavy metals (SHAHRTASH ET AL., 2010). Generally, it has no known physiological function in live organisms (TRAUB AND HOFFMAN, 2006), excluding diatoms for which a Cd-based enzyme plays an essential role in regulating atmospheric carbon (LANE ET AL., 2005). Naturally-occurring Cd in soil ranges between 0.01 and 1.1 mg/kg, depending on the type of parent rocks (EL FALAKY ET AL., 1991; SCULLOS ET AL. 2001). The antropogenic sources of Cd includes industrial emissions and the application of sewage sludge and fertilizers to farm land (SATARUG ET AL., 2003; CHEN ET AL., 2007; PERALTA-VIDEA ET AL., 2009). Cd is regarded as the most mobile heavy metal in soils (PUEYO ET AL., 2003). However, this heavy metal accumulates in soil only in small amounts, but it is easily absorbed by plants and animals (VELTMAN ET AL., 2007). Recent studies found that cadmium pollution has contaminated many agricultural areas (CESUR AND KARTAL, 2007; TANG ET AL., 2011). Therefore, soil Cd concentration may pose serious threat to human health by uptake of Cd from vegetables grown on contaminated soils (ZHAI ET AL., 2008).

Among other terrestrial invertebrates used as bioindicator organisms of soil pollution, land snails are recognized for their outstanding ability to concentrate high amounts of Cd in their body (BERGER AND DALLINGER, 1989; GOMOT DE VAUFLEURY AND KERHOAS, 2000; NOTTEN ET AL., 2006). This is because of specific Cd-sequestering metallothioneins (Cd-MT) that are involved in Cd detoxification (DALLINGER ET AL., 2001; HISPARD ET AL., 2008). *Helix aspersa* (syn. *Cornu aspersum* and *Cantareus aspersus*), known by the common name brown garden snail, is the most often employed land snail as bioindicator

species in environmental monitoring studies. It was found that animals of similar size (weight and/or height) are convenient biological indicators for metallic pollution (COUGHTREY AND MARTIN, 1977). This species ecophysiological particularities are well known, and it is easily reared both in the laboratory and commercially (GARCIA ET AL., 2006). In addition, exposure to Cd-enriched food inhibited snail feeding and growth in a dose-dependent manner (LASKOWSKI AND HOPKIN, 1996). Therefore, GOMOT (1997) considers *Helix aspersa* a reliable Cd-pollution bioindicator, equally efficient with earthworms and much more sensitive than collembolas.

Standardized ecotoxicological tests (ISO 15952, 2006) are currently available for assessing the effects of pollutants via digestive and cutaneous exposure on survival and growth of snails, usually young *Helix aspersa* Müller. Generally, these investigations were performed in specialized laboratory, under a long photoperiod, 18 h L/24 h, at $20 \pm 2^\circ\text{C}$ with a hygrometry of 80–95% (GOMOT DE VAUFLEURY AND PIHAN, 2000). Not only that such laboratory toxicity tests fail to predict effects under variable field conditions, but their applicability is limited only to the species being tested. Contact with the Cd-contaminated soil is essential in digestive and epithelial transfer of Cd from soil to snail (COEURDASSIER, 2002). However, little information exists concerning the soil Cd toxicity under field and/or semi-realistic conditions. Contextually, this study aims to evaluate the sensitivity of snails to Cd exposure via contaminated soil, and to examine the potential usefulness of survival rates as endpoints in assessing the long-term ecotoxicological impact of Cd-polluted soils under semi-realistic field conditions.

MATERIAL AND METHOD

Chemicals

The stock solution of cadmium chloride (CdCl_2 99.999% pure) was purchased from Sigma-Aldrich Chemie GmbH (Buchs, Switzerland). For all metal treatments, nine ascending concentrations of Cd were used to contaminate the soil. The nominal concentrations were 250, 500, 1000, 1250, 1500, 1750, 2000, 2500, and 2900 mg kg^{-1} $\text{Cd}^{2+}/\text{sol}$. CdCl_2 . In contrast, the control group was not exposed to Cd-contaminated soil. Each test included two replicates per concentration with each replicate jar containing 50 snails.

Maintenance of Animals

Juvenile garden snails (*Helix aspersa* Müller) approx 4-month old were purchased from a specialized snail farm (Edimpe Auto S.R.L., Muntenii de Sus, Vaslui county, Romania) in April 2011. All the experiments were conducted outdoor in Timisoara (Timis county, Romania). The thermal and pluvial regime of this area allows a proper snail development during between April and June, when 33 percent of the annual rainfall takes place, the average diurnal temperature usually does not exceed 25°C , and the mean nocturnal temperature does not decrease below $+8^\circ\text{C}$ (NICA, 2009). Before experimental phase 1200 animals were acclimatized to these conditions during 20 days.

To test the samples homogeneity, the shell height and the snail weight were measured and compared statistically. Shell height was compiled from BURA (2004), and was performed with a digital caliper (YT 7201, Yato Electronics Co. Ltd, Guangzhou, China) to the nearest 0.01 mm. All snails were weighted by using an analytical balance (model TP-214, Denver Instrument GmbH, Göttingen, Germany) to the nearest 0.1 mg. The most homogenous 1000 juveniles were transferred in terrariums/plastic boxes (length: 50 cm, width: 20 cm, height: 25 cm, volume: 0.025 m^3 , surface area available for the snails to

move across: 0.10 m²), 50 juveniles per each terrarium. Each box was covered with a lid built of glass fiber net (ϕ mesh = 0.50 cm), mounted on an aluminium frame.

The soil, red turf (code 01-F2-61-A), was purchased from a specialized trader (Iza S.R.L., Timisoara, Romania). The soil had the following physico-chemical properties: pH: 5.50 – 6.50; ash content: < 5.00%; nitrites: 5.50%; nitrates: 8.50%; phosphor: 16.00%; potassium: 18.00%; magnesium: 0.65%; boron: 0.03%; copper: 0.12%; iron: 0.90%; manganese: 0.16%. zinc: 0.04%; chlorine: 0.30%; molybdenum: 0.20%. Before being introduced into the plastic boxes, the soil (500g/plastic box) was contaminated with cadmium chloride solutions, and homogenized for a proper dispersion of Cd ions. A sponge (10x10 cm) soaked with double-distilled water (spectroscopic pure) was placed at the bottom of each terrarium to maintain humidity at 100%. The snails were fed ad libitum with fresh nettle leaves. The nettle leaves were collected daily from the same place, and rinsed in double distilled water to wash off potential air pollutants. To limit food contamination through soil contact, in each terrarium the nettle leaves were placed inside a watch glass (ϕ = 10.00 cm). Every day, the cages were checked to monitor juveniles fitness, whereas dead specimens, excrements, and uneaten food were removed. The experimental phase lasted 60 days.

Statistical Analysis

Statistical analysis was provided by using the Statistica 10 software package, free trial version. For each sample, the shell height and the body weight were checked to see if they meet the normality assumptions (Shapiro-Wilcoxon test, $n = 50$).

All the samples were tested for equal variances of shell height and body weight (Bartlett's test, $n = 1000$). A One Way Analysis of Variance (Anova, $df = 9$) was carried out to test for significant differences in shell size and snail weight among different samples. For survival rate tests, EC50 value was calculated according to formula:

$$y = b_0 - b_0/[1 + (x/b_2)^{b_1}]$$

In this mathematical model, x is the pollutant level ($x \geq 1$) and y is the organism response, in terms of the percent of maximum responsiveness. The parameter b_0 denotes the expected response at saturation, b_2 is the concentration for a half-maximal response, and b_1 determines the slope of the function. Breslow's test (also known as Gehan's generalised Wilcoxon test) was used to compare the survival distribution of all samples. Post hoc analysis performed statistical comparisons between the survival curves of control and Cd-exposed groups (Log-rank test).

RESULTS

The average fresh weight of snails was 2.06 g (range 1.432 – 2.622 g). The mean shell height was 1.923 cm (range 1.840 – 1.995 cm). Statistical tests for normality showed that neither shell height nor snail weight departed with statistical significance from the normality assumption (Shapiro-Wilcoxon test, $p > 0.67$). Analysis of variance demonstrated that variances are equal across all samples both for shell height and snail weight (Bartlett's test, $p > 0.25$). There were no statistically significant differences between group means for shell height and snail weight as determined by One Way Analysis of Variance (ANOVA, $p > 0.55$). Therefore, it was concluded that our samples meet the assumption of homogeneity.

Total survival rate (%) revealed a direct relationship between soil Cd concentration and juveniles death rates (*Figure 1*). Our results showed that survival curves were significantly different among different Cd treatments and the control groups (Breslow's test, $p < 0.001$).

The survival rates of snails exposed to high Cd-contaminated soils (1000–2900 mg kg⁻¹ Cd²⁺/sol. CdCl₂) were significantly higher than those of control snails (Logrank test, 0.05 < p < 0.001). In contrast, no statistical difference were found between the survival curves of snails exposed to lower doses of Cd via soil (250–500 mg kg⁻¹ Cd²⁺/sol. CdCl₂) and the control group (p > 0.55, Log rank test).

Because of data redundancy (i.e. duplication of data as a result of equal survival rates) several algorithms were used to compute the derivatives of the loss function. The Rosenbrock Pattern Search method found the best curve fitting function that accounted for 87.593% of the variance of snail response to Cd exposure via soil (function loss: 0.002, R = 0.9351). It was found that the half-maximal effective concentration (EC₅₀) of Cd toxicity for soil exposure resulted from the watering of soil with 1365 mg kg⁻¹ Cd²⁺/sol. CdCl₂ (Figure 1):

$$y = 0.1615 - 0.1615/[1 + (x/1365.4278)^{6.597}]$$

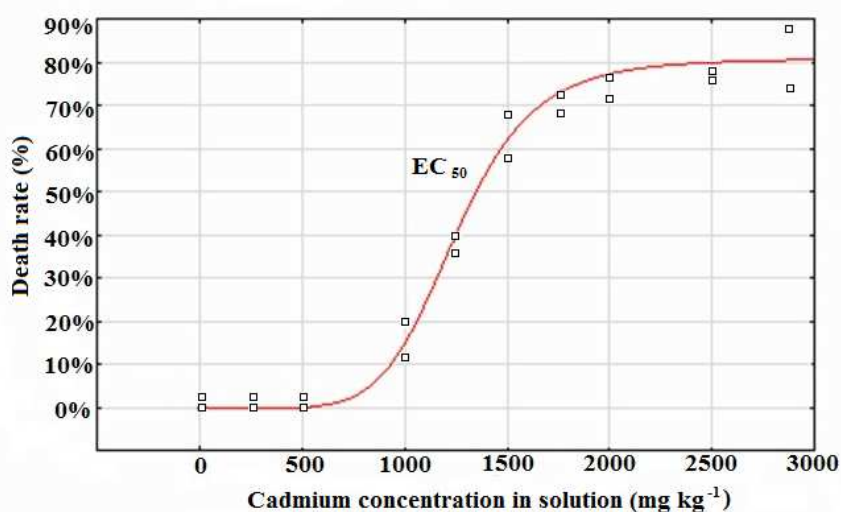


Figure 1. Dose-response curve between soil Cd concentration and snail death rate.

GOMOT-DE VAUFLEURY ET AL. (2006) conducted experiments under laboratory conditions to assess Cd toxicity on juvenile *Helix aspersa* growth and survival rates. It was found that Cd-exposure via food (EC₅₀ = 68–139 mg kg⁻¹) was six fold more toxic than exposure via contaminated soil (EC₅₀ = 534–877 mg kg⁻¹). When comparing to our results it was inferred that such differences resulted from different experimental conditions (i.e., duration, dose, microclimate). COEURDASSIER ET AL. (2002) used two models to expose juvenile *Helix aspersa* to Cd-contaminated substrate (0, 100, 500, 1000 mg kg⁻¹): in direct contact with the substrate or separated from substrate with a perforated plate, thus avoiding tegumentary contact but allowing substrate ingestion. Experiments were performed for 4 weeks under laboratory conditions. The results showed that epithelial contact doubles the rate of Cd transfer via soil to juvenile snails than simple soil ingestion. Generally, elevated Cd bioaccumulation in the snail body, growth inhibition, and decreased food consumption are used to assess Cd toxicity on snails. LASKOWSKI AND HOPKIN (1996) reported high survival rates to *Helix aspersa* juvenile and adult specimens (5.00–8.33%) that were fed with Cd-enriched diet (0.32–145.00 mg kg⁻¹) for four weeks. The same authors suggested that longer exposure would certainly induce lower survival rates as GOMOT-DE VAUFLEURY ET AL. (2006) and the present study have demonstrated it. The applicability of the present approach in ecotoxicology is currently rather theoretical since such heightened

Cd concentrations in soil are rarely expected to occur in the natural environments. Therefore, further studies must approach this problem by using lower Cd concentration and longer time of exposure.

CONCLUSIONS

Total survival rate revealed a direct relationship between soil Cd concentration and juveniles death rates. Survival curves were significantly different among different Cd treatments and the control groups. Our results suggested that longer-term studies are required for assessing the real potential of snail survival rate as bioindicator of Cd-contaminated soils in field conditions.

ACKNOWLEDGMENTS

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REFERENCES

- BERGER, B. DALLINGER, R. (1989): Accumulation of cadmium and copper by the terrestrial snail *Arianta arbustorum* L.: Kinetics and budgets. *Oecologia*, Volume 79. Number 1. pp.60-65.
- BURA, M. (2004): *Cresterea melcilor o activitate profitabila*. ed. Eurobit, Timișoara. pp. 25-29.
- CESUR, H. KARTAL, M. (2007): Determination of cadmium levels in agricultural areas of Çarşamba and Bafra plains. *Environmental Monitoring and Assessment*. Volume 132, Numbers 1-3. 165-169 pp.
- CHEN, T.H. GROSS, J.A. KARASOV, W.H. (2007): Adverse effects of chronic copper exposure in larval northern leopard frogs (*Rana pipiens*). *Environmental Toxicology and Chemistry*, Volume 26. Number 7. pp. 1470-1475.
- COEURDASSIER, M. GOMOT-DE VAUFLEURY, A. LOVY, C. BADOT, P.M. (2002) Is the cadmium uptake from soil important in bioaccumulation and toxic effects for snails?. *Ecotoxicology and Environmental Safety*, Volume 53. Number 3. pp. 425-431.
- Coughtrey, P.J Martin, M.H. (1976): The distribution of Pb, Zn, Cd and Cu within the pulmonate mollusc *Helix aspersa* Müller. *Oecologia*, Volume 23. pp. 315-322.
- DALLINGER, R. WANG, Y. BERGER, B. MACKAY, E. KÄGI, J.H.R. (2001) Spectroscopic characterization of metallothionein from the terrestrial snail, *Helix pomatia*. *European Journal of Biochemistry*, Volume 268. Number 15. pp. 4126-4133.
- EL-FALAKY, A. A., ABOULROOS S.A., LINDSAY, W.L. (1991): Measurement of cadmium activities in slightly acidic to alkaline soils. *Soil Science Society of America Journal*, Volume 55. pp. 974–979.
- GARCÍA, A. PEREA, J.M. MAYORAL, A. ACERO, R. MARTOS, J. GÓMEZ, G. PEÑA, F. (2006): Laboratory rearing conditions for improved growth of juvenile *Helix aspersa* Müller snails. *Laboratory Animals*, Volume 40. Number 3. pp. 309-316.
- GOMOT DE VAUFLEURY, A. COEURDASSIER, M. PANDARD, P. SCHEIFLER, R. LOVY, C. CRINI, N. BADOT, PM. (2006): How terrestrial snails can be used in risk assessment of soils. *Environmental Toxicology and Chemistry*, Volume 25. Number 3. pp. 797-806.

- GOMOT DE VAUFLEURY, A. KERHOAS, I. (2000): Effects of cadmium on the reproductive system of the land snail *Helix aspersa*. Bulletin of Environmental Contamination and Toxicology, Volume 64. Number 3. pp. 434-442.
- GOMOT DE VAUFLEURY, A. PIHAN, F. (2000): Growing snails used as sentinels to evaluate terrestrial environment contamination by trace elements. Chemosphere, Volume 40. Number 3. pp: 275-284.
- GOMOT, A. (1997). Dose-dependent effects of cadmium on the growth of snails in toxicity bioassays. Archives of Environmental Contamination and Toxicology, Volume 33. Number 2. pp: 209-216.
- HISPARD, F. SCHULER, D. DE VAUFLEURY, A. SCHEIFLER, R. BADOT, P.R. DALLINGER, R. (2008) Metal distribution and metallothionein induction after cadmium exposure in the terrestrial snail *Helix aspersa* (Gastropoda, Pulmonata). Environmental Toxicology and Chemistry, Volume 27. Number 7. pp. 1533-1542.
- LANE, T.W. MOREL, F.M. (2000): A biological function for cadmium in marine diatoms. Proceedings of the National Academy of Sciences of the United States of America, Volume 97. Number 9. pp. 4627–4631.
- LASKOWSKI, R. HOPKIN, S.P. (1996): Effect of Zn, Cu, Pb, and Cd on fitness in snails (*Helix aspersa*). Ecotoxicology and Environmental Safety, Volume 34. Number 1, pp. 59-69.
- NICA, D. (2009): Researches regarding the morphophysiology of the gastropods and the farming of the Little grey snail (*Helix aspersa* Muller) in the pedoclimatic conditions of our country. PhD thesis, Banat`s University of Agricultural Sciences and Veterinary Medicine, Timisoara, Romania.
- NOTTEN, M.J. OOSTHOEK, A.J. ROZEMA, J. AERTS, R. (2006): Heavy metal pollution affects consumption and reproduction of the landsnail *Cepaea nemoralis* fed on naturally polluted *Urtica dioica* leaves. Ecotoxicology, Volume 15. Number 3. pp. 295-304.
- PERALTA-VIDEA, J.R. LOPEZ, M.L. NARAYAN, M. SAUPE, G. GARDEA-TORRESDEY, J. (2009):
The biochemistry of environmental heavy metal uptake by plants: Implications for the food chain. The International Journal of Biochemistry & Cell Biology, Volume 41. pp. 1665–1677.
- PUEYO, M. SATRE, J. HERNÁNDEZ, E. VIDAL, M. LÓPEZ-SÁNCHEZ, J.F. RAURET, G. (2003): Prediction of trace metal element mobility in contaminated soils by sequential extraction. Journal of Environmental Quality, Volume 32. pp. 2054–2066.
- SATARUG, S. BAKER, J.R., URBENJAPOL, S. HASWELL-ELKINS, M. REILLY, P.E. WILLIAMS, D.J. (2003): A global perspective on cadmium pollution and toxicity in non-occupationally exposed population. Toxicology Letters, Volume 137. Number 1-2, pp. 65–83.
- SCOULLOS, M. VONKEMAN, G. THORNTON, I. MAKUCH., Z. (2001): Mercury, cadmium, Lead: Handbook for sustainable heavy metals policy and regulation. Kluwer Academic Publishers, Dordrecht. 521 p.
- SHAHRTASH, M. MOHSENZADEH, S. MOHABATKAR, H. (2010): Cadmium-induced genotoxicity detected by the random amplification of polymorphism DNA in the maize seedling roots. Journal of Cell and Molecular Research, Volume 2. Number 1. pp. 42-48.
- TANG, J. BAI, X. ZHANG, B. (2011): Cadmium pollution and its transfer in agricultural systems in the suburbs of Tianjin, China. Soil and Sediment Contamination: An International Journal, Volume 20. Number 6. pp. 722-732.

- TRAUB, S.J. HOFFMAN, R.S. (2006): D Antimicrobials. 87, Cadmium. In: Wonsiewicz, M.J., Edmonson, K.J., Boyle, P.J. (ed.) Goldfrank's Toxicologic Emergencies. 8th edition. The McGraw-Hills Companies, Inc. pp. 1275-1278.
- VELTMAN, K. HUIJBREGTS M.J., VIJVER, M.G. PEIJNENBURG, W.J.G.M. HOBBELEN, P.H.F. KOOLHAAS, J.E. VAN GESTEL, C.A.M. VAN VLIET, P.C.J., HENDRIKS, A.J.
Metal accumulation in the earthworm *Lumbricus rubellus*. Model predictions compared to field data. Environmental Pollution, Volume 146. Number 2. pp. 428-436.
- ZHAI, L. LIAO, X. CHEN, T. YAN, X. XIE, H. WU, B. WANG, L. (2008): Regional assessment of cadmium pollution in agricultural lands and the potential health risk related to intensive mining activities: a case study in Chenzhou City, China. Journal of Environmental Sciences (China), Volume 20. Number 6. pp. 696-703.

STUDY ON THE APPLICATION OF ENVIRONMENTAL PROTECTION METHODS IN CEREAL FARMS FROM IASI COUNTY

BENEDICTA DROBOTĂ, AUREL CHIRAN, ELENA GÎNDU, IONUȚ DROBOTĂ

USAMV Iasi
Department of Agroecology
Mihail Sadoveanu Alley, No. 3, Iași, 700490, Romania
bdrobot@yahoo.com

ABSTRACT

Environmental issue is one of the scientific community concern, reflected in conferences at national and international level, symposia and conferences in which were discussed consistent identification procedures for reducing the impact of pollution.

Agriculture, with industry, may become one of the major sources of pollutants with negative impact on environmental quality through degradation or destruction of ecosystems.

Also, intensive farming lead to soil and water pollution by the excessive use of fertilizers, pesticides, and irrigation water (poor quality and quantity), especially on arable land too loose by applying various works.

The authors have proposed to identify and analyze environmental methods applied in grain farm from Iasi County.

The research methodology was based on statistical survey with written questionnaire that were distributed to a panel of 12 farms of different sizes, of which three farms fall within the 1-100 ha, 3 farms within the 101-500 ha category and 6 farms within the 501-2000 ha category.

Analyzing the results it was found that the production technology of cereals within farms with large areas of land is focus on minimizing CO₂ emissions.

In this respect, for example, the doses of chemical fertilizers is determined depending on the supply of soil with N, P, K, analysis repeated periodically and the experts' advice, crop residues are chopped and incorporated into the soil, which reduces CO₂ emissions, etc.

Keywords: environmental protection, grain farms, pollution

INTRODUCTION

Agri-environmental measures have two *main objectives: reducing environmental risks associated with modern farming and preserving nature and cultivated landscapes.*

In areas with intensive agricultural production, measures are focused on reducing environmental risks (reducing fertilizer or pesticide inputs) and also protecting nature. In more extensive farming areas, measures tend to focus on continuing or re-introducing traditional farming practices with a view to nature protection (Agri-environment Measures - Overview on General Principles, Types of Measures, and Application, 2005; DOSKEY M. G., 2002).

The *Best Management Practice* measures are individual or combinations of management, cultural and structural practices that researchers, have identified as the most effective and economical way of reducing damage to the environment, such as:

✓ *Permanent vegetative cover.* Improves water quality by establishing permanent vegetative cover on farm or ranch land to prevent excessive runoff of water quality or soil loss.

✓ *Animal waste management system.* Improves water quality by providing facilities for the storage and handling of livestock and poultry waste.

✓ *Stripcropping systems.* Improve water quality by providing enduring protection to cropland causing pollution.

✓ *Terrace system.* Improves water quality through the installation of terrace systems on farmland to prevent excessive runoff of water or soil.

✓ *Diversion system.* Improve water quality by installing diversion on farm and ranch

land where excess surface or subsurface water runoff contributes to a water pollution problem.

✓ *Grazing land protection system.* Improves water quality through better grazing distribution and better grassland management.

✓ *Waterway system.* Improves water quality by installing a waterway to safely convey excess surface runoff water across fields at non-erosion velocities into watercourses or impoundments.

✓ *Cropland protection system.* Improves water quality by providing needed protection from severe erosion on cropland between crops or pending establishment of enduring protective vegetative cover.

✓ *Conservation tillage systems.* Improves water quality by use of reduced tillage operations in producing a crop. The reduced tillage operations and crop residue management need to be performed annually.

✓ *Stream protection system.* Improves water quality by protecting streams from sediment or chemicals through the installation of vegetative filter strips, protective fencing, livestock water facilities, etc.

✓ *Permanent vegetative cover on critical areas.* Improves water quality by installing measures to stabilize source of sediment such as gullies, banks, field borders, or similar problem areas contributing to water pollution.

✓ *Sediment retention, erosion and water control.* Improves water quality through the control of erosion, including sediment and chemical runoff from a specific problem area.

✓ *Improving an irrigation and or water management system.* Improves water quality on farmland that is currently under irrigation by installing tailwater return system, converting to a different system to reduce pollutants, or reorganizing existing system to also reduce pollutants.

✓ *Tree planting.* Improves water quality by planting trees to treat critical areas or sources contributing to water pollution.

✓ *Fertilizer management.* Improves water pollution through needed changes in the fertilizer rate, time or method of application to achieve desired degree of nutrient control in critical areas contributing to water pollution.

✓ *Pesticide management.* Improves water quality by reducing the use of pesticides to minimum and manage pests in critical areas to achieve the desired level of chemical contributing to water pollution (CESTI RITA, SRIVASTAVA JITENDRA, JUNG SAMIRA, 2003).

MATERIAL AND METHOD

The objectives of the paper aimed to identify and analyze environmental methods applied in grain farm, from Iasi County, Romania.

The research methodology was based on statistical survey (written questionnaire) with multiple choices.

Surveys, in their various forms, are considered the most appropriate techniques to ensure the research for obtain information. The quality of investigations depends on the quality of selective sampling, which mainly comprises of determining sample and questionnaire development for gather the information.

The sample is a random collectivity drawn from the general collectivity from which to retrieve information for further generalization of the findings. It is a selective part of a whole, whose property or behavior, the researcher wants to know (BURGESS TH., 2001)

Questionnaires with a total of 16 questions were distributed to a panel of 12 farms of different sizes, of which three farms fall within the 1-100 ha, 3 farms within the 101-500 ha category and 6 farms within the 501-2000 ha category.

In terms of juridical form, farms which participated in the study were: one Individual Authorized, 2 Individual Enterprises, 5 Limited Liability Company, two Agricultural Companies and two Joint Stock Companies.

RESULTS

In the agricultural units with grain profile were identified environmental measures such as:

- ✓ for the quantity and type of chemical fertilizer applied will be considered: regular testing of soil, the plant needs for nutrients, foliar analysis, soil moisture, previous crop, specialists recommendations;

- ✓ fertilization should be done in fair weather conditions (to prevent leaching), in an appropriate stage of plant growth (for a rapid absorption) and at correct dose. Groundwater present a major pollution with nitrates, which, in excessive concentrations are considered a health risk;

- ✓ in the farms, a part of chemical fertilizers can be replaced with manure, so it can be reduced the costs with cereals fertilizer, but also soil and water pollution;

- ✓ the quantity of manure applied will take into account: soil texture, soil moisture, nutrient content of manure, nutrient needs of culture, the amount of fertilizer applied;

- ✓ the methods that can be used to control weeds, insects and diseases in cereals, other than chemical treatments are: cultivation of varieties / hybrids resistant to diseases and pests, crop rotation, elimination of diseased plants, hand weeding, mechanical weeding, biological control (predators, parasites and pathogens, pheromone), traps in culture;

- ✓ incorporation of vegetal waste;

- ✓ in farm storage of fertilizers and pesticides will be done inside the building with concrete floor and systems designed to eliminate leakage;

- ✓ waste will be sent to authorized deposit or to recycling programs (KANAGY D. A., 1999; Council Regulation (EEC) No 2078/92).

On the question *"How often is soil tested (analyzed) in your farm?"*, 16.67% of the farms responded that every year, 50% at 4-5 years, 8.33% at 6 years and 16.67% rarely or never.

To the question *"What methods were used for application of chemical fertilizer on your lands / crops?"*, 25% answered – on the soil surface without incorporation, 75% on the soil surface with incorporation, 58.33% while sowing and 33.33% foliar application. Ferti irrigation was not used in the farms that participated in the study (*Figure 1*).

When asked *"What factors were taken into consideration for the decision on the amount and type of applied chemical fertilizer?"*, 50% responded that soil testing, 25% the cost of fertilizer, 16.67% soil moisture, 33.33% the previous culture, 66.67% culture requirements, 33.33% the specialists advice, 8.33% recommendations of their friends. No farm has considered the foliar analysis on the quantity and type of applied chemical fertilizer (*Figure 2*).

Five farms also holding livestock sector, apply manure on the land in quantities between 10 and 60 tonnes per hectare based on: soil texture, nutrient content of manure, nutrient needs of culture, the amount of applied chemical fertilizer, chemical fertilizer cost and quantity of manure resulting from their own farm. A single farm tested manure for nutrient content before being applied.

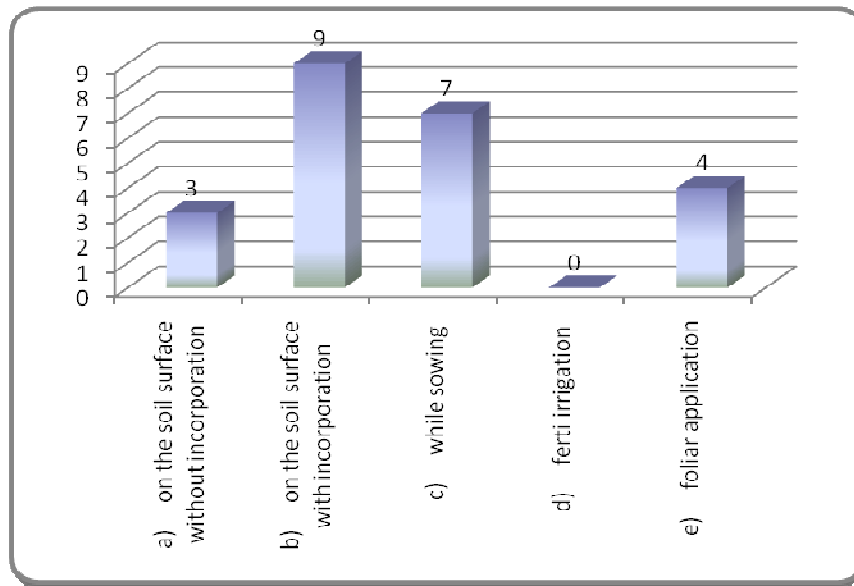


Figure 1. Methods used for application of chemical fertilizer on lands / crops

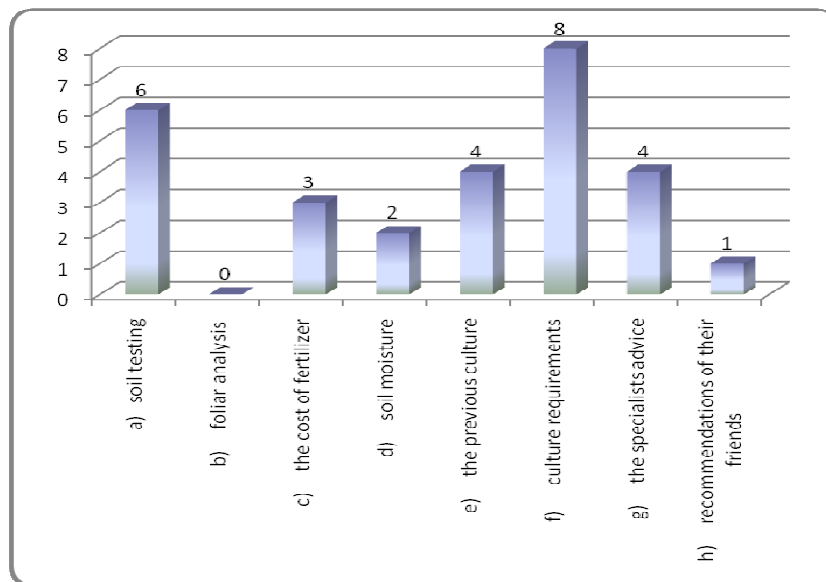


Figure 2. Factors taken into consideration for the decision on the amount and type of applied chemical fertilizer

Among the methods used to control weeds, insects and diseases in cereals, the largest share is held by chemical treatments (83.33%) and mechanical weeding (66.67%). A percentage of 58.33% are using traps in crops and crop rotation, 25% cultivate varieties / hybrids resistant to diseases and pests and 8.33% (especially farms with small areas of land) are using manual weeding.

Biological control (*predators, parasites and pathogens, pheromones*) and removing diseased plants are not used on analyzed farms (*Figure 3*).

On the question “*How are managed crop residues (straw, stalks, haulm, etc.) in your farm?*”, 58.33% said they are baled, 50.00%, embedded in the soil, 41.67%, chopped and scattered on the field and 25% collected. In no farm, crop residues are left on the ground, scattered on the ground without being crushed or burned (*Figure 4*).

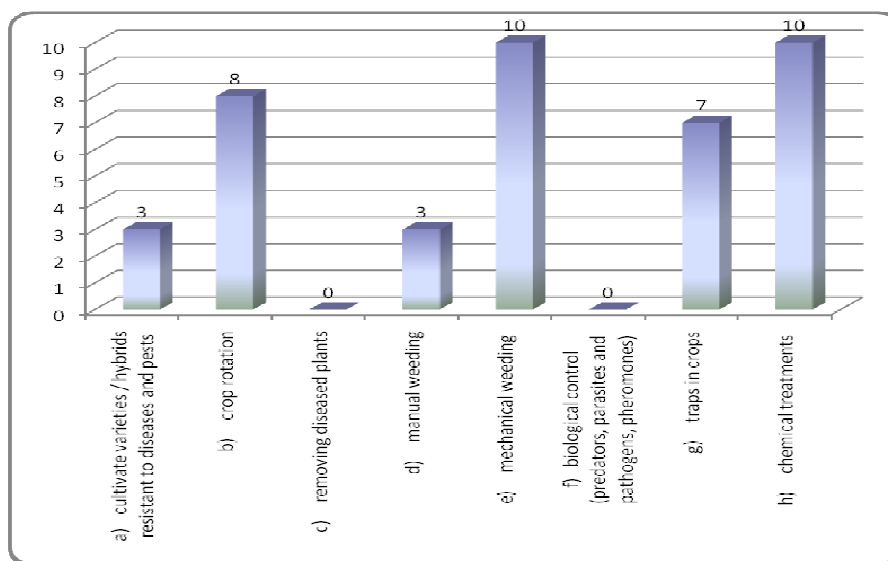


Figure 3. Factors taken into account when deciding on the methods used to control weeds, insects and diseases in cereals

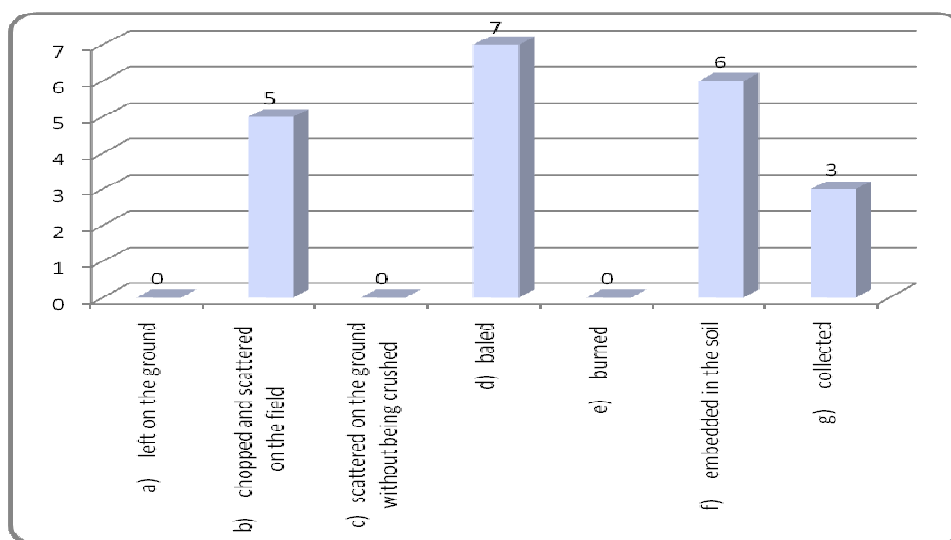


Figure 4. Managing crop residues (straw, stalks, haulm, etc.) in grain farms

Other methods used in environmental protection in Iasi County farms are: *spreading straw on the land (mulching) (41.67%), intercropping / tapes / strips, protection belts, drainage works (8.33%)*.

Land terracing or green fertilizers are not used on studied farms.

Storage of fertilizers and pesticides in large farms is done inside the building with concrete floor, designed with containment to eliminate leakage and waste products of the farm are sent to authorize warehouses for hazardous waste or to recycling programs. Diesel fuel is stored in sealed tanks.

Also, in farms with livestock sector, wastewater is discharged into retention basins built inside the farm.

Small farms do not store hazardous substances and are not actively manage wastewater, which is eliminated by natural drainage.

Over two fifths of the analyzed farms (those with large areas of land) have their own strategy on environmental management.

CONCLUSIONS

1. The technology of cereals production in agricultural holdings with large areas of land (over 1000 ha) focuses on minimizing CO₂ emissions. Thus, the dose of chemical fertilizer is determined by soil analysis which is done periodically, and following the recommendations of specialists. Also, crop residues are chopped and incorporated into the soil, which reduces CO₂ emissions.

2. In the analyzed farms, are respected environmental measures such as: fuel is stored in sealed tanks; in the farm, some chemical fertilizers are replaced with manure, to reduce the costs of grain fertilizer as well as soil and water pollution; storage of fertilizers and pesticides in farm is done in construction with concrete floor, with systems designed to eliminate leakage, waste products of the farm are sent to authorized warehouses for hazardous waste, or to recycling programs, waste water is discharged into retention basins built inside the farm.

3. Farms with small areas of land don't have their own strategy on environmental management and use very few methods of environment protection.

4. Some methods of environment protection are not used in the studied farms (*ferti irrigation, foliar analysis to determine fertilizer needs, removing diseased plants from crops, biological control (predators, parasites and pathogens, pheromones), green manure, land terracing*).

ACKNOWLEDGEMENTS

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REFERENCES

- BURGESS TH., (2001): A general introduction to the design of questionnaires for survey research. University of Leeds, Butterworth-Heinemann, Oxford, U.K.
- DOSSKEY M. G., (2002): Setting Priorities for Research on Pollution Reduction Functions of Agricultural Buffers. Environmental Management Journal Vol. 30, No. 5, pp. 641–650, Springer-Verlag New York Inc., USA.
- CESTTI RITA, SRIVASTAVA JITENDRA, JUNG SAMIRA (2003): Agriculture non-point source pollution control good management practices Chesapeake Bay experience. Environmentally & Socially Development Unit Europe and Central Asia the World Bank Washington, D.C.
- KANAGY D. A. (1999): Environmental Protection Programs Applicable to Modern Agriculture. The Agricultural Law Research and Education Center, The Pennsylvania State University, USA.
- ***), (1992): Council Regulation (EEC) No 2078/92 of 30 June 1992 on agricultural production methods compatible with the requirements of the protection of the environment and maintenance of the countryside, OJ L 215/85 30.6.1992.
- ***), (2005): Agri-environment Measures - Overview on General Principles, Types of Measures, and Application. European Commission Directorate General for Agriculture and Rural Development, Unit G-4 - Evaluation of Measures applied to Agriculture, Studies.

RESEARCHES ON THE BEHAVIOR OF ACTUAL CORN HYBRIDS AT DIFFERENT PLANTING DATES

IONUȚ DROBOTĂ, TEODOR ROBU, BENEDICTA DROBOTĂ

USAMV Iasi, Department of Plant Science
Mihail Sadoveanu Alley, No. 3, Iași, 700490, Romania
ionutdrobota@yahoo.com

ABSTRACT

The knowledge and application of quantitative and qualitative means of increasing corn production is a major concern of growers and researchers in the field.

One of the main factors of increased production in corn is planting dates. Planting at the optimum time favors emergence, growth and development of plants.

The purpose of this paper is to analyze the behavior of current corn hybrids at different planting dates, based on a polyfactorial field experience with hybrids of three maturity groups and 4 planting dates. Thus, observations were made during the vegetation period, like: the appreciation of emergences, cold spring resistance, plants condition and uniformity. The yield obtained was analyzed according to planting dates and hybrids.

The results highlights the importance of following optimum planting date of corn, which is different depending on: soil temperature, location, soil water reserve, disease and pest pressure, weed pressure, used hybrid, tillage system, etc.

The results obtained from the field experience demonstrates the superior production capacity of current hybrids, this is due to the progress in breeding and selection of new corn hybrids.

Keywords: planting dates, actual corn hybrids

INTRODUCTION

Production potential is determined by three components: production potential on plant, tolerance to biotic and abiotic factors and response to inputs (VOICHIȚA HAȘ et al., 2008).

One of the main factors of increased production of corn is planting dates. Planting at the optimum time favors emergence, growth and development of plants.

In corn, if planting is performed in optimal time, solar energy can be used in advance, ground water is used better, growth and development starts earlier, in the end, to achieve higher production. The efficiency of this technology element is evident by increased production and additional energy, even more, respecting the optimal planting date does not require additional expenditures.

Planting dates should take into account: the soil water supply, disease and pest pressure, weed pressure and the used hybrid. Optimum planting time in spring is when in the soil, at 7 am, at the depth of planting is recorded a temperature of 8-10 °C and the trend is of heating (AXINTE et al., 2006; BÎLTEANU, 2003; ROMAN et al., 2011).

Each day of delay after the optimum time can bring production minuses as drought and heat can catch plants in flowering time.

Optimal planting times depend on the location, tillage system and vegetal wastes (NAFZIGER, 1994; SWANSON and WALLACE, 1996).

In an experience, HERBEK et al. (1986) showed that in no-tillage system (the vegetal wastes are on the soil surface) optimal planting time is 14 days later than the conventional system (the vegetal wastes are incorporated).

CIRILO and ANDRADE (1994) found that early planted corn has a lower efficiency

use of solar energy from emergence until silking time; this may explain the reduced production at the corn planted before the optimum time.

In a study conducted by RYAN et al. (2011) it was found that corn yield and net return to seed cost were not affected when planting was delayed 2 weeks, but was 15 % lower when planting was delayed 4 weeks.

Yield loss due to late planting was associated with a 7% decrease in kernel weight and no change in kernels per square meter.

MATERIAL AND METHOD

The field experience was polyfactorial, the studied factors were: the hybrid (3 maturity groups) and planting dates (4 periods). The experience has been located by randomized block method.

The hybrid (three maturity groups): H1 – DKC 3511 (RM 85); H2 – DKC 4590 (RM 95); H3 – DKC 4795 (RM 97).

RM = relative maturity and express the number of days from emergence to black point appearance on kernel. The black point is usually installed when the corn kernels reach about 35% humidity, when the exchange of substances between plant and kernels are decreasing then interrupt.

In our experience we used three control hybrids, one for each of the three analyzed hybrids. Were chosen as control hybrids, each corresponding market leaders from the same maturity groups (hybrids recorded the highest sales).

B. Planting time (4 periods):

The first planting date was established taking into account the specific climatic conditions of 2011. From April 10 to 16 there were registered very low temperatures compared to the multiannual average, around 0°C. Also in this period, the precipitations were very high, which made impossible the seedbed preparation and planting.

Thus, the first planting time was on 20.04.2011 and the others at intervals of 7 days (27.04.2011, 04.05.2011, 11.05.2011).

The corn technology was the conventional one.

Observations were made during the vegetation period, like:

- ✓ **the appreciation of emergences** (Marks from 1 to 9, at 10-12 days after the latest hybrid emergence: 1 - no plot gaps, 5-50% gaps, 9-no plant).
- ✓ **cold spring resistance** (marks from 1 to 9, 1 very good, 9 very weak);
- ✓ **plants condition** (marks from 1 to 9, 1 very good, 9 very weak);
- ✓ **uniformity** (marks from 1 to 9, 1 very good, 9 very weak, noted immediately after tassel appearance, depending on plant height, leaf length and width, cobs shape, silk color, etc.)

RESULTS

Siretel commune is located in the NE part of Romania, along the river Siret (*Figure 1*).

The commune presents a moderate temperate climate. In winter the average temperature falls through -3 °C and in summer reach 22-24 °C.

Average annual rainfall is approx. 550 mm and favors the development of crops. Winds characteristic for this region are from the directions N, N, and S, SE.

The river network of Siretel commune is the river Siret and Sirețel brook.

Groundwater is retained in permeable underground deposits. Medium depths for these groundwater varies between 3-20 m, and sometimes water comes to surface as springs. Soils are gray of forest.

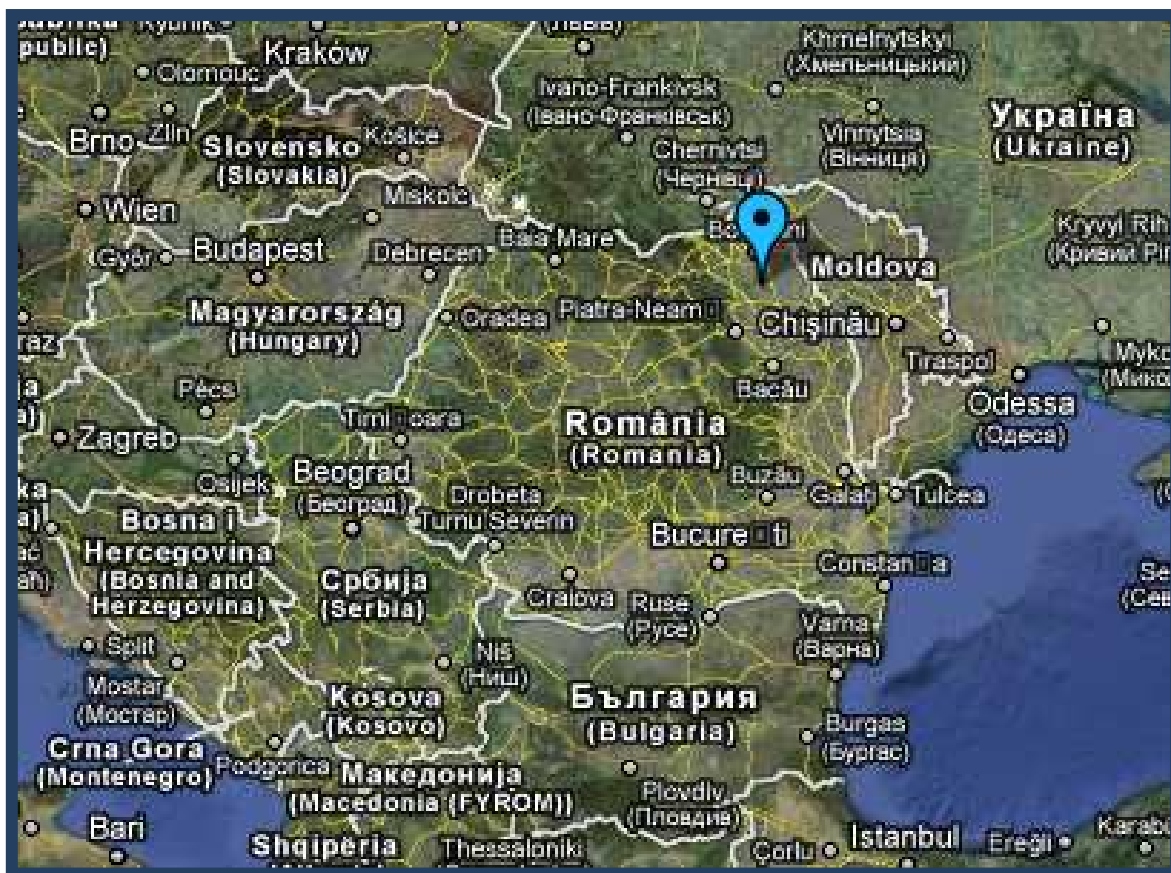


Figure 1. The location of field experience

The year 2011 presented some climate features in the location of experimental field, namely: at the beginning of the planting, between 15- 20 April were recorded very low temperatures (0-2°C), followed by an enough period of time (close to mid-May), when temperatures were below thermal threshold of 10 °C.

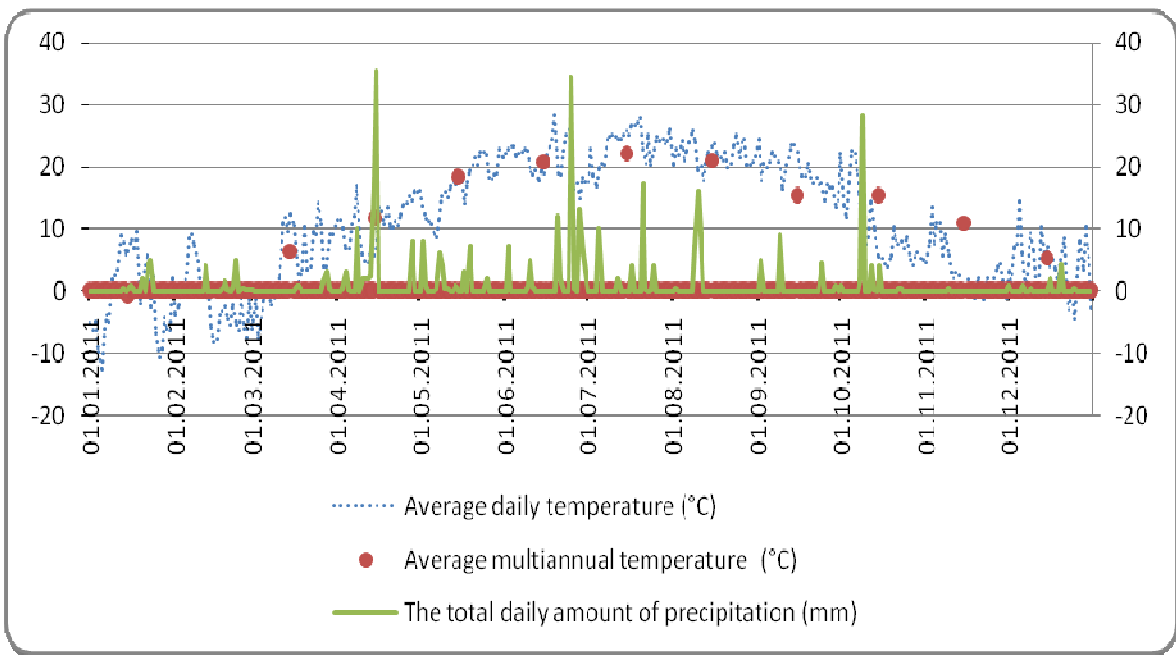
Rainfall amounts were very large (during April - May 2011, of 117.2 mm), which made impossible seedbed preparation and planting earlier than April 20 to 25. In the growing season, rainfall and especially their distribution, was consistent with the need for water of corn plants (*Figure 2*).

For the observations during the growing season, generally **the best marks** were obtained by hybrids grown under planting time 4, followed by the planting time 3, and the worst of those cultivated in first planting time.

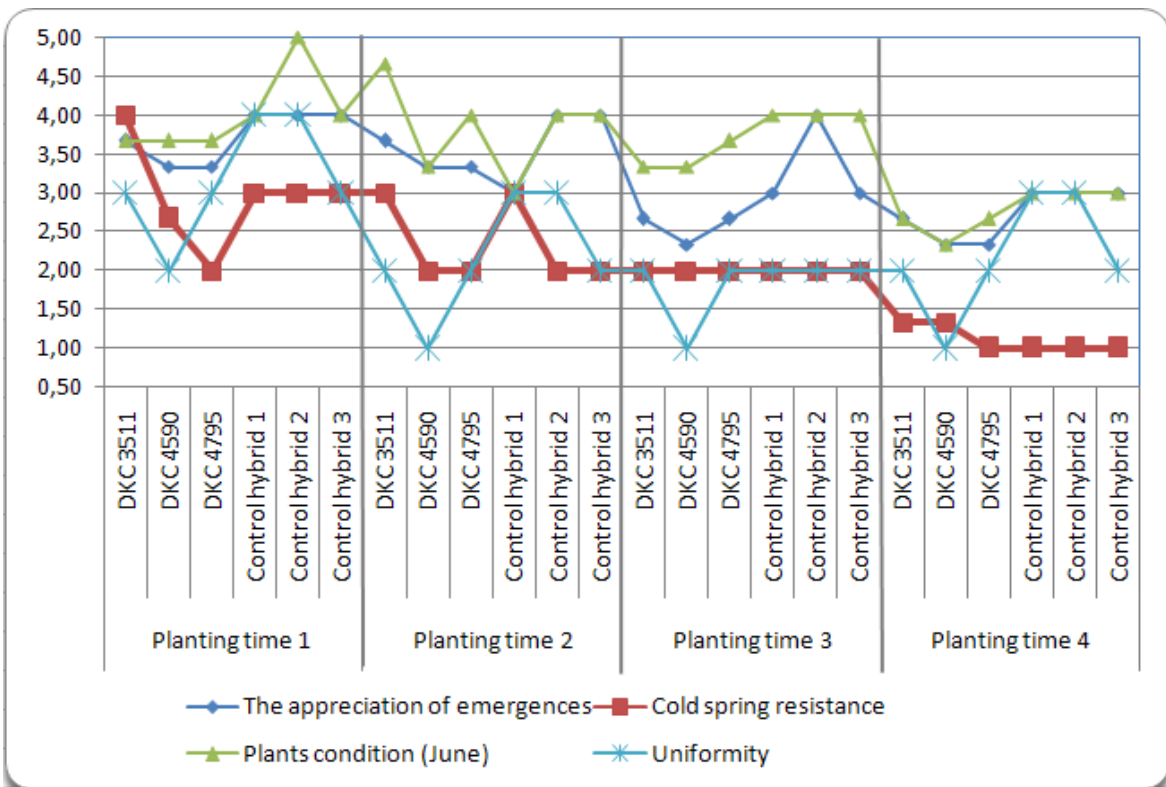
The best marks for **the emergence appreciation** were recorded in hybrid DKC 4795.

Analyzing **cold spring resistance** of the 3 hybrids, it was found that was lower at DKC 3511 hybrid and the highest at DKC 4795 hybrid. DKC 4590 hybrid had an average resistance, comparable to that of control hybrids.

General plants condition was the best on hybrids grown in planting time 4. Hybrid DKC 4590 is highlighted with the best marks at **uniformity observations** in all four planting dates (*Figure 3*).



**Figure 2. Climate data recorded at Iasi Weather Station
(Source: www.freemeteo.com)**



**Figure 3. The behavior of corn hybrids during the growing season
(marks from 1 to 9: 1 very good, 9 very weak)**

Analyzing the hybrids based on planting dates and obtained production, it was found that they had a different behavior from a hybrid to another.

Thus, DKC 3511 hybrid recorded the highest production when it was planted in the

planting time 3.

DKC 4590 hybrid had small variations in production according to planting time. However in the 2nd planting time it reached the highest level of production.

DKC 4795 hybrid recorded the lowest production variations depending on time of planting, giving **it a very high plasticity**. The highest productions were recorded when it was planted in the first period.

In terms of productions recorded at the control variants were revealed: Control Hybrid 1 recorded a declining production from planting time 1 to planting time 4. Control Hybrid 2 production has increased from planting time 1 to planting time 2, with a slight decrease in planting time 3 and reaching a maximum period of production in planting time 4.

Control Hybrid 3 recorded increasing production from planting time 1 to planting time 4.

Comparing productions registered at analyzed hybrids with variants control (market leaders) it was found that productions are clearly in favor of current hybrids, which have a superior capacity of production against control hybrids. This is naturally due to progress in breeding and selection of new corn hybrids (*Figure 4*).

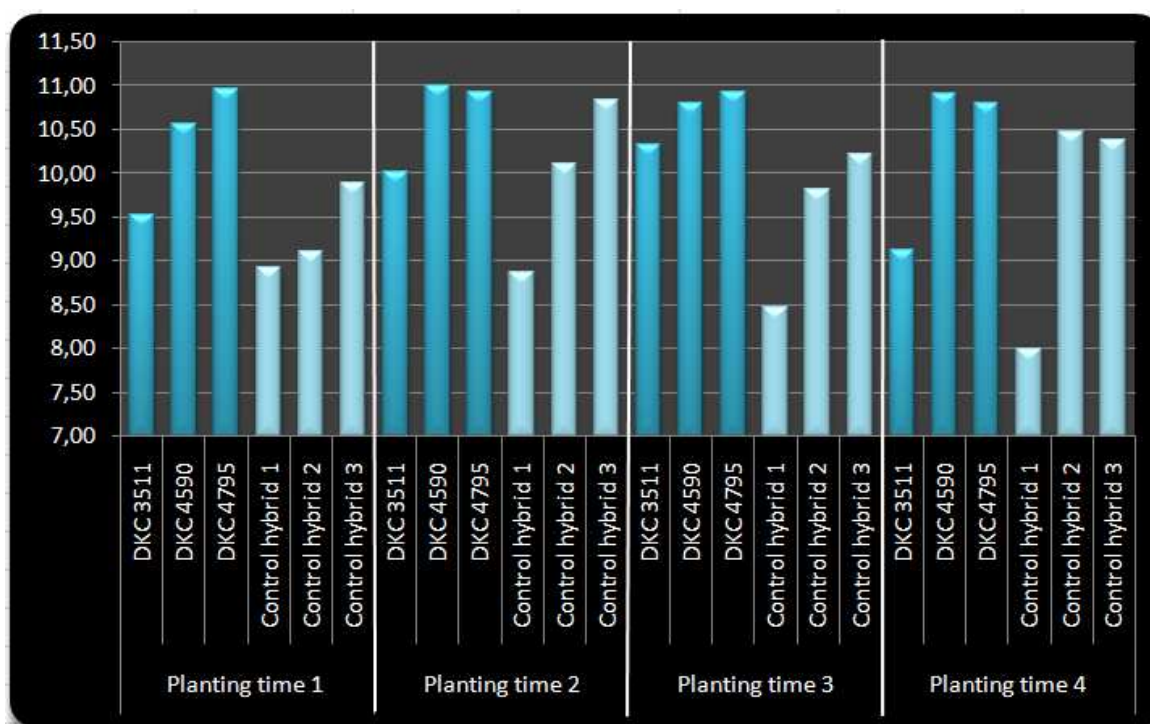


Figure 4. The average production of studied corn hybrids (t/ha)

CONCLUSIONS

1. The optimum planting times for corn, is different depending on: soil temperature, location, soil water reserve, the pressure of pests and diseases, weed pressure, the used hybrid, tillage system, etc.
2. **For the observations during** the growing season (emergence appreciation, resistance to cold spring, plant condition and uniformity), the best marks were obtained by hybrids grown under planting time 4, followed by the planting time 3, and the worst of those cultivated in first planting time.

3. Tested hybrids behaved differently depending on planting dates. On average, the highest productions were recorded in planting time 2 and planting time 3.
4. The hybrid DKC 4795 recorded the lowest production variations depending on planting time, giving it a very high plasticity. The highest productions were recorded when it was planted in the first period.
5. Looking at the average production, the high production capacity is observed at current hybrids, this is due to the progress in breeding and selection of new corn hybrids.

ACKNOWLEDGEMENTS

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REFERENCES

- AXINTE M., ROMAN GH.V., BORCEAN I., MUNTEAN L.S., (2006): Plant growing. Ion Ionescu de la Brad Editure, Iași.
- BÎLTEANU GH., (2003): Plant growing. Vol. 1 Cereals and legumes. Ed. CERES, București.
- CIRILO, A.G., ANDRADE F.H., (1994): Sowing date and maize productivity: I. Crop growth and dry matter partitioning. Crop Sci. 34: 1039- 1043.
- HERBEK, J.H., MURDOCK V.L., BLEVINS R.L., (1986): Tillage system and date of planting effects on yield of corn on soils with restricted drainage. Agron. J. 78:580-582.
- NAFZIGER, E., (1994): Corn planting date and plant population, J. Prod. Agric. 7:69–62.
- ROMAN GH.V., TABARA V., PÎRȘAN P., ROBU T., AXINTE M., ȘTEFAN M., MORAR G., CERNEA S., (2011): Cereals and legumes. Vol. 1, University Publishing, Bucuresti.
- RYAN J. VAN ROEKEL, JEFFREY A., (2011): Coulter Agronomic Responses of Corn to Planting Date and Plant Density. Agronomy Journal, Vol. 103 No. 5, p. 1414-1422.
- SWANSON ST., WALLACE W., (1996): Planting Date and Residue Rate Effects on Growth, Partitioning, and Yield of Corn. Publications from USDA-ARS / UNL Faculty. Agronomy Journal, vol. 88.
- VOICHIȚA HAȘ, TOKATLIDIS I., HAS I., MYLONAS I., (2008): Analysis of specific parameters in realizing the potential and capacity for corn production. AN. I.N.C.D.A. FUNDULEA, VOL. LXXVI.

FEEDING OF TOMATO PULP BALED SILAGE IN GAME PRESERVES

CSABA FERNYE, KRISZTIÁN KATONA, LÁSZLÓ SZEMETHY

Szent István University, Gödöllő, Faculty of Agricultural and Environmental Sciences,
Institute for Wildlife Conservation
H-2100 Gödöllő, Páter K. street 1.
korcsmaster@gmail.com

ABSTRACT

The supplementary winter feeding is a widespread practice in Europe and parts of North America. The role of feeding is maintenance of high game population density, maintenance of body condition or reduction of winter mortality. Feeding may also be carried out to reduce the environmental damage caused by games during winter. The secondary products from the food industry can provide potential winter extra-food for game species due to their relatively low price and valuable nutrient content. To know whether these secondary products can be utilisable food for game we collected information about the diet composition of game species. Actually, we investigated the proportion of tomato pulp silage in the diet of different large game species in those intensively managed game preserves during winter

The study was carried out in two game preserves (Bodony and Bárna). The study was conducted in Bodony from November 2009 to March 2010. In this period 23 bales of tomato pulp silage (each was one ton) were placed on three different feeding plots in the game preserve. In Bárna investigations were carried out between December 2010 and May 2011. In this game preserve 44 bales of tomato pulp silage were placed on six feeders. We collected faecal droppings of different large game species around feeders and along transects between them. The diet composition of game species was determined by microhistological faeces analysis.

In both areas all samples investigated contained of tomato. In approx. 60% of samples was dominated by tomato pulp silage. The red deer consumed the tomato pulp in the highest, while mouflon in the lowest proportion. Nevertheless, the proportion of tomato in the samples ranged between 36-89%.

Our results suggest that supplementary winter feeding could be very important for large game species in intensively managed game preserves with dense game populations. The secondary products from the food industry could provide suitable quality supplementary food for large game species. However, we emphasise the fundamental importance of the natural food resources of the habitat.

Keywords: diet, deer, wild boar, mouflon, microhistological analysis

INTRODUCTION

The supplementary winter feeding is a widespread practice in Europe and parts of North America. The role of feeding is maintenance of high game population density, maintenance of body condition or reduction of winter mortality. Feeding may also be carried out to reduce the environmental damages caused by games during winter (PUTMAN AND STAINES, 2004). RAJSKY ET AL. (2008) stated that a combination of hay with maize and grass silage or pelleted feed can reduce bark browsing. Nevertheless, the role of feeding is not always clear. Investigations in free-ranging populations showed that only a part of red deer individuals consumed the supplementary feed, and only in a low proportion (KATONA ET AL., 2010). As supplementary food can be very expensive, it is a basic question whether the animals consume it or not. The secondary products from the food industry can provide potential winter extra-food for game species due to their relatively low price and valuable nutrient contents.

To know whether these secondary products can be utilisable food for game we have to “ask the animals” and collect information about their diet composition. Our research team carried out an investigation about the utilisation of tomato pulp silage as a supplementary feed for game. This secondary product was considered as a waste of the

manufacturing process. However it has a high lycopene, ascorbic acid and antioxidant content (TOOR and SAVAGE, 2005). Therefore, it can become potential food for ungulates.

Our question was:

- What is the proportion of tomato pulp silage in the diet of different large game species in intensively managed game preserves during winter?

MATERIAL AND METHOD

Study areas

The study was carried out in two game preserves (Bodony game preserve and Bárna game preserve). Both preserves are located in the North Hungarian Mountains. In the Bodony game preserve (275ha) four game species were present during our studies: the red deer (*Cervus elaphus*, 60 individuals estimated) the fallow deer (*Dama dama*, 35 individuals) the mouflon (*Ovis aries*, 150-180 individuals) and the wild boar (*Sus scrofa*, 120 individuals). The forest cover in the area is 40% (primarily locus and pine) the other 60% contains reeds, grassy areas and game plots. The dominant shrubs are blackthorn (*Prunus spinosa*) and hawthorn (*Crataegus monogyna*). In Bárna (300 ha) five game species were present: the red deer (60-70 individuals) the fallow deer (30-40 individuals) the mouflon (30-40 individuals) the Pere David's deer (*Elaphurus davidianus*, 8-9 individuals) and the wild boar (200 individuals). 82% of the area is composed of forests. The main tree species are the turkey oak (*Quercus cerris*, 30%) the Scots pine (*Pinus sylvestris*, 25%) and the black locust (*Robinia pseudoacacia*, 15%). The dominant shrubs are blackthorn, hawthorn and blackberry (*Rubus* spp.).

Field studies

On the feeding plots ten individual pellet groups were collected from each game species in each time. In Bárna investigations were carried out between December 2010 and May 2011. In this game preserve 44 bales of tomato pulp silage were placed on six feeders. The faecal droppings were collected within a transect line of five meters width between the feeders five times. The faecal pellets were taken into plastic bags and kept in a freezer until further processing.

Diet composition analysis

The diet composition of game species was determined by microhistological faeces analysis (KATONA and ALTBÄCKER, 2002). For analysis the samples were thawed at room temperature. Composite faecal samples were made for each sampling period for each feeding plots for each species by making a homogenised mixture from ten pellet groups (droppings from Bárna were analysed individually). A small subsample of these homogenised mixtures was boiled in 2 ml of HNO₃ for 3 minutes. Epidermis fragments were removed and dispersed into a mixture of 0.1 ml glycerine and 0.05 ml of 0.2% Toluidin-Blue and placed in slides. Microscopic slides were covered and examined by systematic scanning under 100X and 400 X magnifications. One hundred epidermis fragments were identified on slides using a reference collection of plant species collected from the study area. Proportion of diet components were estimated as the number of fragments for a particular forage class relative to the total number of fragments. Identified categories were: tomato, maize, corn, grasses, forbs, browses, pine, and seed. The

normality of data was determined by Kolmogorov-Szmirnov tests. Statistical comparisons were carried out by parametric unpaired t test or one-way ANOVA test with Tukey post-hoc test or nonparametric Kruskal-Wallis test with Dunn post hoc test.

RESULTS

In Bodony 63 composite faecal samples were analysed. All of these samples contained of tomato. In 57 % of these samples tomato was the dominant food component (36-89%) (*Figure 1*). The red deer consumed the tomato pulp in the highest, while mouflon in the lowest proportion (Kruskal-Wallis test: $KW=12,754$ $p<0,01$, Dunn post-hoc test: red deer vs. mouflon: $p<0,05$, wild boar vs. mouflon: $p<0,05$, others: ns.) There was no significant temporal change in the consumption of tomato pulp, however it was near to the significance level (Kruskal-Wallis test: $KW=9,342$ $p=0,053$).

In Bárna 57 individual faecal samples were analyzed. Except one or two samples we always detected the consumption of tomato. In 64 % of these faeces tomato was the dominant food component (36-87%) (*Figure 2*). The Pere David's and red deer consumed the tomato pulp in highest proportion, while mouflon in the lowest proportion (Kruskal-Wallis test: $KW=15,818$, $p<0,001$, Dunn post-hoc test: red deer vs. mouflon: $p<0,01$, Pere David's deer vs. mouflon: $p<0,01$, others: ns.). The proportion of tomato has significantly decreased in the diet during the feeding period (Kruskal-Wallis test: $KW=29,920$, $p<0,001$, Dunn post-hoc test: May vs. February: $p<0,001$, May vs. April $p<0,001$, others: ns.). At the same time the proportion of forbs has significantly increased in the diet (Kruskal-Wallis test: $KW=32,428$, $p<0,001$, Dunn post-hoc test: May vs. December: $p<0,001$, May vs. January: $p<0,001$, May vs. February: $p<0,001$, May vs. April: $p<0,001$, others: ns.).

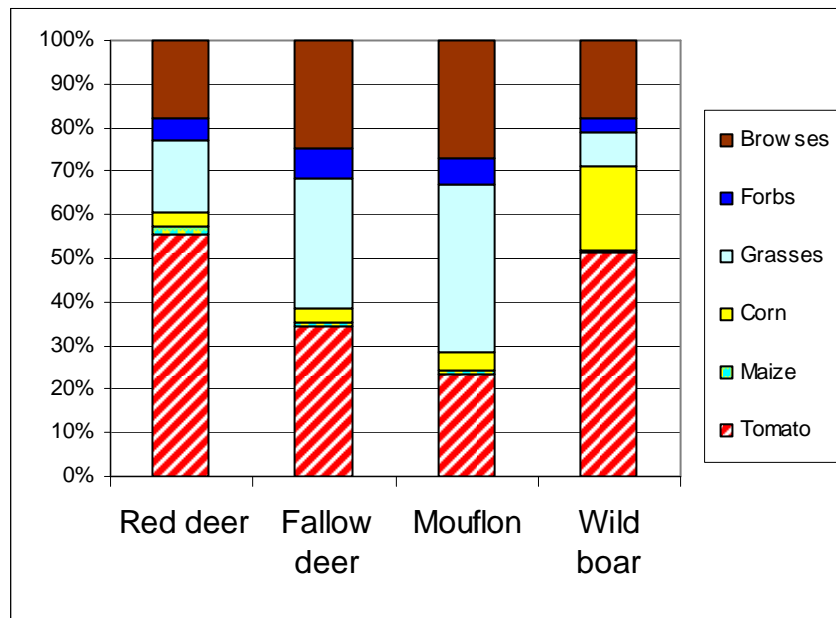


Figure 1. Diet composition of different game species in Bodony game preserve. Average data of six sampling time and three feeding plots are shown (n=15-16)

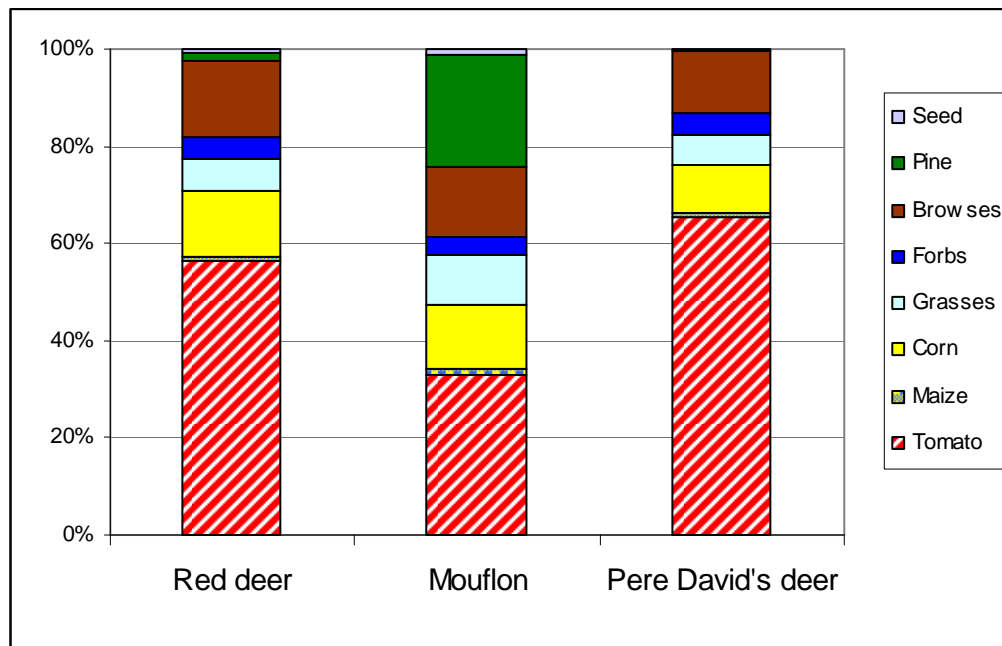


Figure 2. Diet composition of different game species in Bárna game preserve. Average data of individual samples are shown (n= 22; 25; 9, respectively)

CONCLUSIONS

Our results suggest that supplementary winter feeding could be very important for large game species in intensively managed game preserves with dense game populations. We found that in both areas the studied species consumed the tomato pulp in high proportion. This rate of consumption was much higher than we found earlier in free-living deer populations (less than 10%, KATONA et al., 2010). However, our result does not necessary mean that the tomato pulp is an optimal food. It is also possible that tomato pulp was a food, which was available in a greater amount in the game preserves and its consumption did not cause any significant wildlife health problem. Large herbivores generally forage on different shrubs of understory, e.g. elderberry or blackberry. Hawthorn and blackthorn, dominant species of the studied preserves, are not among usually preferred species (KATONA et al., 2011). Overall the tomato pulp could provide suitable quality supplementary food for large game species. However, we emphasise the fundamental importance of the natural food resources of the habitat.

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REFERENCES

- KATONA, K., ALTBÄKER, V. (2002): Diet estimation by faeces analysis: sampling optimisation for the European hare. *Folia Zool.* 51(1): 11-15.
- KATONA, K., SZEMETHY, L., BÉLTEKINÉ GÁL, A., TERHES, A., BARTUCZ, K. (2010): Kiegészítő takarmányozás szerepe a gímszarvas téli táplálkozásában. *Vadbiológia* 14: 19-28.
- KATONA, K., SZEMETHY, L., CSÁNYI, S. (2011): Forest management practices and forest sensitivity to game damage in Hungary. *Hungarian Agricultural Research*, 20(1): 12-16.
- PUTMAN, R. J., STAINES, B. W. (2004): Supplementary winter feeding of wild red deer *Cervus elaphus* in Europe and North America: justifications, feeding practice and effectiveness. *Mammal Society, Mammal Review* 34: 285-306.
- RAJSKY, M., VODNANSKY, M., HELL, P., SLAMECKA, J., KROPIL, R., RAJSKY, D. (2008): Influence supplementary feeding on bark browsing by red deer (*Cervus elaphus*) under experimental conditions. *Eur J Wild Res* 54: 701-708.
- TOOR, R.K., SAVAGE, G.P. (2004): Antioxidant activity in different fractions of tomatoes. *Food Research International*. Volume 38. Number 5. 487-494.

THE ROLE AND IMPORTANCE OF ROSE PRODUCTION IN LIFE OF SETTLEMENT SZÓREG

JOZSEF GAL – RITA KOVACS

University of Szeged
Faculty of Engineering
6724 Szeged, Mars ter 7.
galj@mk.u-szeged.hu

ABSTRACT

The rose is a magnificent, mysterious plant. It had been grown before Christ. Today it is sold mainly as a cut flower. A great amount comes from Szőreg to the internal market, but gardeners of Szőreg export it to wholesalers or directly to costumers, as well. This is a particular field to grow and sell rose-trees. Nowadays traders make roses available to costumers in this form, too. It is worth mentioning their industrial use since roses are used in food and pharmaceutical industries and in cosmetics, as well.

Rose-trees need special soil, light, water and nutrient. Their complex existence is presented as a comparative advantage around Szőreg where there are excellent conditions for cultivation of roses. No wonder that more than 90% of rose production in Hungary comes from Szőreg and its surroundings.

This study intends to examine what economic and cultural role rose tree growing has in the life of a small town in the south-east of Hungary – taking a rose-growing family farm as an example.

Keywords: rose-growing, rose tree growing, rural development, rose festival, family farm

INTRODUCTION

The rose had a very important role in certain cultures even before Christ. In the course of time it had evolved as a domesticated plant, its role had increased in different religions-mainly in the pagan body of beliefs, before Christianity took the rose as a religious symbol. It had already been grown in 1500 BC, that time it was utilized in cosmetics and therapy. It has been cultivated as an ornamental plant since 18-19th centuries. Roses can be found all over the world: in the moderate and subtropical parts of the Old and New Worlds. It grows almost everywhere in Europe, except for the Arctic Circle. (MÁRK 1976; MATTOCK J. – NEWDICK, J. – SUTHERLAND, N., 1994)

In our country rose-growing is typical around Szeged. The former co-operative farm in Szőreg took the important role in promotion of rose tree growing. Gardeners of Szőreg made this region well-known with their hard work.

We are presenting specialties in growing and selling formed by today through the example of a family farm.

ROSE TREE GROWING IN SZÓREG

The rose culture in the area between the rivers Tisza and Maros goes back in the past of more than a hundred years. This geographical area has excellent climatic and geological conditions. Rose trees are connected to Szőreg by both the appropriate natural conditions and tradition of their cultivation. The soil of good quality which is rich in nutrient, the suitable amount of water and sunshine are all available here. (HÖHNE, J. – WILHELM, P. G.,

1999) These lands can be found between Szőreg and Deszk in the area bordered by Tisza and Maros.

The family farm examined in our survey was founded in 1989. Today they have 50 thousand stems of young and selected roses. Until 2007 they were contracted clients of foreign breeders, so they grew the rose trees to order. Almost every rose tree was exported during the time of contracts. Cultivation and export were regularly checked by the administrative departments, which were in function that time. Today they produce for home producers, mostly commercial kinds because it is easier and it does not involve registration and controlling.

The examined family farm can be regarded as a typical one, this model characterizes rose gardeners. Each working process from planting to picking is done by the female members of the family. There are three of them- the mother and the two daughters- who carry out the precise, less physical duties. The male members of the family, the father and the son, do the work which needs more physical strength. Most of the processes are motorized in order to save time and money. Each family member has its own duty but they need other human resources for the seasonal work.

Cultivation, irrigation, nutrient supply and plant protection are accomplished with machines driven by a tractor: before planting they loosen the soil with a plough in middle-depth (around 18-24 cm). (JAKOBI, K.,1993; RICHTER, G. – PROLL, T., 2005) They are very careful so that the surface of the soil cannot turn downwards. After the soil has settled (the end of March, the beginning of April), they can start planting which they use a planting machine of two lines for. They can plant the 50 thousand stems of young rose trees within two days. After this step they water the stocks with a windable irrigation system which can be repeated several times depending on the weather conditions.

In the suitable weather conditions the wild subjects become fully ripe by the middle of July. They become ready for budding which is started around 10 July. Three members do this work in the family. They have used a special machine for it for two years so they can save a lot of time and energy. They can finish budding in two weeks with 5 persons for 50 thousand stems of wild subjects.

After budding they do not remove the ribbon, they wait until the next spring. They remove it only after slotting so there is a smaller chance that either the frost or the pest damages them. Slotting is started in late winter. The slot is exactly between the leaves and the new shoot. Before picking they cut back the rose trees in the height of 1 cm, and then they remove the leaves from them. This process is started in the middle of October. It is the most complex step. One person – always the father – controls the machine which picks up the young tree. He has to take a very big responsibility since he should drive the tractor very slowly and evenly so that the picking machine cannot cut the stump to pieces. The employees pick up the rose trees from the ground and then classify them. Two female members of the family check classification and then attach the class labels. They put a white label on the 1st class stems, orange on the 2nd class and red on the 3rd class. 10 classified stems are put in a pile which is bundled by the brother. He bundles the stems first in a bundle of 10 and then of 50. Then, they put them on the trailer connected to the tractor, and finally, they are carried to the storage. They store them in a separate building until the customer transport them. In the meantime they water them so that the stems cannot get dry.

ROSE GROWING TODAY IN HUNGARY

4-5 million stems of roses are grown in Hungary every year. 98% of them is produced in the region of Szőreg: in Tiszasziget, Újszentiván, Kübekháza, Szőreg and Deszk. Some home data are shown in *Table 1*.

The open-field acreage rose	
2009	46,8 hectare
2010	44,2 hectare

Eye Mode planting	
2009	4 680 000 pieces
2010	4 420 000 pieces

Field produced noble rose tree (I and II Class)	
2009	3 600 000 pieces
2010	3 400 000 pieces

Table 1. The Rose-growing number of data

Source: http://www.mgszh.gov.hu/szakteruletek/szakteruletek/novterm_ig (25th 02. 2012)

The planted subject is generally 20% more than the amount of the ready stems but the farmers take this number into consideration when planting so they can fulfill the orders without problems. Around 76% of the open-field acreage roses are exported packed with free roots, only 24% of the full amount of rose trees is sold in the home market.

There are 31 bigger producers in the Szőreg region who earn their living only from rose growing. Around 31 families are occupied directly or indirectly with rose growing in open fields. One producer deals with around 30-40 thousand stems here. The planting proportion was 10 thousand stems five years ago which has grown to 40 thousand by today. The number of farmers is small regarding the Hungarian conditions which results that the offer of the relatively small number of producers can hardly fulfill the demand for the product.

The number of the species grown here changes every year because of the wide variety of the customers' demand. As an average, farmers grow 200 types of rose trees in Hungary. The different departments can only estimate the data of rose growing, for some reasons, so it is not easy to find exact data.

Today it is Hungary which exports the most rose trees, some millions a year, in Europe. Orders from breeders make the biggest export, among them the most important ones: Meilland (France), De Ruyter (the Netherlands), Kordes (Germany). (JESZENSZKY Á., 1978)

The examined family farm has exported to 19 countries so far. Constant destinations are: Germany, France, Croatia, and Italy. They export the most to France, the Netherlands and Germany.

The specialized knowledge, experience which is handed down from fathers to sons,

customs, good examples, joy felt in work, pride, sure income, success in the precise work- all these make the rose culture which has conquered Europe. The local people believe that those who were born in Szőreg have rose growing in their blood which is not only work but passion, as well.

ROSE FESTIVAL IN SZŐREG

It has been a tradition since 1990 that the Rose Festival is organized at the end of June. The event itself is an opportunity for farmers and people interested to meet each other which has a significant marketing value, too. Also, this event makes the rose even more popular.

At that time of the year Szőreg is dressed in rose petals. In 2004 the rose of Szőreg became a 'hungaricum' which is not only an honor but a special trade mark, too, from marketing point of view. The last decade enchanted thousands of people with the beautiful flower compositions. <http://www.programturizmus.hu/tdestination-szoregi-rozsaunnep.html> (2012.02.28.)

These farmers try to utilize their existing conditions, results. They are planning the future locally which they have the necessary natural and environmental circumstances for. These settlements have made allowance for their conditions, their professional knowledge, tradition, the employment rata and income and protection of village values.

They know the market demand and they intend to realize an exemplary rural development by integrating the local traditions. They deeply believe that both good reputation and its producers have to be respected. It is an example for that people working in agriculture can easily learn what they think sensible. Development of a community depends on where their members settled down and what culture of production they formed there.

CONCLUSIONS

In the modern farm the rose trees are grown to sell them for home or foreign customers, breeders. Besides, they are utilized for industrial purposes; it is worth mentioning the food and pharmaceutical industries and the cosmetics, too.

Hungary's soil, the surroundings of Szőreg, the areas of the South Great Plain Region are excellent for growing roses.

The people of Szőreg are highly appreciated in Szeged region. They form a community where different ethnic groups have been living together in tolerance for centuries, where the people are connected by the exemplary love for work, beautiful gardens, flowers and roses. For roses which give not only safe job but joy, as well. And not only for the farmers but for the German, Italian or Danish housewives who plant and take care of the famous rose trees of Szőreg.

A real community needs a common holiday. It was found by the people of Szőreg in the Rose Festival which has been an attractive, splendid event in the Szeged Festival Programs for years, it is a must to take part in it.

The rose has become the emblematic element of Szőreg. Life and work of lots of families are arranged around it. Nevertheless, the rose means even more here: the central element of the social contact and socialization which symbolizes the common aims and inherence. It is part of the culture and the passing down of knowledge over generations. Also, the rose and the rose tree are our national treasure too, that is why it is a protected trade mark. The vicinity of Szeged (Szőreg is its administrative part) offers the advantages of a big city so the opportunity to protect traditions (ZSÓTER B., 2006) and to utilize the life in a modern city, the unity of country and town and of the living and working place are all realized at the same time here.

REFERENCES

- HÖHNE, J. – WILHELM, P. G. (1999): *Tizenkét hónap a kertben* (Zwölf Monate im Garten, Weltbild Verlag GmGH, Augsburg, 1997) Magyar Könyvklub, Budapest, (ford.: Fischer Irén)
- JACOBI, K. (1993): *Rózsák gondozása* (Rosen, BLV Verlagsgesellschaft mbH, München, 1992, ford.: Mőcsényi Mihályné) A rózsák című mű második, javított kiadása, Mezőgazda Kiadó és a Planétás Kiadó közös kiadványa
- JESZENSZKY Á. (1978): *Oltás, szemzés, dugványozás*, Hetedik, változatlan kiadás, Mezőgazdasági Kiadó, Budapest
- MATTOCK J. – NEWDICK, J. – SUTHERLAND, N. (1994): *Rózsák* (Roses, Coombe Books, 1993, Colour Library Books Ltd., Godalming, Surrey, 1993, ford.: F. Nagy Piroska), Móra Ferenc Könyvkiadó, Budapest
- MÁRK G. (1976): *Rózsák zsebkönyve*, Mezőgazdasági Kiadó, Budapest
- RICHTER, G. – PROLL, T. (2005): *Rózsák*, (ford.: Valló Ilona), Sziget Könyvkiadó Kft., Budapest
- ZSÓTÉR B. (2006): *Mezőhegyes történeti bemutatása 1875-ig*. Historical presentation of Mezőhegyes to 1875. Agrár és Vidékfejlesztési Szemle, ISSN: 1788-5345, 2006. 01., 89-92.
- A rózsatermesztés adatai http://www.mgszh.gov.hu/szakteruletek/szakteruletek/novterm_ig (2012.02.22.)
- Szőregi Rózsaiünnep meghívó <http://www.programturizmus.hu/tdestination-szoregi-rozsaunnep.html> (2012.02.28.)

SERVICE MARKETING EXAMINATION OF OPUSZTASZER HERITAGE PARK AS A RURAL DESTINATION

JOZSEF GAL – EDINA VINCZE-LENDVAI – ILDIKO ROZSA

University of Szeged
Faculty of Engineering
6724 Szeged, Mars ter 7.
galj@mk.u-szeged.hu

ABSTRACT

Today the service industries are developing rapidly therefore the service marketing tasks are getting more and more into the focus. Those who are engaged in the subject do researches to explore the emotions, attitudes and purchasing motives in decision-making and the purchasing processes of different services. Decisions are made not only by companies but costumers, parents, families and circles of friends, too, when they plan their programs for the weekend considering their income and expenses. That is why we feel important to examine our subject on the basis of the service marketing of the Opusztaszer National Heritage Park, which takes a prominent part in the cultural life of the Southern Hungarian Plain, in order to render help to improve the services of the institution. The examination is complemented with a non-representative questionnaire survey which, nevertheless, is suitable to give the background to a wider survey. On the basis of the answers given some chances of improvement have been seen which we are planning to recommend for the Opusztaszer National Heritage Park.

Keywords: touristic destination, national memorable place, rural development, education and history, service marketing

INTRODUCTION

In case of a service we cannot talk about goods in a traditional sense since the customer has to undergo the experience itself that is how he can see and feel the service. The task of entrepreneurs and service providers is to make the chosen service more and more tangible. They have not prove that the costumers enjoy services, which can be done by organized shows, by offering a unique content attached to the product or by broadcasting special advertisements. However, it should be taken into consideration that it is only an experience and not a content to be stored. (KOLOS K. – KENESEI ZS., 2007)

While examining services the most essential factor is that providing and using a given service has to be done at the same time and in the same place. The experience can be felt only in the service itself then and there where the provider makes it possible. Considering these factors we have to admit that both the service provider and service user take a very big risk in the service market.

The service is nothing else than a kind of promise which is supported by the image, that is the picture the service provider would like to show about itself, the picture which is published about the organization. This image is considerably influenced by the leading product or the service presented by the organization. In case of the Opusztaszer National Heritage Park these products are the Feszty Panorama and the outdoor village museum. Besides these, the main target of each permanent or temporary exhibition is to increase the number of visitors and to give more information for a wider public.

It is difficult to pass the message of the Park, namely it is worth visiting Opusztaszer more times, to each sector of the target group. To improve this situation the Park utilizes a wide range of PR-means, so it always appears at different events, exhibitions, and in the printed and electronic media, as well. The conscious communication has to be constant, it has to be planned. The effect of the information sent yesterday is decreasing continuously as time goes by, thus it needs constant work to be up-to-date constantly.

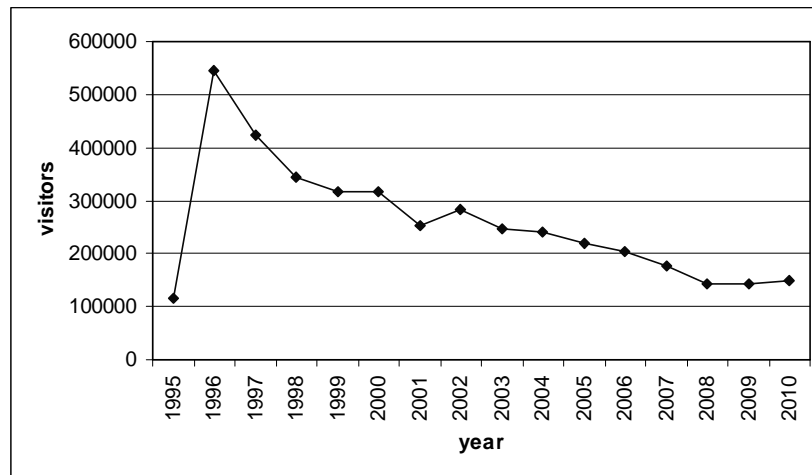


Figure 1. Number of visitors

Source: [HTTP://OPUSZTASZER.HU/KOZLEMENY](http://opusztaszer.hu/kozlemeny) (2010)

According to messages have been published it would be possible to measure efficiency, results and impacts.

THE OPUSZTASZER NATIONAL HERITAGE PARK

It was Anonymous who wrote in his book, entitled *Gesta Hungarorum*, that war-lord Arpad and the tribe leaders settled down in the area of today's Opusztaszer for 34 days and they framed the common law of the future country. It means that it was the birthplace of the Hungarian statehood. The Opusztaszer Heritage Park, which spreads on an area of about 55 hectares, was established in this settlement of great history. One of the greatest treasures of the Hungarian can be seen here: the Feszty Panorama (called 'The Hungarian conquest') which commemorates this important event of our history. The monumental piece of work can be visited in the Heritage Park since 1 August, 1995. (<http://opusztaszer.hu/tortenet> 2011.01.16)

The Opusztaszer Heritage Park accepted its 4 millionth visitor in 2010. While in 2006 the culture at the time of the conquest was the only topic around which the image was structured, nowadays the project of the outdoor village museum ('Step into the Past') has successfully closed up to the line of interactive services. We can take part in the peasant culture of the 1920s. The anniversary of the Hungarian conquest brought an outstanding number of visitors; however, it has been impossible to approximate that number since then. (Figure 1) We can participate in a contemporary school lesson, we can meet gendarmes, we can get to know the everyday life of a shepherd or a highwayman, or if we feel like doing it, we can bake some typical peasant food (eg. traditional bread called

‘kenyerlangos’) or make squash from elderflower.

There are several exhibitions, pieces of art, programs to attract the visitors. The main sights and attractions are: Monastery, Outdoor Ethnographical Museum, Arpad-Monument, Historic Statue Park of Counties, Szeged Gate, Szekely Gate, Cumans’ Statues, National Monument of the Army and Land Distribution, ‘Heritage of Szer’, Statue of Anonymous, Nomad Park, Csete-yurts.

The main objects are to show these historic events and processes of symbolic value and to arouse the interest for a trip to Opusztaszer and thus to move from the attitude obstacles those who have been indifferent so far. It is important to give new information, new pieces of knowledge while staying in the Park. Utilizing the opportunities, getting more information- all of them can make the visit more meaningful.

The experts of the Park have the intention to change the everyday routine, to motivate teachers to evolve a new desired routine, a hoped process, the learning process of the history and past which is rich in experiences. Obviously, they need open-minded students, visitors who are ready to accept these intentions.

In case of Opusztaszer a positive local initiative has an impact on the country, too, visitors arrive from more and more places, and there is an increased interest in the modern, interactive exhibitions. However, the interest is not followed by the expected number of visits. At the same time, it is important to point out that a national historic exhibition should not join the line of commercial theme parks. The underlined targets are the authentic representation and transmission of culture which serve to strengthen the sense of being Hungarian. The paper knowledge becomes deeply rooted knowledge only when it is connected to reality. This process is supported by the programs which are realized by the experts, local people and the visitors together.

It is the philosophy or mission of the Opusztaszer Heritage Park that they want to connect culture with development, reform, transformation, renovation which they have to take demands of the visitors (or customers) into consideration for. The service marketing tools give help to this mission. Their elements are in harmony with the factors which determine life of the whole society and with the whole culture of the individual member of the society. Or more precisely: how do we work, eat, move, live, wear our clothes and behave at home, in family, on the streets, at our working places, with people or in politics? As opposed –in a narrower sense- the museum marketing gives a special role to the science, arts, philosophy and religion from the viewpoint of the culture as a whole.

In case of the Opusztaszer Heritage Park it is the middle class of the Hungarian society which is regarded as the potential target group who –mostly families- visit the events on a regular basis. However, we have to know that it is necessary to have a wide middle class of high level which not only adapts itself to the circumstances created by modernization but also it can support their development. (LITAUSZKI T., 1989)

SURVEY AND RESULTS

Demands of those who use the services provided by the Opusztaszer Heritage Park are continuously changing which means possibilities but a new challenge, as well. It is the

adjustment which has become one of the most important tasks for the service provider so in this case it is necessary to get to know these demands and then, to offer the suitable replies. It is practical to make a service line which is based on the Hungarian conquest and the awareness of being Hungarian. Then it is possible to connect the added value of history, architecture, the fine arts, ethnography and other fields, too. In museums the so-called service packages are often provided but the main question is: on what extent is it necessary to put the emphasis on the classical ways of getting knowledge and how much on the interactive cognition? Both of them have own advantages and disadvantages. People are hungry for information, exploration but at the same time, they are open to the mass products and services of the entertainment industry. Where is the wise balance? How can it be realized in case of a museum park? The Opusztaszer Heritage Park put more services into the service line so that they can exploit capacities which have not been utilized so far.

Besides service development the price is of a great importance, too. We have to keep in mind that in today's economic situation families first renounce the amount of money spent on culture. It is always necessary to regard the price which people are ready to pay for an experience of this kind since it is the families that give the largest number of visitors.

The Opusztaszer Heritage Park tends to attract the visitors with significant bonuses, special package tickets or- on certain days- with extra services and programs. However, their possibilities are limited because they cannot operate as a real financial enterprise so the mechanism of market control is limited. Although the Opusztaszer Heritage Park is unique in its type so we cannot list thematic rivals, real rivals are other leisure programs. Basically, it can be said that in this case price reduction of some percentage would not result in the significant increase of the number of visitors.

Possibilities of the marketing are very limited. The visitor can find fixed prices and it is very simple to buy the ticket on the venue. It is the only flexibility that he can choose from different options depending on what he wants to visit. Besides, it is worth discussing how they intend to raise the visitor's interest at all. How do the guests decide to go to Opusztaszer, at all? Obviously, it is necessary to use the modern ICT tools, the website or any other forms of the media. It means a lot if teachers talk about the conquest in History lessons so that the children ask their parents to see the place they learnt about. Study trips connecting to this topic bring a considerable number of visitors.

Nowadays promotion is very important. Today not only the Opusztaszer Heritage Park itself but other additional services around it should be examined together. Szeri Tavern (Szeri Csarda) as a place to eat out, the wooden houses around it as accommodation, the hedge maze all make the destination much more attractive. The promotion as a whole should be advertised in the interest of the common aim. There are unexploited possibilities in this field.

The specialty of the services is that the experience is realized in the given period of time so it cannot be stored that is why it is the service process which bears great importance. (KISS M., 2005) The Opusztaszer Heritage Park devote a lot of energy to organize, advertise and realize thematic days, programs and events. During these days the new generations have the opportunity to get to know their ancestors' life and traditions (e.g. Easter, the Day of the New Bread, Nativity plays, cooking from traditional ingredients and with traditional utensils and in traditional ways etc.). Besides, they can commemorate the national holidays solemnly. The whole process itself brings us back to our past in a way that responds

today's rules and using its modern technique gives a new prospect in travelling in time.

We should remember that euthenics is today's most important requirement. The given subject is presented by well-trained, well-qualified experts taking part actively in the experience. Nowadays it is not enough to have the guard lady who reads or knits while watching the visitors. Due to interactivity reciprocity is essential thus the visitor becomes the part of the experience- at time even in appearance (e.g. wearing special clothes or doing certain work etc.).

The experience is full when it is lasting. To reach this aim it is necessary to consider that not only the moment should be outstanding but also it should give a kind of knowledge, or a complex picture carved into our memories. An object can help achieve this aim which is in this case the entrance ticket or an object made by the visitor himself on the venue.

MEASURING THE VISITORS' SATISFACTION

Visitors to the Opusztaszer Heritage Park are generally satisfied with the services and the surroundings (on the basis of a non-representative sample done with 86 persons). The opinion about the infrastructure inside the Park is positive though it is not the same with its surroundings. They mention the bad quality of roads and the rarity of bus service. (Figure 2)

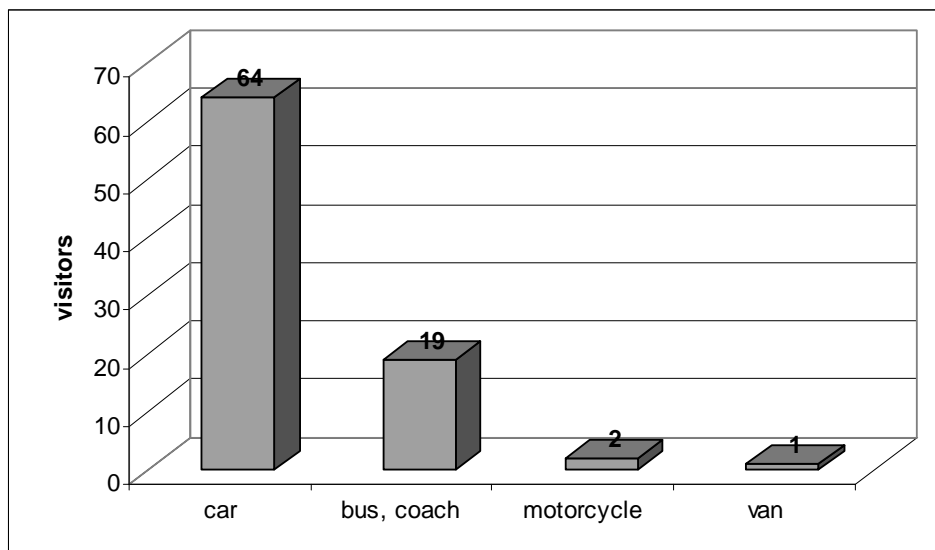


Figure 2. Visitors arrived by ...

Source: AUTHORS'S SURVEY (2010)

They are satisfied with the employees regarding both their attitude and knowledge. A very small percentage of visitors come back on an annual basis, maybe because the Park lacks the new programmes. The sights always get very high points considering the visitors' satisfaction which means that there is no problem with attractions already existing. Thus, it is necessary to concentrate on the demand for new things. (Figure 3)

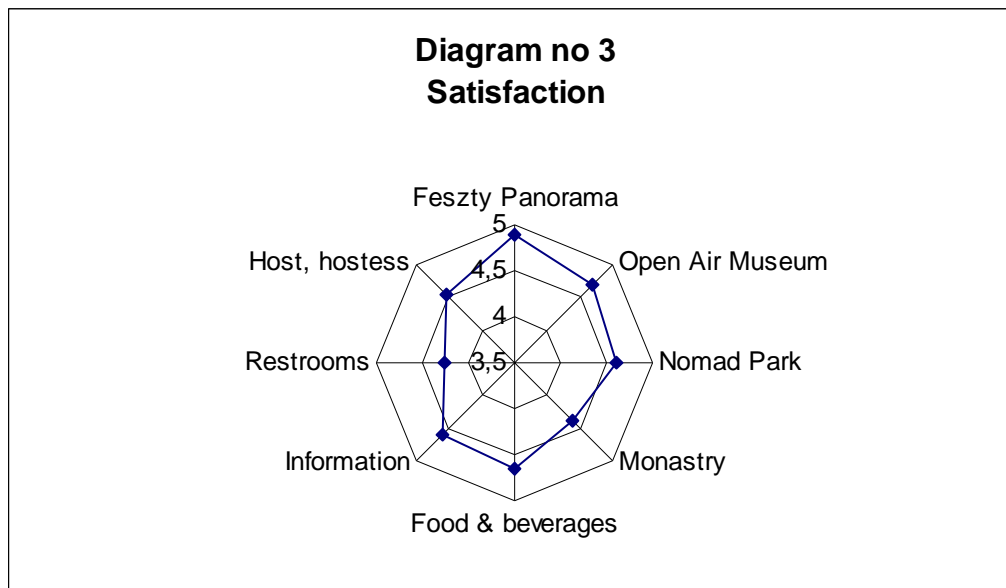


Figure 3. Satisfaction
Source: AUTHORS' SURVEY (2010)

More and less everybody would recommend the Park for their friends. It is interesting that most of them visited the place because of „an old decision”.

The most famous sight of the Park is the Feszty Panorama. Regarding its subject it has a special value for the Hungarian tourists. It is well-known for its monumentality among foreign guests, as well. Traditional programs are organized in different part the country, like 20th August, the Day of Archers, the Day of Melons, Saint-Martón's Day, etc. In addition to them, special architectural sights have been stressed: Rotunda, Csete Yurts, the windmill.

With its 5 new exhibitions opened on 20 August, 2010 the Opusztaszer Heritage Park caught up on its work. The glass path to the Feszty Panorama and the new exhibition areas attract new visitors to the park, while the old ones are invited to Opusztaszer again.

From the view of tourism the Opusztaszer Heritage Park has outstanding possibilities. A good example for it is Szeged since during the Open-Air Theatre the number of visitors increases. Besides, favorable effects can be achieved in co-operation with other service providers of the region in tourism. It is worth mentioning the thermal baths: in cities Morahalom, Kiskunmajsa, Szeged and the activity of travel agencies. Since the Opusztaszer Heritage Park belongs to the Kiskunsag National Park it is suitable to organize different educative programs or to plan environmental projects there, too.

This venue is the perfect destination for school trips or study trips, moreover it has all the technical conditions for wedding ceremonies, receptions, conferences, study tours or different trainings.

It is known that the competitors are there in the region with their complex service package. On one hand, it is necessary to enter the competition with them, on the other hand the Park have to preserve the traditional role because it is not able to attract enough number of visitors exploiting exclusively the historic-ethnographic approach.

CONCLUSIONS

In our survey can be seen a picture about the marketing connections of the services provided by the Opusztaszer Heritage Park. It is planned to focus on the importance of service management, then on the condition of the Park as the marketing strategy of one of the largest theme parks and finally on its prospects for present and future.

Regarding the economic role of advertisements they are the motor which drives economy, according to marketing experts. It is necessary to reach the visitors, to inform them what new programs are organized in Opusztaszer. They have to realize that they must come back. Pages on tourism are about to offer programs of high level. A popular video file can produce 100 thousand downloads a day. It is absolutely necessary to update the project profile of the Opusztaszer Heritage Park on the social networks, like Facebook, IWiW, and to increase the frequent use of its message boards. According to some media experts, the printed press is getting into the background while online newspapers, news browsing take its place.

The greatest advantage of direct marketing is that it can reach the clients more precisely, comparing to other marketing tools, and we can direct our sources exactly there where we can expect potentially the best results. We can get more visitors by means of direct marketing. Besides, it is important to pay attention to the existing clients, to form the visitor loyalty as a result of which we can increase the number of visitors more. There are different opinions in connection with the efficiency of direct mails; nevertheless it has proved to be one of the most efficient tools in case of both company and private costumers. We can make personal invitations for target groups, as well. It is important to show appealing information in order to raise a kind of wish in the reader to visit the Opusztaszer Heritage Park. The leaflets placed at the entrance can give information about the forthcoming events. Besides, electronic mails are important, too, as the most wide-spread application on the Internet. The sms campaign is suitable for several marketing purposes. The sms campaign can increase the number of guests on the day of the given event.

In today's economic conditions increase of number of visitors in the Opusztaszer Heritage Park and maintenance of the visitors' satisfaction can be reached only with a definite raise in the level of services.

REFERENCES

- KISS M. (2005): Alapmarketing, AULA Kiadó Kft, Budapest
KOLOS K. – KENESEI ZS. (2007): Szolgáltatásmarketing, Alinea Kiadó, Budapest
LITAUSZKI T. szerk. (1989): Párbeszéd a mindennapi kultúráról, Kölcsey Ferenc Megyei-Városi Művelődési Központ és Ifjúsági Ház, Debrecen
Az Emlékpark története <http://opusztaszer.hu/tortenet> 2011.01.26.
Közlemények <http://opusztaszer.hu/kozlemenyek> 2010.11.22.

CHANGING WORLD-CHANGING TENDENCIES OF NAMING SHOPS AND SERVICES. THE DYNAMICS OF LINGUISTIC LANDSCAPE IN THE CENTER OF HÓDMEZŐVÁSÁRHELY

MÁRTA GALGÓCZI-DEUTSCH

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

ABSTRACT

The names of shops and services constitute a vast part of the linguistic landscape of an area, mainly the city center as most shops are located there. In the modern globalized world, signage of shops is linguistically colorful. World languages appeared in shop names with English in the first place and the application of foreign words in the signage is internationally an increasingly popular phenomenon. However, in the past, before the 1990s, using foreign words in shop signage was not a fashionable trend. In my work I examine the change of shop naming practice from a historical perspective in the center of Hódmezővásárhely within a century. I divided the more than 100 years long period in three sections, starting from the early 20th century, the period of communism and the present times. I collected photos and old postcards of the town center from these three periods where the shop names are visible and examined how the shop naming tendency changed during the decades and how the proportion of foreign names have increased by the beginning of the 21st century.

Keywords: linguistic landscape, history, foreign languages, business, comparative analysis

INTRODUCTION

Linguistic landscape, introduced and defined by Landry and Bourhis as “the language of public road signs, advertising billboards, street names, place names, commercial shop sign and public signs on governmental buildings combines to form the LL (linguistic landscape) of a given territory, region, or urban agglomeration” (LANDRY ET AL., 1997, 25). The linguistic landscape is present in our daily life: signs and noticeboards are visible in the streets, public buildings and shops (GORTER ET AL., 2008). The examined places can be shopping centers, schools, offices, companies, buses, swimming pools, and streets (SPOLSKY, 2009).

As a result of the globalization, by the end of the 20th century the centers of cities became culturally and linguistically colorful and complex (GORTER, 2006). World languages, especially the English language, as the fashionable and prestige language infiltrates in the elements of public signage (GORTER, 2006). Studies of the linguistic landscape provide analyses of written information in streets in a certain area (GORTER ET AL., 2008).

The signage of shop and services greatly contribute to making the linguistic landscape of the cities more colorful. In most European countries the application of foreign languages in business signage has become very widespread. The use of foreign words and names in shop names, advertisements and signage are not without purpose: the foreign words provide extra meaning, prestige or provoke association with the ethnocultural stereotype of the country where the language is spoken (BARNI ET AL., 2009).

The linguistic landscape of a town is not static. It is changing dynamically as shops and services are closing down and new ones are opening. Furthermore, society, regimes, politics

are changing. All these changes are reflected in the linguistic landscape of a place. Therefore, linguistic landscape is both symbolic and informative (GORTER ET AL., 2006). It gives the observer information about the actual power relations, political situation and fashionable trends of language use. In this study the temporal change of the linguistic landscape in the center of Hódmezővásárhely is overviewed from the early 20th century till nowadays.

MATERIALS AND METHODS

Using Huebner and Backhaus' method according to which he restricts his research in space, (BACHAUS, 2007) I limited my research to one area. With the help of a map I determined the center of Hódmezővásárhely as this is the area where the most shops and services can be found. For the mapping of the present linguistic landscape I used a digital camera and took photos of the signage with foreign languages while noting down the names of all shops and services in the area for quantitative results. After that I calculated the ratio of foreign language signs according to languages and presented the results in a pie chart. For the historical data I gathered material from Németh László library and Emlékpont Museum using postcards and photos, and grouped them according to the period when they were taken. To limit the time span, still get a thorough picture of the history I started the comparative examination from the early 1900s so that insight of the linguistic landscape change over a century could be gained. Also, visual material is more available from this period. Since the purpose of the study was to get an insight of the linguistic landscape of a given historical time and make and to compare the data of the different time sections, I divided the period from 1900 to the socialist regime, from the socialist regime till the 1990, when the change of the regime happened and from the 1990s till today. Based upon the visual materials I collected containing shops and their signage the change in the signage trend over the century could be observed.

The early 20th century

In this period the tendency for naming shops and services mainly included the name of the owners that provided the shop name respectively. Therefore, shop signage consisted names, often of foreign origin in their signage, sometimes with the profile added, frequently in possessive form: *Grossmann R. és Fia* (Grossmann R. and son), *Manheim Lipót Áruháza* (Manheim Lipót's supermarket), *Bandula Sándor Vas és Fűszerkereskedése* (Bandula Sándor's Haberdashery and Grocery), *Vadász Miklós Drogériája* (Vadász Miklós' Drugstore), *Pitzer Sándor, Nemes Ármin*. Other shop names that did not contain proper names, were written in Hungarian language, e.g. *Kék Csillaghoz* (To Blue Star).

The socialist regime

The period of the socialist regime lasted from 1949-1989 in Hungary. In the photos and postcards I found it seems that instead of proper names, shops obtained their names from their function, thus signage contained Hungarian words referring to the products sold or services provided at a given business. For instance: *Háztartási és Vegyiárúk* (Household Goods and Chemicals), *Barkácsbolt* (DIY), *Műszaki Faárúk* (Technical Wood), *Hód Áruház, Komplet Ruházati Vállalat* (Hód Department store, Complet Clothes Company), *Jármű szaküzlet*

(Vehicle Shop), Illatszerbolt (Perfumerie), *Gyermek Ruhabolt* (Kids's Clothes Shop), *Sport, Játék, Ajándék, Rekord Áruház* (Sport, Toys, Gifts, Record Department Store), *Takarék Pénztár* (Savings Bank), *IBUSZ* (Travel Agency).

Names were given in Hungarian language almost exclusively. I found only two examples of non-Hungarian language use in shop signage: *Espresso*, a café in present Kossuth square, and *Sport, Horgász, Camping Bolt*, (*Sport, Fisherman, Camping Shop*) as name, however, the signage under contains '*Kemping Árúk*' (the Hungarian equivalent for 'camping goods'). It seems that the word 'camping' appeared in both ways, but the English word appeared in the name, with more emphasised visual display written in bigger letters.

From the late 20th century until today

By the late 20 with the spreading of the globalization, foreign languages infiltrated in the public signage in respect of shops and services. The booming in the presence of the foreign languages is a relatively modern phenomenon and an international practice. Mostly, the purpose of applying foreign languages in the signage of businesses is to provoke association with the ethnocultural stereotype of the speakers of the country where the language is native to. The signage does not necessarily has to be meaningful, relevant to the shop's profile or understandable to the speakers of the language, only to be easily associated with the stereotype. The most widespread foreign language in non-English speaking countries is English (PILLER, 2003).

Typical language choices according to profiles and the joint ethnocultural stereotypes: Italian: restaurants, confectionaries (often ice cream stalls) and fashion. The ethnocultural stereotype of good food and positive attitude to life). (*Don Pedro Pizzeria*); French: fashion, parfumerie, restaurant (the ethnocultural stereotype of elegance) (*Amica Boutique*); English: informatics, electronics primarily, occasionally luxury cars, chocolate. English cannot be categorized unanimously as it is a highly fashionable foreign language associated with the Western culture, and youth culture (GORTER, 2006) thus used in any fields of signage. (*Electro digit*); German: technology (the ethnocultural stereotype of precision, quality and reliability).

In Hódmezővásárhely, just like in other European cities, the signage of shops and services abound in foreign languages, especially English by the early 21st century. The data collected in 2011 show that about 50% of shop names and signage includes foreign languages, totally or partially.

The foreign language use in shop signage can occur in different ways (KALLEN, 2009, SHOHAMY ET. AL., 2009): the entire word in foreign language without native language equivalent (1); foreign word is complementary, along with the native language content (2); it blends with the native language in one word (3); foreign word is inserted in the native language context (4).

CONCLUSIONS

The shop and service names of Hódmezővásárhely have undergone a major change establishing the more colorful linguistic landscape including English, Italian, French, German, Latin and other languages. In the early the 1900s the shops primarily got their names from

their owners, containing foreign elements only in case the name had foreign sound or origin. In the era of socialism, names that referred to the shop profiles were applied, thus foreign elements were hardly present. After the 90s with the spreading of the globalization, foreign names, words or elements appeared with English in the first place and started to boom. The international trend of foreign language use in shop signage is flourishing in Hódmezővásárhely, sometimes for provoking association with the ethnocultural stereotype, but often independently from meaning or shop profile to create prestige or a cosmopolitan atmosphere (EDELMAN, 2009). With the international fashion of the booming foreign language use, it can be supposed that trend in Hódmezővásárhely will persist or even increase.

In the early 1900s there was a preference towards the use of the owner's name (e.g. *Nemes Ármin, Grósz Izidor*) then in the socialist regimes proper names appeared rarely they were rather substituted by the function or the profile of the shop, using Hungarian language. By the end of the 20th century foreign languages have infiltrated into shop naming practice and if proper names are used, they are often of foreign origin (e.g. *Don Pedro*). The dominance of English language can also be observed. The foreign language use appears in about 50% of shop names, and mainly corresponds to the international trend of the application of foreign names or words in shop signage. Considering that in the beginning of the 1900s the shop names with foreign sound were only present because the owner had a foreign sounding name, then in the socialism until the 1990 there was almost no foreign language used in shop signage, it can be concluded that the foreign language use in shop signage appeared and has become a popular naming practice after the 1990s.

REFERENCES

- BACKHAUS P. (2007): "Linguistic landscapes. A comparative study of urban multilingualism" Clevedon, Multilingual Matters Ltd, UK
- BARNI M. AND BAGNA C. (2009): "A mapping technique and linguistic landscape in linguistic landscape", Shohamy and Gorter: Linguistic landscape: Expanding the scenery. London: Routledge, UK. p. 126-141.
- EDELMAN L. (2009): "What's in a name? Classification of proper names by Language", Shohamy and Gorter: Linguistic landscape. Expanding the scenery. Routledge, UK. p. 141-145
- GORTER D., ED. (2006): "Linguistic landscape: A new approach to multilingualism", Clevedon, Multilingual Matters Ltd, UK
- GORTER D., CENOZ J. (2008): "Knowledge about language and linguistic landscape", Hornberger, ed.: Encyclopedia of language and education, USA Springer, p. 2090-2102
- LANDRY R., BOURHIS, R. Y. (1997): "Linguistic landscape and ethnolinguistic vitality: An empirical study", Journal of language and social psychology 6, 23-49
- PILLER I. (2003): "Advertising as a site of language contact", Annual Review of Applied Linguistic, 170-181
- SPOLSKY B. (2009): "Prolegomena to a sociolinguistic theory of public signage" Shohamy and Gorter, eds.: Linguistic landscape. Expanding the scenery. London, Routledge, UK, p. 25-40
- NÉMETH LÁSZLÓ Public Library Hódmezővásárhely
EMLÉKPONT MUSEUM Hódmezővásárhely

THE MANY FACES OF ONE TOWN: MAPPING THE LINGUISTIC LANDSCAPE OF DOWNTOWN OF HÓDMEZŐVÁSÁRHELY FROM VARIOUS PERSPECTIVES

MÁRTA GALGÓCZI-DEUTSCH

University of Szeged Faculty of Agriculture
Andrássy u.15. Hódmezővásárhely, 6800 Hungary
deutsch@gkg.u-szeged.hu

ABSTRACT

An examination of the linguistic landscape can happen from different perspectives depending on the aspect of it the linguist wants to investigate. The most frequent thematic categorizations for examination are the viewpoints of tourism, economy and minority language use and the business perspectives. Accordingly, from a touristic point of view the examination focuses on whether the public places frequently visited by tourist present relevant information in foreign languages and what languages are used. This provides information about the preparedness of the area for 'accepting' foreign tourists and can ease their stay. From a minority language perspective the appearance of minority languages in signage in public places is examined to get information about the status of minority language/s. The business perspective examination includes the mapping of signage and names disposed by shops and services. The linguistic landscape is mapped and analyzed from the point of view of the foreign languages applied, their content and relevance to the establishment (shop or service) type to get information about how much the shops of a certain profile follow the international trends in using foreign languages in the signage. In this paper the linguistic landscape of the center of Hódmezővásárhely, Hungary, is examined from the perspective of tourism, minority languages and business. The territory of the research is limited to the center of town as it houses most businesses and tourists are likely to visit it. The purpose of this paper is to investigate the different results gained from the mappings carried out on the different perspectives. The objective is to outline the linguistic landscape of the town center and by comparing the results conclusions as to which aspect the town center is the most and the least prepared for within the same area are drawn.

Keywords: linguistic landscape, rural tourism, foreign languages, business, comparative analysis

INTRODUCTION

The linguistic landscape of town centers is becoming increasingly multilingual in our globalized world. Choosing languages other than the official language(s) of the country for signage in the public sphere can be based on various considerations. The linguistic landscape is present in our daily life: signs and noticeboards are visible in the streets, public buildings and shops (GORTER et al., 2008). The term 'linguistic landscape' was introduced by Landry and Bourhis in 1997 and they defined it as "the language of public road signs, advertising billboards, street names, place names, commercial shop sign and public signs on governmental buildings combines to form the LL (linguistic landscape) of a given territory, region, or urban agglomeration" (LANDRY et al., 1997, 25). Therefore, the centers of cities are culturally and linguistically colorful (GORTER, 2006). Studies of the linguistic landscape provide analyses of written information in streets in a certain area (GORTER et al., 2008). The examined places can be shopping centers, schools, offices, companies, buses, swimming pools, and streets (SPOLSKY, 2009). Spolsky and Cooper distinguish eight main

types of public signage: “street signs, advertising signs, warning notices and prohibitions, building names, informative signs (directions, hours of opening), commemorative plaques, objects (postbox, police call box), graffiti” (SPOLSKY, 2009, 34).

Based on Backhaus’s description, I regarded a sign as multilingual sign if it contained at least one language in addition to, or instead of, Hungarian (BACKHAUS, 2006). The multilingual signage in public spaces can have both informative and symbolic functions. Landry and Bourhis distinguish two major functions of public signs: informative and symbolic functions (SPOLSKY, 2009). In the case of the bilingual signs in Hódmezővásárhely, too, it is possible to distinguish between these two functions. As I will demonstrate below, signage examined from the perspective of tourism providing information in bilingual form has real informative value, whereas signage from the business perspective in streets has rather symbolic value.

In international tendencies, cities assign a growing preference to the application of foreign languages, with English in the first place in the shop front signage. English is the most widely used language—after the official language(s)—used in shop signage. It is followed by French, Italian and German. Also, the appearance of bilingual signs is more frequent than that of monolingual foreign language ones (SCHLICK: 2003). In this paper I examined in what degree the linguistic landscape of Hódmezővásárhely corresponds to this tendency.

In the present paper I examine the linguistic landscape of the center of Hódmezővásárhely from three different perspectives: tourism, business and minority language use.

MATERIALS AND METHODS

For gathering information about the three perspectives, different types of public signage need to be examined. I have used the distinction of Spolsky and Cooper to carry out the examination. (SPOLSKY, 2009). I grouped the types of public signage thematically, according to which example of signage carries important information in the examined areas. Therefore, for the examination of the perspective of tourism I collected signage such as warning notices and prohibitions, informative signs (opening hours and directions disposed in public places that are likely to be visited by tourists: banks, post offices etc.), commemorative plaques, and objects. For this examination I mapped the signage applied inside the buildings as well, since that is also part of the public space, and tourist can get information from the signage within the building than outside. These buildings were museums, hotels, shops, banks and the post office.

For the business perspective I collected data from advertising signs outside shops and services. Shops and services frequently apply names and signage in foreign languages in order to provoke associations with the stereotype of the country (PILLER, 2003) where the language is spoken as mother tongue, to increase prestige, to express a cosmopolitan feeling (EDELMAN, 2009) or to convey extra meaning (BARNI et al., 2009).

For the minority language examination I collected data from street signs, warning notices and prohibitions, informative signs in order to see whether there are any minority languages applied in the signage.

To determine the area of mapping the linguistic landscape I used a map and limited my data collection to the center of Hódmezővásárhely as it is the place most likely visited by tourists and inhabitants of the town, and most of the shops and services are also here. Following Cenoz and Gorter's method (GORTER, 2006), I took photos of the all the signage, both monolingual and multilingual, to examine their content and visual disposal and noted down all the shop names for a quantitative analysis. Using Griffin's method (GRIFFIN: 2004) I grouped and counted the shop and service names, and established the average in percentages to determine the ratio of foreign language signage.

RESULTS

The tourism perspective

From the tourism perspective I examined the Ginkgo Sas Hotel, Sas Kávézó café, the post office, three banks (MKB, K&H, and Postabank), and the Emlékpont Museum as well as the interiors of shops in the main street.

As a result I have found that the Ginkgo Sas Hotel, designed to cater for wellness, holiday and conference tourism, has a high preparedness for the acceptance of foreign tourists. The signage in the interior contains both Hungarian and English in such a way that Hungarian was followed by English signage of the same content. Bilingual information includes the price list, bar and restaurant menu cards, information on the bike rental, smoking prohibitions and signs for location and giving directions. The welcome sign and shop sign was monolingual English. The menu cards use three languages: Hungarian, English and German. Generally, it can be concluded that the hotel is the place in town that is the most prepared for non-Hungarian speaker visitors. The bilingual signage they apply – using the distinction by Landry and Bourhis – has more of an informative than symbolic function. That is, they provide the non-Hungarian speaker guests with relevant information about the hotel and its facilities.

The Sas Kávézó has very scarce written signage; however, all written information is multilingual. Written signage can be found on the menu cards in Hungarian, English, German and Italian.

In the Emlékpont Museum, where memory of the town's life under the Soviet regime is disposed, information about opening hours and ticket prices are written bilingually on the outside of the museum building. However, within the museum, narratives, memory plaques, descriptions and biographies are in Hungarian only. For speakers of English, though, audio guides and tourist guides are available upon request for an extra fee. Bilingual signage in English with the informative function is scarce in the museum. Only the very basic information is displayed in two languages. In bilingual signs only English language is included in addition to Hungarian.

Other places that are likely to be visited by tourists are the post office and banks. In case of the post office, there is only one multilingual sign prohibiting the use of mobile phones and cameras inside the building. It includes Hungarian, English, German, French and Russian. However, all the other functionally relevant information and directions (which button to push on the machine for a ticket for different activities) are in monolingual Hungarian only. It seems that only information regulating customers' behavior is written in

languages other than Hungarian, but no language aid is provided for them if they want to use the services.

In the banks information about the opening hours, the use of ATMs after closing time and information on regulations is written in English, too. In the inside of shops no foreign language signage is disposed, except for the Spar supermarket, where a grammatically incorrect 'Don't smoking' sign is displayed at the cashier's indicating that no cigarettes are sold to underage persons. Furthermore, signs giving directions to the sights of the town are in Hungarian only.

It can be concluded that the city center has multilingual signage to make foreign visitors' orientation easier during their stay, and the Ginkgo Hotel and the banks are the most prepared for this. However, other facilities that are likely to be visited by foreigners scarcely dispose signage in other languages than Hungarian of informative value. Moreover, mainly the English language is applied, but in some instances German and other world languages appear, too. Although the town is frequently visited by Serbian and Romanian tourists, their languages cannot be found in any signage. This fact suggests that visitors from other, non-English (or German) speaking countries are expected to understand world languages, primarily English.

Business perspective

From the business perspective I examined the signage on shops and services, focusing on their names. I have found that 50% of the signage in shop and service names are written in foreign languages. Among foreign languages, English is the most widely used, it appears in 66% of the foreign names. Italian is the second most widespread, occupying 8% of the foreign language signage, German 7%, and other languages (French, Latin, other) 22%.

The use of foreign languages in the shop and services names in the center of Hódmezővásárhely mainly corresponds with international tendencies (PILLER: 2003), according to which Italian and French languages are mainly used fashion establishments and restaurants, German and English in technology, but English, as the international language of trendiness and very fashionable in advertising, cannot be restricted to specific areas. It is also most widely used in shops that sell jewelry, cosmetics and electronics (SCHLICK: 2003).

Similarly to international tendencies, Italian and French languages appear in the field of fashion (*Amica boutique*), English in the field of electronics and informatics (*Electrodigit*). Also, similarly to international tendencies, English is not limited to a number of categories as it appears in the signage of various types of profiles: traveling (*Last Minute Travel*), fashion (*Trendy, Balance*), banking (*Unicredit*), parfumerie (*Lady*) and catering (*Joker Café*). However, German appears in chemists' (*Rossmann*), supermarkets (*Spar*) and in a hunter's store (*Hargita-Jagd Vadászbolt*).

The appearance of 'mock-language' suggests extra meaning that can be expressed by the not appropriate use of the language (PILLER, 2003). In the center of Hódmezővásárhely this application is also present (*T-Boy, Yesss*). In the first name, the Hungarian pronunciation of the name provides the extra meaning ('t-boy', pronounced as [te:boy] means 'madness' in Hungarian), and in the latter, the ungrammatical use of triple 's' emphasizes the meaning.

The application of foreign names in the center of Hódmezővásárhely also reflects the international tendency that foreign languages in names are applied because they can express

more content than the Hungarian name would: in the shop name *T-Boy* the use of *Boy* implies the shop profile as it sells men's clothing. *Amica boutique* containing both Italian and French words refers to the shop's profile not only in language but also in word use (Italian *amica* means "girlfriend"): it sells Italian and French fashion clothes for women. Furthermore, the names of shops and services do not always reflect the profile. In these cases, the main aim is to be fashionable, to provide a cosmopolitan atmosphere or to express extra meaning by choosing a name from a foreign language (HULT, 2009).

However, there are differences in the application of foreign languages in names in Hódmezővásárhely compared to the international tendencies. In Hódmezővásárhely, the use of foreign languages is rare in catering, certain languages are completely or almost completely missing from certain areas (French from fashion and German from technology), at least in the center.

Languages with no data recorded elsewhere in studies of the linguistic landscape for shops and services can be found in Hódmezővásárhely: Latin in catering (*Lucullus* and *Veritas*), English and German in perfumeries (*Lady* and *Rossmann*). Also, although I have found no data in other studies regarding travel agencies, in the town center these almost exclusively use English, similarly to financial services and private health services (e.g. a dentistry).

In summary, it can be asserted that the application of foreign languages is widespread (50%) in shop and services names in Hódmezővásárhely, with the use of English language in the first place, although, monolingual signs outnumber bilingual ones. As the business profile is not always reflected or connected to the name, it can be concluded that applying Spolsky's categories (SPOLSKY, 2009) they rather have symbolic and not informative value. This way, the linguistic landscape of the center of Hódmezővásárhely from the business perspective fits well into the international tendencies.

Minority language perspectives

In Hódmezővásárhely the minority language groups are very scarce. According to the 2001 census data, 98% of the population is Hungarian, 1% gypsy and 1% other, mainly Slovakian and German, but are inhabitants of Chinese, Bulgarian mother tongues, however, all signage I examined in the area (from street signs, warning notices and prohibitions, informative signs) lack any minority languages.

It seems that the town entirely lacks any signage containing languages other than Hungarian or world languages.

CONCLUSIONS

From the linguistic landscape of the center of Hódmezővásárhely, it can be concluded that foreign language use has a priority in the field of shop and service names and they have primarily symbolic function. However, signage disposing informative function in foreign languages is scarce, it is present primarily in the Ginkgo Sas Hotel, the Emlékpont Museum and banks, and is entirely absent from other outdoor signage providing directions and information. All signage with informative function contains world languages only, primarily English, and German, Italian French in some cases. Foreign tourists from neighboring countries (such as Romania or Serbia) are expected to understand the world

language in getting information. Though there are some minority groups living in the town, no minority languages are disposed on signage.

The town well fits into the international tendency of foreign language application in shop and service names to create a fashionable, cosmopolitan feeling, however, it needs development and amplification in foreign language signage for informative values to promote tourism.

REFERENCES

- BACKHAUS P. (2006): "Multilingualism in Tokyo: A look into the linguistic landscape" Gorter, D., ed.: "Linguistic landscape: a new approach to multilingualism", Clevedon, Multilingual Matters Ltd, p. 52-67.
- BARNI M. and BAGNA C. (2009): "A mapping technique and linguistic landscape in linguistic landscape", Shohamy and Gorter: Linguistic landscape: Expanding the scenery. London: Routledge, UK. p. 126-141.
- CENOZ J., GORTER D. (2006): "Linguistic landscape and minority languages" Gorter: "Linguistic landscape: a new approach to multilingualism", Clevedon, Multilingual Matters Ltd, UK, p. 67-81.
- GORTER D., ed. (2006): "Linguistic landscape: A new approach to multilingualism", Clevedon, Multilingual Matters Ltd, UK
- GORTER D., CENOZ J. (2008): "Knowledge about language and linguistic landscape", Hornberger, N ed.: Encyclopedia of language and education, USA Springer, p. 2090-2102.
- EDELMAN L. (2009): "What's in a name? Classification of proper names by language", Shohamy and Gorter: Linguistic landscape: expanding the scenery. London, Routledge, UK. p. 141-145
- GRIFFIN J. L. (2004): "The presence of written English on the streets of Rome: A review of English in Italy, with evidence of its infiltration into public life", English Today 78. p. 3-8.
- HULT F. M. (2009): "Language ecology and linguistic landscape analysis", Shohamy and Gorter, eds.: Linguistic landscape: expanding the scenery. London, Routledge, UK. p. 88-105.
- LANDRY R., BOURHIS, R.Y. (1997): "Linguistic landscape and ethnolinguistic vitality: An empirical study", Journal of language and social psychology 6, 23-49
- PILLER, I. (2003): "Advertising as a site of language contact", Annual review of applied linguistics, Volume 23. p. 170-181.
- SPOLSKY B. (2009): "Prolegomena to a sociolinguistic theory of public signage" Shohamy and Gorter, eds.: Linguistic landscape. Expanding the scenery. London, Routledge, UK, p. 25-40.
- <http://hu.wikipedia.org/wiki/H%C3%B3mez%C5%91v%C3%A1s%C3%A1rhely>

TOMATO PULP BALED SILAGE FOR FEEDING GAME

JUDIT GALLÓ¹, SZILVIA OROSZ², LÁSZLÓ SZEMETHY¹, ZSOLT SZABÓ³, SZILVESZTER KAZINCZY¹,

¹Szent István University, Faculty of Agricultural and Environmental Sciences, Institute for Wildlife Conservation, Gödöllő 2100, Páter Károly Street 1, Hungary

²Szent István University, Faculty of Agricultural and Environmental Sciences, Department of Nutrition, Gödöllő 2100, Páter Károly Street 1, Hungary

³Aranyfácán Product Co. Ltd. Hatvan, Hungary
gallojudit@gmail.com

ABSTRACT

The aim of the study was to determine the nutrient content, fermentation quality and microbial status of wet tomato pulp silage after applying different treatments in two consecutive years. In the first year, dried whole seed wheat (20% based FM) was applied in order to reduce the hazard of effluent production and undesirable fermentation processes and to increase energy content of tomato pulp. Ensiling was carried out in metal barrels/treatment with a capacity of 150-180 kg/barrel. In the second year, dried ground corn (20%) was applied for the same reasons as before and to increase nutritive value of the by-product. In the first year, the applied dried whole seed wheat (used at 20%) increased the net energy content for maintenance of tomato pulp, which has an important role in game feeding during the winter (roe deer and red deer, wild boar). The calculated lactation net energy content was similar to a maize silage harvested with approx. 25-30% starch content. Mixing of 20% dried whole seed wheat reduced significantly the acetic acid ($P \leq 0.05$), the volatile fatty acid ($P \leq 0.05$) concentration, while increased the lactic: acetic acid ratio in the core of the silages as compared to T2 (T2: 1.72 ± 0.07 vs T3: 3.25 ± 0.09). A lower fermentation intensity was found in combination with a better organic acid profile, presumably due to a higher DM content in 20% wheat treatment as compared to tomato pulp. However, it is not recommended to add whole seed to the wet by-product due to the negative effect on the top 1-20 cm layer. In the second year, low fermentation intensity was found in the control tomato pulp (20% corn) baled silage, as well as an undesirable fermentation process was found in the case of 0.5% salt treatment in the mixed tomato pulp baled silage. Therefore, application of salt is not recommended. Inoculation effectively inhibited the production of butyric acid and reduced the protein loss by 6% as compared to the control, therefore it is highly recommended to apply as silage inoculant during the ensilage of the wet by-product. In summary, it was confirmed that the new baling system was able to form well-shaped and stable bales. High density, quick wrapping (within 120 sec after bale-forming), had a beneficial effect on fermentation quality. The study showed that wet tomato pulp had a limited fermentation capacity, but under anaerobic conditions it was possible to store for long term (100 days) with a good microbial status. It is recommended to use dried ground cereal as an additive (20%) to increase dry matter and energy content, moreover to improve volatile fatty acid composition of the wet tomato pulp silage.

Keywords: tomato pulp, bale, silage, fermentation, biological additive

INTRODUCTION

In game nutrition, using of supplementary fodder satisfied all needs of big game species (roe deer and red deer) is an important and urgent task because of reduction of costs. Supplementary fodder is important both to the females (period of pregnancy), and to the males (condition loss in the mating season). Supplementary fodder is needed in winter, when the shrub layer and juicy feeds are partly or totally missing from the forests. Tomato pulp may be a good supplementary fodder. It comes into being in the canning factories in large volumes in a short time as a by-product.

HADJIPANOYIOTOU (1994) found that ensiled tomato pulp could be a potential protein- and energy source in animal nutrition. It contains valuable seed-oil, colouring agents (lycopene,

β -carotene, xanthophyll, flavons and other pigments), vitamins, aromas, i.e. their components have antibiotic and antioxidant effects.

The aim of our study was to determine the nutrient content, fermentation quality and microbial status of wet tomato pulp silage after applying different treatments in two consecutive years.

MATERIAL AND METHOD

Experiments in the first year

Ensiling was carried out in metal barrels/treatment with a capacity of 150-180 kg/barrel. Treatments were designed as follows: (T1) tomato pulp as control, (T2) tomato pulp covered with 1kg/barrel salt (NaCl) in order to reduce aerobic spoilage on the top surface, (T3) mixture of tomato pulp and dried whole seed wheat (20%) covered with 1 kg/barrel salt (NaCl), (T4) mixture of tomato pulp and dried whole seed wheat (20%) covered with 1 kg/barrel salt (NaCl) and treated with silage inoculants (*Lactobacillus acidophilus* and *Enterococcus faecium*; dose 10 kg/ton, 10^5 CFU/g fresh material).

Crude nutrients, starch, total sugar, total carotene, pH, lactic and volatile fatty acid composition, aerobic mesophyl bacteria and moulds were analysed on the 100th day of fermentation according to the Hungarian National Standards (Hungarian Feed Codex, 2004).

Experiment in the second year

Experimental treatments were as follows: (1) mixture of tomato pulp and dried ground corn (20%), (2) mixture of tomato pulp and dried ground corn (20%) treated with 0.5 % salt, (3) mixture of tomato pulp and dried ground corn (20%) treated with Sil All 4x4 silage inoculant (*Enterococcus faecium*, *Pediococcus acidilactici*, *Lactobacillus plantarum*, *Lactobacillus salivarius*, and amylase, hemicellulase, cellulase, pentosanase; dose: 5g/ton, 10^5 CFU/g fresh material, sprayed in 2 litre water/ton).

Baling was carried out by a Göweil LT Master fixed-chamber baler-wrapper machine. Nominal size of the bales was: 1.20 x 1.22 m. A pressure of 130 bar was applied during the baling process. Film wrap (25 μ m thick) was applied 70% pre-stretched and with 6 layers (by 28 turns) and 70% pre-stretch.

Crude nutrients, starch, total carotene, pH, lactic and volatile fatty acid composition, aerobic mesophyl bacteria and moulds were analysed on the 70th day of fermentation according to the Hungarian National Standards (Hungarian Feed Codex, 2004).

In both cases, the purpose of salt addition was to increase the mineral content of the silage fed during winter time and to determine the possible antibacterial and antifungal effect of the salt in the wet by-product silage.

RESULTS

Results of the first year

Table 1. shows the chemical composition and nutritive value of different tomato pulp silages

Table 1: Nutrient content of tomato pulp silage according to the different treatments

Content		Treatment 1	Treatment 2	Treatment 3	Treatment 4
DM	g/kg	253.2	288.8	375.8	362.5
Crude protein	g/kg DM	191.1	199.2	168.7	169.1
Crude fat	g/kg DM	154.5	174.2	112.0	117.5
Crude fiber	g/kg DM	431.9	412.4	216.6	229.9
NDF	g/kg DM	574.5	541.7	332.7	336.4
ADL	g/kg DM	323	308.8	156.1	166.6
Total carotene	g/kg DM	430.2	505.7	215.3	216.1

In the case of fresh tomato pulp adequate fermentation was found (pH 4.35 ± 0.22 ; total acid content 55.91 ± 8.54 g/kg DM; lactic acid: acetic acid ratio: 1.89 ± 0.28 , butyric acid: 0.64 ± 0.17 g/kg DM) with good hygienic status (4.03 ± 0.56 log₁₀ CFU/g aerobic bacteria; 3.81 ± 0.07 CFU/g moulds) after 100 days of ensilage (Table 2). Treatment T2 (salt on the top) had no significant effect on fermentation or microbial status of the tomato pulp silage either on the top, or in the core. There is a presumable explanation, that the packed tomato pulp density was so high (208.7 kg DM/ m³), that the aerobic spoilage on the surface (3-5 cm on the top) had no effect on the fermentation in the core (50 cm depth). However, the salt was ineffective even on the top, observing a similar spoiled layer in both treatments T1 and T2 (3-5 cm). Mixing of 20% dried whole seed wheat reduced significantly the acetic acid ($P \leq 0.05$), the volatile fatty acid ($P \leq 0.05$) concentration, while increased the lactic:acetic acid ratio in the core of the silages as compared to T2 (T2: 1.72 ± 0.07 vs T3: 3.25 ± 0.09). According to the results, in treatment T3 a lower fermentation intensity was found in combination with a better organic acid profile, presumably due to a higher DM content in treatment T3 (375.8 g/kg DM), than in T2 (288.8 g/kg DM). However, aerobic spoilage was found in the top 20 cm of the mixed silages compared to T2, where the spoiled layer was just 3-5 cm. Therefore it is not recommended to add whole seed to the wet by-product due to the negative effect on the top 1-20 layer (aeration). It is suggested using dried ground cereal as fine structural and hygroscopic additive. The applied microbial additive had negative effect on fermentation in the case of mixed tomato pulp silage (significantly higher acetic acid ration and mould $P \leq 0.05$, and higher propionic acid-, volatile fatty acid- with lower LA:AA ration as compared to T3 treatment.)

Dried whole seed wheat (used at 20%) increased the net energy content for maintenance of tomato pulp (NEM: 4.88 MJ/kgDM; NEg: 2.53 MJ/kgDM; NEI: 4.46 MJ/kgDM) by 38.7% (NEM: 6.77 MJ/kgDM; NEg: 4.20 MJ/kgDM; NEI: 6.18 MJ/kgDM), which has an important role in game feeding during the winter (roe deer and red deer, wild boar). The calculated lactation net energy content is similar to a maize silage harvested with approx. 25-30% starch content.

Table 2: Fermentation profile of the different tomato pulp silages (n=5)

Treatments			Treatment T1	Treatment T2	Treatment T3	Treatment T4
pH	Mean		4.35	4.30	4.20	4.29
	Std. dev.		0.22	0.11	0.04	0.03
Lactic acid	g/kg DM	Mean	35.96	33.20	31.16	33.40
		Std. dev.	7.17	3.00	3.28	3.64
Acetic acid	g/kg DM	Mean	18.95a	19.28a	9.61b	12.46c
		Std. dev.	2.15	1.19	1.13	0.38
Propionic acid	g/kg DM	Mean	0.35	0.18	0.06	0.18
		Std. dev.	0.33	0.06	0.04	0.06
Butyric acid	g/kg DM	Mean	0.64	1.59	0.22	0.23
		Std. dev.	0.17	1.10	0.11	0.16
Volatile fatty acids	g/kg DM	Mean	19.95a	21.05a	9.89b	12.87b
		Std. dev.	1.94	1.23	1.15	0.38
Organic acids	g/kg DM	Mean	55.91a	54.26a	41.05b	46.28a
		Std. dev.	8.54	4.04	4.40	3.61
LA/AA ratio	g/g	Mean	1.89a	1.72a	3.25b	2.68b
		Std. dev.	0.28	0.07	0.09	0.31
AEMB	log10 CFU/g FM	Mean	4.03	4.00	3.47	3.98
		Std. dev.	0.56	0.44	0.15	0.69
Moulds	log10 CFU/g FM	Mean	3.81a	3.76a	4.07a	4.63b
		Std. dev.	0.07	0.23	0.28	0.23
Total sugar	g/kg DM	Mean	4,95a	4,95a	10,30b	12,52b
		Std. dev.	1,32	1,61	3,26	1,88

Different letters show significant differences at level of $P \leq 0.05$

Results of the second year

Table 3. shows the chemical composition and nutritive value of the fresh tomato pulp and different tomato pulp silages

Table 3: Nutrient content of fresh tomato pulp, dried ground corn and baled tomato pulp silages according to the different treatments

	Fresh tomato pulp	Treatment 1	Treatment 2	Treatment 3
DM (g/kg)	269.3	408.3	409.2	375.5
Crude protein (g/kg DM)	197.9	146.1	147.3	147.4
Crude fiber (g/kg DM)	400.9	209.2	216.0	217.4
Total starch (g/kg DM)	24.0	283.1	313.9	290.2
Total carotene (mg/kg DM)	167.8	144.1	147.2	146.0
Aerobic bacteria (ln CFU/g)	5.00			
Moulds and yeasts (ln CFU/g)	1.90			

Fresh tomato pulp (DM 269.3 g/kg; 197.9 g/kg DM crude protein; 400.9 g/kg DM crude fiber; (Table 3.) 5.00 log₁₀ CFU/g aerobic bacteria; 1.90 log₁₀ CFU/g moulds and yeasts) were mixed with 20% hygroscopic dried ground corn in order to reduce the risks of effluent production and an un-desirable fermentation processes, moreover to increase nutritive value of the by-product (baled tomato pulp silage ensiled with 20% dried ground corn: 6.84 MJ/kg DM NE_m; 6.33 MJ/kg DM NE_l and 4.26 MJ/kg DM NE_g). Dried ground corn (used in 20%) increased the net energy content for maintenance of tomato pulp by 40% (tomato pulp 4.88 MJ/kg DM NE_m; 2.53MJ/kgDM NE_g; 4.46MJ/kgDM NE_l), which

has an important role in game feeding in the winter time (roe deer and red deer, wild boar). The calculated lactation net energy content is similar to maize silage harvested with approx. 30-35% starch content.

It was confirmed that the new baling system was able to form well-shaped and stable bales such a wet by-product as fresh tomato pulp with a small particle size (initial dry matter range of the mix was 362.6-375.7 g/kg). Extreme bale weight (1120±12.6 kg/bale, n=6), high density (355±4.0 DM kg/m³, n=6) and low density-deviation were achieved with the new technology due to high pressurization (130 bar) and small particle size. Effluent amount range was 6-10 litres per bale. High density, quick wrapping (within 120 sec after bale-forming), has a beneficial effect on fermentation quality. However, low fermentation intensity was found in the case of control tomato pulp (20% corn) baled silage (total acid content 42.1±1.9 g/kg DM; pH 5.0±0.2; butyric acid: 1.5±0.8 g/kg DM). An undesirable fermentation process was found in the case of 0.5% salt treatment in the mixed tomato pulp baled silage (total acid content 55.5±15.2 g/kg DM; pH 5.1±0.1 P=0.034; LA:AA: 1.7±0.2; butyric acid: 1.5±0.8 g/kg DM P=0.042,) therefore application of salt is not recommended. Inoculation effectively inhibited the production of butyric acid (total acid content 42.3±2.1 g/kg DM; pH 4.6±0.0; butyric acid: 0.0 g/kg DM) -see Table 4-, and reduced the protein loss by 6 % as compared to the control, therefore it is highly recommended to apply as silage inoculant during the ensilage of the wet by-product

Table 4: Fermentation profile of the different baled tomato pulp silages (n=3)

			Treatment T1	Treatment T2	Treatment T3
pH	Mean		4.97a	5.13b	4.57a
	Std. dev.		0.16	0.14	0.05
Lactic acid	g/kg DM	Mean	17.85	16.32	19.82
		Std. dev.	5.11	1.87	3.88
Acetic acid	g/kg DM	Mean	9.16	9.63	10.39
		Std. dev.	1.21	0.10	0.90
Propionic acid	g/kg DM	Mean	1.46	6.24	0.85
		Std. dev.	0.25	8.14	0.00
Butyric acid	g/kg DM	Mean	1.48a	3.70b	0.00a
		Std. dev.	0.80	0.77	0.00
Volatile fatty acids	g/kg DM	Mean	12.10	19.57	11.24
		Std. dev.	1.95	8.01	0.90
Organic acids	g/kg DM	Mean	42.05	55.45	42.29
		Std. dev.	1.93	15.19	2.07
LA/AA ratio	g/g	Mean	2.02	1.70	1.93
		Std. dev.	0.80	0.20	0.54

Different letters show significant differences at level of P≤0.05

CONCLUSIONS

Conclusions of the results of the first year

The study showed that wet tomato pulp had a limited fermentation capacity, but under anaerobic conditions it was possible to store for long term (100 days) with a good microbial status. It is recommended to use dried ground cereal as an additive (20%) to increase dry matter and energy content, moreover to improve volatile fatty acid composition of the wet tomato pulp silage.

Conclusions of the results of the second year

Based on the experimental results, it can be concluded, that the new bale-forming

technology provides stable wet tomato pulp silage (20% ground corn) for long term storage, moreover, the transportable baled silage with considerable energy and protein concentration and as carotene source can have beneficial effects in game feeding during the winter time. Application of a biological additive is recommended in order to inhibit undesirable fermentation processes in the baled tomato pulp silage.

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REFERENCES

HADJIPANAYIOTOU (1994): Laboratory evaluation of ensiled olive cake, tomato pulp and poultry litter. Livestock Research for Rural Development. Volume 6, Number 2, October 1994 Agricultural Research Institute, Nicosia, Cyprus.
<http://www.cipav.org.co/lrrd/lrrd6/2/cyprus1.htm>

THE EFFECT OF ASH FROM THERMAL POWER STATION ON THE HEAVY METAL CONTENT OF *FESTUCA ARUNDINACEA* AND *FESTUCA PRATENSIS*

GASPAR SORIN, SCHMIDT BRIGITTA, SUMALAN RADU, MOISUC ALEXANDRU

Banat University of Agricultural Science and Veterinary Medicine Timisoara
Timisoara, Str. Calea Aradului, Nr. 119, Timiș, 300645
soring06@gmail.com

ABSTRACT

Due to its biological activities, adsorption and absorption properties, the soil can function as a cleaning system for many industrial pollutants in moderate concentrations. Because of the microelement content of ash, it can be used for improvement of acid soils or with microelement deficit. The present paper describes the possibilities of using thermal power station ash as amendment and source of microelements for two gramineous species, used as forage and energetic plants. For the experiment design we used randomized blocks with 3 repetitions. The ash was incorporated in soil before sowing of *Festuca arundinacea* and *Festuca pratensis* species. Experimental variants were the following: V_0 – 0 t/ha non-treated control, V_1 – 1 t/ha, V_2 – 3 t/ha and V_3 – 5 t/ha ash. Plant samples were collected from the above-ground organs, one year after sowing. Heavy metal content was determined using atomic absorption spectroscopy method. Regarding the metal content, the data show that the application of ashes in different dosages had similar effects on both of the gramineous species. The zinc content decreases slightly with the increase of ash dosage at both of the species. Compared to control variant, the copper content increases directly with the amount of applied ash at *Festuca arundinacea* and decreases at *Festuca pratensis*. Cobalt, nickel and manganese concentrations presented an increase due to higher ash concentrations at both of the plant species compared to control. From all of the assessed metal contents, manganese presented the highest concentrations in plants. The concentrations are low compared to non-treated control, thus there was no toxicity effect of the studied heavy metals from thermal power station ashes.

Keywords: *Festuca arundinacea*, *Festuca pratensis*, thermal power station ash, heavy metals

INTRODUCTION

The problems of using ashes from thermal power stations has been discussed worldwide, especially in countries which use since a long time coal as fuel in thermal power stations and dispose of huge quantities of ashes. Utilization of ashes in agriculture for treating different categories of soils, can be a way to use high quantities of this waste product (OROS, 2002). Due to its biological activities, adsorption and absorption properties, the soil can function as a cleaning system for many industrial pollutants in moderate concentrations. Because of the microelement content of ash, it can be used for improvement of acid soils or with microelement deficit. Besides there is the unburned coal, which could determine a certain increase of organic content of some extremely poor soils. Due to its natural alkalinity and very high active surface, ash has a great capacity of neutralizing acidity (CAPITANU, 1999, RETHMAN, 2001). Though these materials can be used as amendment on some soils, when applied in high quantities, some types of ashes, especially those with increased heavy metal content, can be harmful to plants. In this framework, the present paper approaches the possibilities of using ashes from ash pits as amendment and source of microelements for two gramineous species important as forage and energy culture, without determining a significant accumulation of heavy metals in these plants.

MATERIAL AND METHOD

For researches we used eumezobasic brown soil – vertic, moderately gleic, with alkalization in depth, strongly clogged up on medium/fine river deposits, medium clay/medium clay-loam, with low pH on the superior layer (pH = 5.20). Humus content of the soil profile shows low values (2.42% in the 0 - 38 cm layer). For the experiment design we used randomised blocks with 3 repetitions. The thermal power station ash (pH = 8.10) was collected from the 0-30 cm layer of Utvin ash pit of the Southern Thermal Power Station of Timisoara, “CET Timisoara Sud”, which is situated in an area not covered by vegetation, containing recently deposited ash. The ash was applied before sowing and after a disc harrowing. The ash was applied manually then incorporated in the soil with drill. No herbicides were used. 5 days after ash application sowing was realized in rows. Plant material consisted in *Festuca arundinacea* Schreb., Brio variety and *Festuca pratensis* Huds., Tâmpa variety. For each plant species, experimental variants were the following: V₀ – 0 t/ha non-treated control, V₁ – 1 t/ha, V₂ – 3 t/ha and V₃ – 5 t/ha ash. Plant samples were collected from the above-ground organs (leaves and stems), one year after sowing. Heavy metal content was determined from homogenized samples using atomic absorption spectroscopy method (with flame), at Banat University of Agricultural Sciences and Veterinary Medicine of Timisoara, Romania. After calcination to raw ash in porcelain capsules at 525±25°C in a calcinatory with thermal control, the samples were dissolved in HCl. The solution was sprayed into the air-acetylene flame of an atomic absorption spectrophotometer. The absorbance of radiation was measured at the specific wavelength for each element. The data were subjected to analysis of variance using ANOVA.

RESULTS

Regarding the heavy metal content, statistical analysis of data shows that the application of ashes in different dosages had similar effects on both of the gramineous species. At *Festuca arundinacea* the concentration of zinc decreased with 2.97% when 1 t/ha ash was applied, with 4.38% at 3 t/ha and with 5.56% at 5 t/ha ash treatment compared to control variant (Table 1).

Table 1. Effect of ashes on the zinc content in *Festuca arundinacea* Schreb. plants (mg/kg D.M.)

Variant	Content (mg/kg S.U.)	Differences (mg)	Differences %	Significance
Control (0 t/ha ash)	18.51	-	100	
1 t/ha ash	17.96	-0.55	97.03	-
3 t/ha ash	17.70	-0.81	95.62	-
5 t/ha ash	17.48	-1.03	94.44	-

LSD 5% = 1.27

LSD 1% = 1.93

LSD 0.1% = 3.09

[mg]

Table 2. Effect of ashes on the copper content in *Festuca arundinacea* Schreb. plants (mg/kg D.M.)

Variant	Content (mg/kg S.U.)	Differences (mg)	Differences %	Significance
Control (0 t/ha ash)	11.00	-	100	
1 t/ha ash	11.27	0.27	102.45	-
3 t/ha ash	11.47	0.47	104.27	*
5 t/ha ash	11.70	0.70	106.36	**

LSD 5% = 0.43

LSD 1% = 0.65

LSD 0.1% = 1.05

[mg]

The copper concentration increased with 2.45% when 1 t/ha ash was applied, with 4.27% at 3 t/ha and with 6.36% at 5 t/ha ash treatment compared to control variant (*Table 2*).

Table 3. Effect of ashes on the cobalt content in *Festuca arundinacea* Schreb. plants (mg/kg D.M.)

Variant	Content (mg/kg S.U.)	Differences (mg)	Differences %	Significance
Control (0 t/ha ash)	2.43	-	100	
1 t/ha ash	2.46	0.03	101.23	-
3 t/ha ash	2.47	0.04	101.65	-
5 t/ha ash	2.50	0.07	102.88	-

LSD 5% = 0.19 LSD 1% = 0.28 LSD 0.1% = 0.45 [mg]

The other metal contents also increased, as follows: at 1 t/ha ash treatment cobalt content increased with 1.23%, nickel with 6.43% and manganese with 3.72%; at 3 t/ha, cobalt content increased with 1.65%, nickel with 8.19% and manganese with 4.15%; at variants where we applied 5 t/ha ash, cobalt content increased with 2.88%, nickel with 9.36% and manganese content increased with 9.74%, compared to control non-treated variant (*Tables 3, 4 and 5*).

Table 4. Effect of ashes on the nickel content in *Festuca arundinacea* Schreb. plants (mg/kg D.M.)

Variant	Content (mg/kg S.U.)	Differences (mg)	Differences %	Significance
Control (0 t/ha ash)	1.71	-	100	
1 t/ha ash	1.82	0.11	106.43	-
3 t/ha ash	1.85	0.14	108.19	*
5 t/ha ash	1.87	0.16	109.36	*

LSD 5% = 0.11 LSD 1% = 0.17 LSD 0.1% = 0.27 [mg]

Table 5. Effect of ashes on the manganese content in *Festuca arundinacea* Schreb. plants (mg/kg D.M.)

Variant	Content (mg/kg S.U.)	Differences (mg)	Differences %	Significance
Control (0 t/ha ash)	153.11	-	100	
1 t/ha ash	158.80	5.69	103.72	**
3 t/ha ash	159.47	6.36	104.15	**
5 t/ha ash	168.03	14.92	109.74	***

LSD 5% = 3.45 LSD 1% = 5.23 LSD 0.1% = 8.40 [mg]

The concentration of heavy metals in Meadow fescue increased with the increase of ash dosages, with the exception of zinc and copper, but the differences between variants were low or even extremely low in case of some elements.

Table 6. Effect of ashes on the zinc content in *Festuca pratensis* Huds. plants (mg/kg D.M.)

Variant	Content (mg/kg S.U.)	Differences (mg)	Differences %	Significance
Control (0 t/ha ash)	18.58	-	100	
1 t/ha ash	18.03	-0.55	97.04	-
3 t/ha ash	17.70	-0.88	95.26	-
5 t/ha ash	17.17	-1.41	92.41	o

LSD 5% = 1.14 LSD 1% = 1.73 LSD 0.1% = 2.78 [mg]

Compared to control variant, the zinc concentration decreases with 2.96% at 1 t/ha ash variant, with 4.74% in case of 3 t/ha variant and with 7.59% when 5 t/ha ash was applied (Table 6).

The copper concentration in plants also decreased, as follows: with 1.55% at 1 t/ha variant, with 3.82% at 3 t/ha variant and with 3.91% at 5 t/ha variant compared to control (Table 7).

Table 7. Effect of ashes on the copper content in *Festuca pratensis* Huds. plants (mg/kg D.M.)

Variant	Content (mg/kg S.U.)	Differences (mg)	Differences %	Significance
Control (0 t/ha ash)	11.00	-	100	
1 t/ha ash	10.83	-0.17	98.45	-
3 t/ha ash	10.58	-0.42	96.18	-
5 t/ha ash	10.57	-0.43	96.09	-
LSD 5% = 1.11 LSD 1% = 1.68 LSD 0.1% = 2.70				[mg]

Table 8. Effect of ashes on the cobalt content in *Festuca pratensis* Huds. plants (mg/kg D.M.)

Variant	Content (mg/kg S.U.)	Differences (mg)	Differences %	Significance
Control (0 t/ha ash)	2.33	-	100	
1 t/ha ash	2.37	0.04	101.72	-
3 t/ha ash	2.42	0.09	103.86	-
5 t/ha ash	2.47	0.14	106.01	*
LSD 5% = 0.11 LSD 1% = 0.17 LSD 0.1% = 0.28				[mg]

Table 9. Effect of ashes on the nickel content in *Festuca pratensis* Huds. plants (mg/kg D.M.)

Variant	Content (mg/kg S.U.)	Differences (mg)	Differences %	Significance
Control (0 t/ha ash)	3.24	-	100	
1 t/ha ash	3.29	0.05	101.54	-
3 t/ha ash	3.31	0.07	102.16	-
5 t/ha ash	3.33	0.09	102.78	-
LSD 5% = 0.32 LSD 1% = 0.48 LSD 0.1% = 0.77				[mg]

Table 10. Effect of ashes on the manganese content in *Festuca pratensis* Huds. plants (mg/kg D.M.)

Variant	Content (mg/kg S.U.)	Differences (mg)	Differences %	Significance
Control (0 t/ha ash)	146.44	-	100	
1 t/ha ash	151.80	5.36	103.66	*
3 t/ha ash	153.45	7.01	104.79	**
5 t/ha ash	161.60	15.16	110.35	***
LSD 5% = 4.44 LSD 1% = 6.72 LSD 0,1% = 10.80				[mg]

The other metal contents presented an increase, as follows: compared to control, at 1 t/ha variant the cobalt concentration increased with 1.72%, the nickel with 1.54% and the manganese with 3.66%; at 3 t/ha variant, the cobalt content increased with 3.86%, the nickel with 2.16% and the manganese with 4.79%; when 5 t/ha ash was applied, the cobalt content increased with 6.01%, the nickel with 2.78% and the manganese with 10.35% compared to control variant (Tables 8, 9 and 10). The manganese concentrations in all

variants are also high compared those in *Festuca arundinacea*. The manganese content reached 161.6 mg/kg dry matter at variant treated with 5 t/ha ash.

CONCLUSIONS

The analysis of data showed that the two gramineous species presented the same reaction to different dosages of thermal power station ashes. At both species, the zinc concentration decreased only slightly with the increase of ash dosages. Compared to control variant, the copper concentration increased at *Festuca arundinacea* and decreased at *Festuca pratensis* with the application of ash treatments. The cobalt, nickel and manganese concentrations increased compared to control with the increase of ash dosages at both species. Of the analyzed heavy metals, the manganese presented the highest concentrations. The low differences in heavy metal content compared to non-treated control plants there was no problem with toxicity at the dosages we tested. It can be concluded that both of the *Festuca* species resist without difficulties to dosages of 5 t/ha (and even more) thermal power station ash, with the condition to be applied on soils with the same properties as used in our experiment. These two species are tolerant to even higher heavy metal concentrations, accumulating concentrations of 418.18 mg/kg zinc in shoots of *Festuca arundinacea* and average concentrations of 354.66 mg/kg zinc, on soils polluted with zinc salts (YANG, 2008, SIMON, 2005).

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REFERENCES

- CAPITANU, V., DUMITRU, M., TOTI, M., RADUCU, D., POPA, D., MOTELICA, M., (1999): Impactul emisiilor termocentralelor asupra mediului ambiant. Recultivarea haldelor de cenușă. Institutul de Cercetări pentru Pedologie și Agrochimie, Cluj-Napoca. pp. 21-196.
- OROS, V. (2002): Reabilitarea ecologică a siturilor degradate industrial, Editura Universității Transilvania, Brașov. pp. 61-170.
- RETHMAN, N.F.G., TRUTER, W.F., (2001): Plant responses on soils ameliorated with waste products. 16th National Meeting of ASSMR, Albuquerque, NM, USA. pp. 425.
- SIMON, L. (2005): Stabilization of metals in acidic mine spoil with amendments and red fescue (*Festuca rubra* L.) growth. Environ. Geochem. Health, Vol. 27. pp. 289-300.
- SIMON, L., TAMAS, J., KOVACS, E., KOVACS, B., BIRO, B. (2006): Stabilization of metals in mine spoil with amendments and growth of red fescue in symbiosis with mycorrhizal fungi. Plant Soil Environ. Vol. 52. pp. 385-391.
- YANG, R-Y., TANG, J-J., YANG, Y-S., CHEN, X., (2007): Invasive and non-invasive plants differ in response to soil heavy metal lead contamination. Botanical Studies Vol. 48. pp. 453-458.

HELICULTURE AS A TOOL FOR RURAL DEVELOPMENT IN SOUTHERN TRANSYLVANIA

VOICHITA GHEOCA¹, LETIȚIA OPREAN²

¹“Lucian Blaga” University of Sibiu, Faculty of Sciences,

²“Lucian Blaga” University of Sibiu, Faculty of Agricultural Sciences, Food Industry and Environmental Protection,
5-7 Dr. I Rațiu St., RO – 550012, Sibiu, Romania
ygheoca@yahoo.com

ABSTRACT

In Romania there is no tradition as regards the consumption of snails. After several decades of land snails populations' exploitation for international trade, in the last decade the farming of edible snails has evolved in Romania. The expansion of this practice was encouraged by the SAPARD Program and several foreign companies, promising a quick and easily obtained benefit. About 650 snail farms were established in Romania between the years 2004-2008, most of them using the Italian method, with *Helix aspersa* in pastures. However, this method had proved its deficiency in the given environmental conditions, leading to high mortality rates. An autochthonous method was developed using *H. pomatia*, applied by farmers organized in a cooperative, and which have invested in their own processing factory in southern Transylvania, aiming to obtain valuable biologic products. Both the individual farmers and the cooperative were not able to sustain the losses registered during the first years, and find a market for their products, a situation that lead to the collapse of heliciculture in Romania. Despite the unfortunate experience, this new agricultural activity has the potential of a profitable practice in Romania, and especially in Transylvania, not just due to the demand of the European market, but also to the climatic conditions, which make possible the snail farming. Choosing the appropriate technology and species could allow the development of profitable businesses in the rural areas, which could serve as alternative to the exploitation of *Helix pomatia* natural populations.

Keywords: Heliciculture, snail farming, alternative production, rural development, Southern Transylvania.

INTRODUCTION

In the last years the field of agriculture was extended with new nontraditional alternative productions, which respond to the European market demands. This is the case of heliciculture, which was extended during the last decades beyond its traditional areas. The term “heliciculture” originates from Latin and signifies the productive process of growing edible land snails in captivity, in outdoor or indoor farming systems.

Although the term was just recently popularized, it refers to a practice with ancient roots, snails being part of human food since prehistoric times, as shown by the abundance of shells in many archeological sites (LUBELL, 2004). The Greeks, Phoenicians, and other pre-roman Mediterranean cultures ate land snails, practice conserved until today in the Mediterranean cuisine (DUHART, 2009). In ancient Rome the snails were fatten with flour, aromatic herbs and wine in so named “cochlear gardens”. During the expansion of the Roman Empire, the use of snails has also extended as far as its boundaries. The European Middle Age brought a new significance for the consumption of snails, in convents their meat being allowed during the fast. In the 19th Century, snails are introduced in America, Africa and some Asian countries.

Snails were valued over time not just for their taste and nutritional properties, but also for numerous therapeutic or biological properties (BONNEMAIN, 2005). Pliny thought that snails increase the speed of delivery, and recommended their use to treat pain related

to burns and abscesses. Through time, various snail preparations were used for different purposes, starting with snail extracts used for dermatological disorders, symptoms associated with tuberculosis and nephritis and ending with helicidine, a bronchorelaxant drug (PONS et al, 1999), or HPA lectine used as a marker in several types of cancer (THIES et al, 2001).

In Romania there is no tradition concerning the consumption of snails. At the beginning of the 20th Century the affinity with the French culture led to the takeover of some culinary habits. Thus, the famous “escargot” was sold in the groceries from Bucharest, being brought from Transylvania or Banat. Today, the biggest consumers of this culinary delicacy in Europe are France, Italy, Spain, Germany, and Austria. Only in France the consumption of snails is evaluated to over 35.000 tones/ year, over 90% of this amount originates from Eastern Europe and the Mediterranean countries.

The culinary success of the famous "garden snail" caused an overexploitation which, associated with the degradation of suitable habitats due to land use and pesticides, determined a decline of the natural populations in some countries from Western Europe. That is why *Helix pomatia* was included in the Red Lists of several countries, being forbidden its collecting from the wild. *Helix pomatia* is also part of the Bern Convention's list, Appendix III, concerning the vulnerable animal species whose exploitation is the object of a management. This is one of the reasons why the harvest of land snails from their natural habitats was progressively replaced in West European countries by the breeding of these animals, a practice which was extended during the last decades also in some East European countries.

This paper aims to analyze the potential of heliciculture in southern Transylvania, as a tool for rural development in the context of this practice's evolution in Romania.

MATERIAL AND METHOD

In order to investigate the evolution of the land snail breeding activity in Romania, it was analyzed the data available at Ministry of Agriculture and Rural Development, County Directions for Agriculture and Rural Development, Payment Agency for Rural Development and Fishing. An analysis of applicability for different technologies used in snail farming was made. Further information was acquired from the snail processing units, current and former snail farmers.

RESULTS

General aspects

In Romania, the farming of edible snails has evolved in the last decade and especially during the period 2004-2008, when many agricultural producers were attracted by the idea of getting almost immediate benefit with little investment and no much technical effort. The mirage of getting rich was supported by several foreign companies, advertised by the National Agency for Agricultural Consulting. The Italian companies have signed contracts with the farmers, thus the companies supplied the breeders and the technology, by the other hand, the farmers delivered their products. Theoretically these contracts should have brought benefits for both parts, but often the quality of breeders wasn't the promised one, their price was enormous, and the technology not adapted for the local conditions. Also, frequently the companies did not buy the snails from the farmers as contracted. As expected, the result was, after a boom of this practice, an identically quick collapse of it.

Financial issues and agricultural policies

The establishment of a snail farm does not represent a major investment, and an amount of 10 000 Euro is generally considered suitable for a 2000 m² farm. This is one of the reasons why many people in Romania were attracted by this apparently great business. The expansion of this practice in Romania was encouraged by the SAPARD Program, dedicated to support the efforts being made by the Central and East European applicant countries in the pre-accession period as they prepared for their participation in the common agricultural policy and the single market. A number of seventy snail farms all over the country were financed by this program, with a total amount of over 320 000 Euro. *Table 1* presents the distribution of the financed projects by county, as well as their value.

Table 1. The distribution of the SAPARD financed snail farms in Romania and the value of the founding for each applicant county

(source: the Ministry for Agriculture and Durable Development, Payment Agency for Rural Development and Fishing, <http://www.apdrp.ro>.)

County	No of farms	Value in Euro	County	No of farms	Value in Euro
Alba	1	12.439,69	Iasi	2	29.272,58
Arad	6	37.130,70	Ilfov	4	26.237,16
Arges	2	15.746,62	Maramures	2	16.193,99
Bacau	3	22.508,34	Mehedinti	1	7.097,42
Botosani	4	70.602,20	Olt	3	57.781,42
Braila	2	14.486,13	Satu Mare	1	11.112,06
Caras-Severin	3	9.522,74	Salaj	3	25.646,83
Calarasi	1	3.546,54	Sibiu	5	53.309,49
Constanta	1	20.335,77	Suceava	4	42.404,76
Dambovita	1	3.010,63	Teleorman	1	2.870,72
Dolj	4	19.069,93	Timis	3	16.430,66
Giurgiu	1	11.466,69	Vaslui	1	12.733,77
Gorj	7	41.055,67	Valcea	2	22.491,88
Hunedoara	1	8.628,83	Vrancea	1	27.010,91
Total value of the 70 farms founded:					321.321,05

The mentioned seventy farms were established during the period 2005-2006, the peak of the snail farming trend in our country. Obviously, this number constitutes just a small fraction of the total number of farms developed in Romania, which is estimated at about 650. Unfortunately there is no reference about the total number of farms ever existent in Romania. The data concerning this practice are divided between several national agencies and registers, whereat the farmers were interested to register. Under the law 166/2002 concerning the agricultural exploitations, each farmer had to register as agricultural operator into the Register of Agricultural Exploitations, but just a small number of farms (about 40) were registered here. More of them (92) were registered on the List of Operators in Ecologic Agriculture, certificate which allowed the farmer to sell his product toward the biologic products processing factories. The *Figure 1* present the number of ecologic snail farms by county, as registered in 2008. The largest number of certified ecologic farms is registered in the counties from south of Transylvania: Braşov – 32 farms, Covasna – 13, Sibiu – 8 and Alba -5. This situation, although incomplete, underlines the potential of the

area, both in terms of suitable environmental conditions and receptivity of small businessman towards this alternative agricultural production.

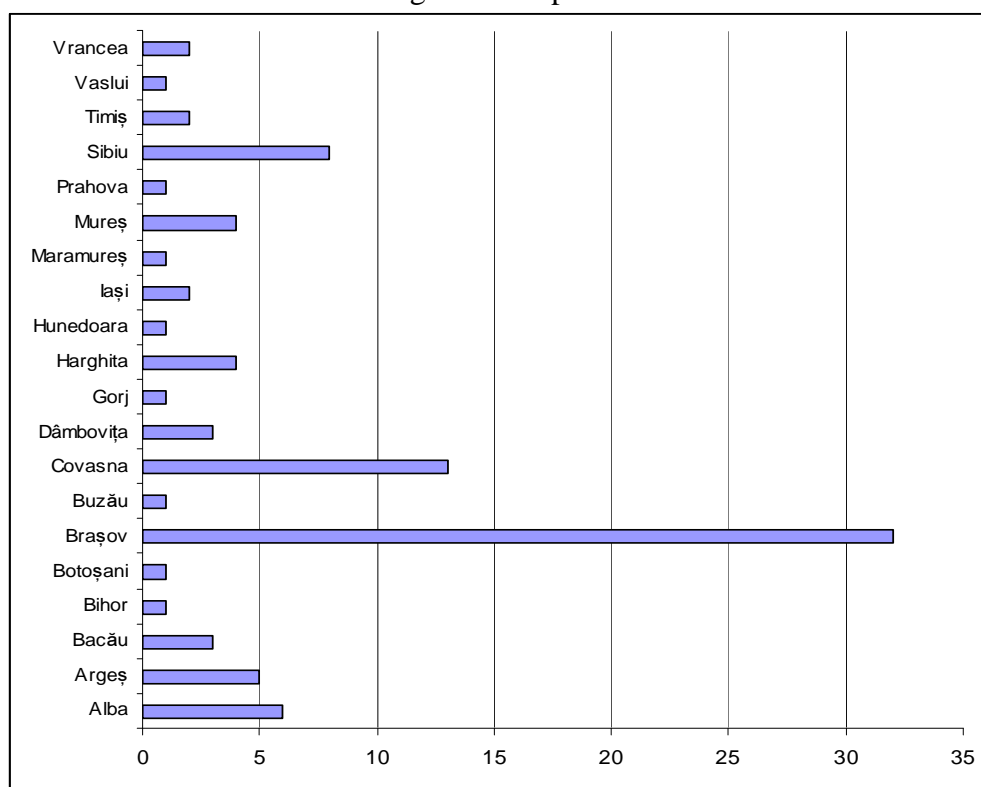


Figure 1. The number of ecologic snail farms by county, registered in 2008
 (source: Ministry of Agriculture and Rural Development – The list of operators for ecologic agriculture)

Climatic conditions and more or less adapted technologies

Southern Transylvania is featured by the climate regime of Transylvanian Plateau, a continental climate, heavily influenced by the predominant western oceanic circulation, by the protected position provided by the Carpathians and by local conditions. The yearly thermic amplitude varies between 21–23.5°C. The multiannual means of temperature decreases from +8,6 - +9 °C in the depressionary and plateau area to +4.3 °C – +2 °C in the mountains. The monthly multiannual means of temperature fluctuate between -4.4°C in January (Sibiu) and +19.5°C in July. The absolute values of temperature recorded in the depressionary submontaneous area (at Sibiu Station) were about -31.8°C (23rd of January 1963) and +37.5 °C (25th of August 1997). The precipitation regime is characterized by the increase of values with altitude, with more prolonged regime of precipitations in spring – summer period. The multiannual means of precipitations vary between 650–750 mm in the depressionary areas and between 900-1200 mm in the mountains. The monthly averages of precipitations vary between 85–102 mm at Dumbrăveni, 76–100 mm at Sibiu, 150–200 mm at Păltiniș. The thermic values and the level of precipitations are favorable for the development of *Helix pomatia*, the single edible land snail species naturally present in the area, equally collected in the wild and farmed. *Helix pomatia* is also often preferred to *H. aspersa* for its flavour and its larger size. The latest one, *H. aspersa* (*Cornu aspersum*) is native to the Mediterranean region including North Africa and probably the Atlantic coastal regions from Portugal to the Netherlands and the British Isles. It was introduced to Greece and Asia Minor in classical times (e.g. KERNEY et al. 1983, MIENIS 2007). It is the most common species used in heliciculture, due its adaptability to different climatic conditions and is known as the only species which may be raised in closed artificial conditions. This plasticity is the reason of its introduction, during the last few decades,

round the world (e.g. PICKERING, 2009, JUŘIČKOVÁ and KAPOUNEK, 2009, MIENIS, 2007, SANDERSON and SIRGEL, 2002, BARKER, 1982).

A number of 475 farms were established in Romania using the Italian technology – the Cherasco method – with *H. aspersa* breeding in completely outdoor conditions, with fresh plant diet or with supplement of dry fodder. The Italian method that uses *Helix aspersa* with outdoor hibernation, was a failure for the Romanian farmers, which sometimes encountered a mortality of 80-90% for *H. aspersa*, due to the low temperatures in winter.

A more appropriate technology for our climatic conditions seems to be the use of *Helix pomatia*, a species more adapted for hostile winter conditions, and who can bury in winter even at one meter depth. The inconvenient is that *H. pomatia* is a slow grower, it needs 2.5-3 years to reach the exploitable size, and is more sensitive. An autochthonous method to raise *H. pomatia* is known as Teliu method, and is an adaptation of Cherasco method to *H. pomatia*, with a possibility of harvesting throughout the year.

A more beneficial activity – meat processing

A consequent further stage in the snail growing practice in Romania was the transition from the marketing of living snails, towards much valuable processed products. Several small processing units were established during the last decades, the three most important of them are located in South of Transylvania: *Pomarom Alba Iulia*, established in 1993, *Rolux Hateg* established in 1999, and *Escar Prod Teliu*, in 2005. The first two were conceived for the processing of the snails harvested in the wild, and their activity was extended as the new practice raised, while the last one, *Escar Prod Teliu*, was designed as a cooperative of 220 snail growing farmers from the entire country. Organized in 2005, the cooperative has started in the snail growing business with the idea of obtaining an organically certified product, worthy of international marketing. They have established a reproduction and growth method for *Helix pomatia*, a free range method to reduce the stress factor and to insure a well balanced diet, within the parameters of certifiably organic agriculture, known as Teliu method, as mentioned before. During the first two years of their activity, the farmers were able to insure the raw material necessary to the production of over 1000 tones/year of finished product. *Escar Prod* was a modern processing plant, built to the latest standards of food products handling and processing, having the ISO 22000/HACCP certifications, as well as the EcoCert International Bio certification. Among the finished products were: pasteurized morsels of meat in bouillon, brine or proper juice; snail meat soup; snail stew; Escargots Bourguignon; snail meat sausage; snail meat pate. Despite their auspicious start, they were able to function only two years after the plant installation, in 2008. The most important processing factory in Romania was declared bankrupt in 2010, and so were its shareholders too.

The other two processing factories, the only ones active at this moment in Romania, are responsible with the processing of the entire amount of exported snails, most of them collected in the wild, and a small amount raised in the still surviving farms.

CONCLUSIONS

The snail farming in Romania has disappeared, as quickly as it started. Whatever method did they use, the snail farmers have abandoned one by one this practice. The high mortality, the duration between investment and first benefits, as well as the marketing difficulties, have lead now to a collapse of this practice in Romania. In the south of Transylvania only two farms survived, one in Sibiu County, and a second in Hunedoara. Although many farms are not functional, they keep providing *H. pomatia* for the

processing factories, using their authorizations for farming, but actually collecting the snails from the wild, endangering the natural populations, and making impossible the control of the exploited amount. Despite the unfortunate experience, this new agricultural activity has the potential of a profitable practice in Romania, and especially in Transylvania, not just due to the European market demand, but also to the climatic conditions, which make possible the snail farming. Choosing the appropriate technology and species could allow the development of profitable businesses in the rural areas, which could serve as alternative to the exploitation of *Helix pomatia* natural populations.

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REFERENCES

- BARKER G.M., (1982): Notes on the introduced terrestrial Pulmonata (Gastropoda:Mollusca) of New Zealand. *Journal of Molluscan Studies*, 48: 174–181.
- BONNEMAIN B. (2005): *Helix* and Drugs: Snails for Western Health Care From Antiquity to the Present, *eCAM* ; 2 (1); pp 25–28.
- DUHART, F. (2009): Snails and European Societies since the Antiquity. An Ethnozoological Essay, *STVDIVM. Revista de Humanidades*, 15 (2009) ISSN: 1137-8417, pp. 115-139 (in Spanish)
- JUŘIČKOVÁ L., KAPOUNEK F. (2009): *Helix (Cornu) aspersa* (O.F. Müller, 1774) (Gastropoda: Helicidae) in the Czech Republic, *Malacol. Bohemoslov.* (2009), 8: 53–55.
- KERNEY M.P., CAMERON R.A.D. JUNGBLUTH J.H., (1983): Die Landschnecken Nord- und Mitteleuropas. – Verlag Paul Parey, Hamburg und Berlin, 384 pp.
- LUBELL, D.(2004): Prehistoric edible land snails in the circum-Mediterranean: the archaeological evidence, *Petits animaux et sociétés humaines. Du complément alimentaire aux ressources utilitaires*, XXIVe rencontres internationales d’archéologie et d’histoire d’Antibes Sous la direction de J.-P. Brugal et J. Desse Éditions APDCA, pp77-88.
- MIENIS H.K., (2007): Verslag van een onderzoek naar het voorkomen van landslakken op de Afsluitdijk uitgevoerd in 1989 [A survey of the presence of terrestrial molluscs Afsluitdijk, the Netherlands, in 1989]. – *De Kreukel*, 43(8): 115–124 (in Dutch).
- PICKERING J., (2009): Discover life. Worldwide web electronic publication. <http://www.discoverlife.org/mp/20o?kind=Cornu+aspersum> (14.9.2009)
- PONS F, KOENIG M, MICHELOT R, MAYER M, FROSSARD N. (1999): The bronchorelaxant effect of helicidine, a *Helix pomatia* extract, interferes with prostaglandin E2. *Pathol Biol (Paris)*. Jan;47(1):73-80.
- ROMANIA.Ministry of Agriculture and rural development, 15.01.2012: <http://www.madr.ro/>
- ROMANIA.Payment Agency for Rural Dev. and Fishing, 15.01.2012: <http://www.apdrp.ro/>
- SANDERSON G., SIRGEL W., (2002): Helicidae as Pests in Australian and South African Grapevines. – In: *Molluscs as crop pests*, Barker G.M. (ed.), CAB International UK, London, pp. 255–270.
- THIES, A, MOLL, I BERGER, J . SCHUMACHER U., (2001): Lectin binding to cutaneous malignant melanoma: HPA is associated with metastasis formation, *A British Journal of Cancer* , 84(6), 819–823.

CASE STUDY OF A SPIDER WEB ENTROPY ANALYSIS

PÁL GODA- ADRIENN NAGY– LÁSZLÓ PÉLI

Szent Istvan University
Faculty of Economics and Social Sciences
Insitute of Regional Economics and Rural Development
H-2100 Gödöllő, Páter K. street 1.

Goda.Pal@gtk.szie.hu; Nagy.Adrienn@gtk.szie.hu; Peli.Laszlo@gtk.szie.hu

ABSTRACT

In our paper we will present a part of a result of a complex research, which in we have examined *five approaches of system analysis* from the development aspects of rural areas. *The cross-sectional system analysis approach* helps us to understand the different outputs of relations and interactions between individual systems and underlines the importance of *harmony* between individual systems and the limits of growth regarding economic, social and environmental systems. *The development system analysis approach* emphasizes that an area can be defined as a system, too. The inappropriate interventions may cause distortions in the systems and the ideal tetraeder-like theoretical system will be upset. *The functionalist system analysis approach* tries to define the functions within the system. The definition of functions within the system is inevitable for drafting the development. In order to ensure the most efficient utilization of development sources, the functions of subsystems and their possibilities within the system should definitely be understood. *The holistic system analysis approach* focuses on the complexity of an area and helps to learn the system as a whole. The theory tries to consider all those elements that can be involved in the development and aims to describe these system elements in their complexity. *The reductionist system analysis approach* takes apart the system to its elements and aims to draft development concepts from the totality of the components. In our paper we will present the *combination of the five approaches (Spider Web Entropy Analysis)* through a case study.

INTRODUCTION

All the five system analysis methods that were examined are suitable from their own aspects to highlight the problems of an area and to provide basis for drafting the future developments. The detailed examination of individual models, however, showed clearly that they have weaknesses and they try to describe the problem not in its complexity but according to a randomly chosen logical system. On the basis of the above, such a situation analysis and strategy development attitude is required which is able to synthetize the individual system analysis methods appropriately. The general spider web theory can be regarded the synthetization of the five types of system analysis approach (GODA et al., 2008).

Based on the complexity of inequalities of the territories is not advantageous to do an examination only in one dimension NAGY- KÁPOSZTA (2006). KÁPOSZTA et al. (2008) highlight the subsystems of the development are in sum and part relationship with each other, and they act as a sensitive system. The entropy analysis is not unfamiliar way of the territorial researches. The phenomena of entropy come from the Information Theory, which can be used for comparing the distribution of two territories' quantitative criterion (NÉMETH, 2005). Based on the researches of PESTI (2009), the agricultural production structure analysis of the entropy can be used in practice. The index that varies between the items "ordered" refers to the distribution. NEMES NAGY (1998, 2005, 2009) also deals in detail with the problem of orderliness in his number of scientific work, mainly in the order of the regional spatial structure understands. The abstract way of thinking the meaning of

entropy theory formed the so-called spider web-entropy analysis, which helps to find out how is the structure order between the pillars of the spider web.

SPIDER WEB ENTROPY ANALYSIS

Besides the examination of pillars one by one, the other objective of situation analysis is to map the relations between pillars. This objective can be fulfilled by spider web entropy analysis. The mathematical basis of spider web entropy analysis is provided by the objective, subjective and corrected cohesion. Objective cohesion indicates the strength of relation between the statistical data of pillars (basis of objective regional subindices). The correlations of indices within one pillar are not considered as the results of correlation matrix, because the objective is to determine the strength of relations between pillars and not to examine the strength of relations within a pillar. The „ r_i ” values received are regarded as weight in the determination of relations between two pillars. The relation between two pillars is expressed as the product of multiplication of individual objective regional subindices and the belonging „ r_i ” value. Thus the relation of two pillars can be described as the weighted average of objective regional subindex number „ n ”, weighted with „ r_i ” value. On the basis of this, the objective cohesion of two pillars can be expressed with a calculation consisting of several steps.

Following the drafting of correlation matrix, the first step is the determination of average correlation of indices to another pillar. The determination of average correlation should be calculated with geometric mean, but due to the correlations outlined in the dissertation, the average correlation can be calculated in two ways:

if it is true that $rp_{i_1-p_{j_1}} \in R_0^+$ és $rp_{i_2-p_{j_2}} \in Z^+$, then

$$\bar{r}_{p_{i_1}-p_j} = \sqrt[n]{\prod rp_{i_1-p_{j_k}}}$$

if it is not true that $rp_{i_1-p_{j_1}} \in R_0^+$ és $rp_{i_2-p_{j_2}} \in Z^+$, then

$$\bar{r}_{p_{i_1}-p_j} = \frac{\sum_{i=1}^n rp_{i_1-p_{j_i}}}{n}$$

where: $\bar{r}_{p_{i_1}-p_j}$ is the average correlation of the first index of pillar i to pillar j

The average correlations and the formerly calculated objective regional subindices will help to draft the objective cohesion (OC) of two pillars, according to the following calculation:

$$\overline{OC}_{p_i-p_j} = \frac{ORI_{p_{i_1}} * \bar{r}_{p_{i_1}-p_j} + \dots + ORI_{p_{i_n}} * \bar{r}_{p_{i_n}-p_j} + ORI_{p_{j_1}} * \bar{r}_{p_{j_1}-p_i} + \dots + ORI_{p_{j_n}} * \bar{r}_{p_{j_n}-p_i}}{\sum \bar{r}_{p_{i_n}-p_j} + \sum \bar{r}_{p_{j_n}-p_i}}$$

where: $\overline{OC}_{p_i-p_j}$ is the objective cohesion of pillar i and j

Subjective cohesion expresses the strength of relation between data of pillars coming from questionnaires (basis of subjective regional subindices). The theoretical process of calculating subjective cohesion is the same as the calculation of objective cohesion. Values „ r_i ” are calculated from the correlation matrix made of responses given to the questionnaire.

The relation between two pillars are given as the product of multiplication of individual subjective regional subindices and the belonging „ r_i ” values. Thus the relation between two pillars can be described as the average of SZT subindices number „ n ”, weighted with given „ r_i ” value. The methodology of calculating „ r_i ” value is the same as the calculation used for objective cohesion.

The subjective cohesion (SC) of two pillars can be drafted with the help of average correlations and the formerly calculated subjective regional subindices, according to the following equation:

$$\overline{SC}_{p_i-p_j} = \frac{SRI_{p_{1i}} * \overline{r}_{p_i-p_j} + \dots + SRI_{p_{2i}} * \overline{r}_{p_i-p_j} + SRI_{p_{3i}} * \overline{r}_{p_i-p_j} + \dots + SRI_{p_{ni}} * \overline{r}_{p_i-p_j}}{\sum \overline{r}_{p_i-p_j} + \sum \overline{r}_{p_i-p_j}}$$

where: $\overline{SC}_{p_i-p_j}$ is the subjective cohesion of pillar i and j

The adjusted cohesion for the relation of two pillars can be given by the geometrical average of objective and subjective cohesion, by applying the following equation:

$$\overline{AC}_{p_i-p_j} = \sqrt[2]{\overline{OC}_{p_i-p_j} * \overline{SC}_{p_i-p_j}}$$

where: $\overline{AC}_{p_i-p_j}$ is the adjusted cohesion of pillars i and j

$\overline{OC}_{p_i-p_j}$ is the objective cohesion of pillars i and j

$\overline{SC}_{p_i-p_j}$ is the subjective cohesion of pillars i and j.

The conclusions in the examination of entropy are made from the cohesion outcomes. We distinguish three states: spider web of low entropy, medium entropy and high entropy. These states are determined as follows:

if, $\overline{AC}_{p_i-p_j} \vee \overline{OC}_{p_i-p_j} \vee \overline{SC}_{p_i-p_j} = 1$, then the relation of the two pillars has **low entropy**

$1 > \overline{AC}_{p_i-p_j} \vee \overline{OC}_{p_i-p_j} \vee \overline{SC}_{p_i-p_j} \geq 0,5$, the relation of the two pillars has **medium entropy**

$0,5 > \overline{AC}_{p_i-p_j} \vee \overline{OC}_{p_i-p_j} \vee \overline{SC}_{p_i-p_j} = 0$, the relations of the two pillars has **high entropy**

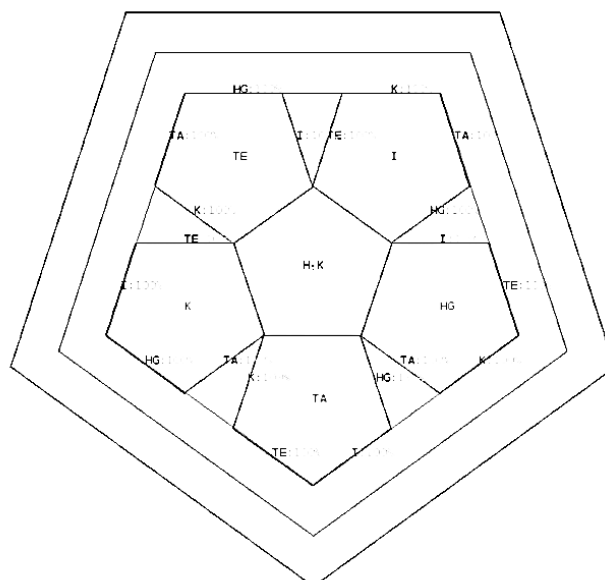
where: $\overline{AC}_{p_i-p_j}$ is the corrected cohesion of pillars i and j

$\overline{OC}_{p_i-p_j}$ is the objective cohesion of pillars i and j

$\overline{SC}_{p_i-p_j}$ is the subjective cohesion of pillars i and j.

The examination of spider web entropy is assisted by a visualization method we developed. Each pillar is has four points of contact to the other pillars. The relation of pillars to themselves is not examined, therefore it always has fix value in the model. There are altogether sixteen contacts on the figure, which is equal to eight real contacts, because the relation between two pillars appears twice but contains the same information. The introduces the relation in an inverse proportion. If the tightness of relation is close to zero, the hole on the web can be observed.

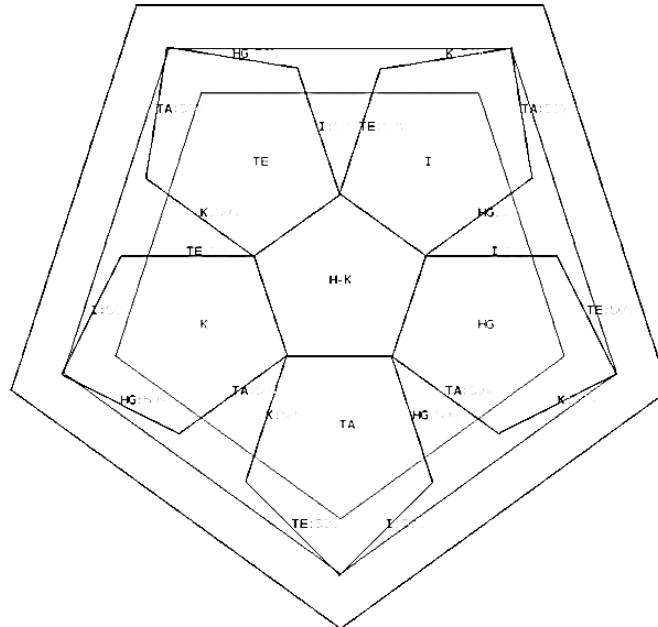
The spider web with low entropy is a theoretical spider web in which the relation of all the pillars show **low entropy**. The relations between pillars can be seen and sensed clearly. Completely sustainable balance is formed in this system. The structure of the spider web is in order, there is no hole in it.



The spider web with low entropy

Source: GODA, 2012

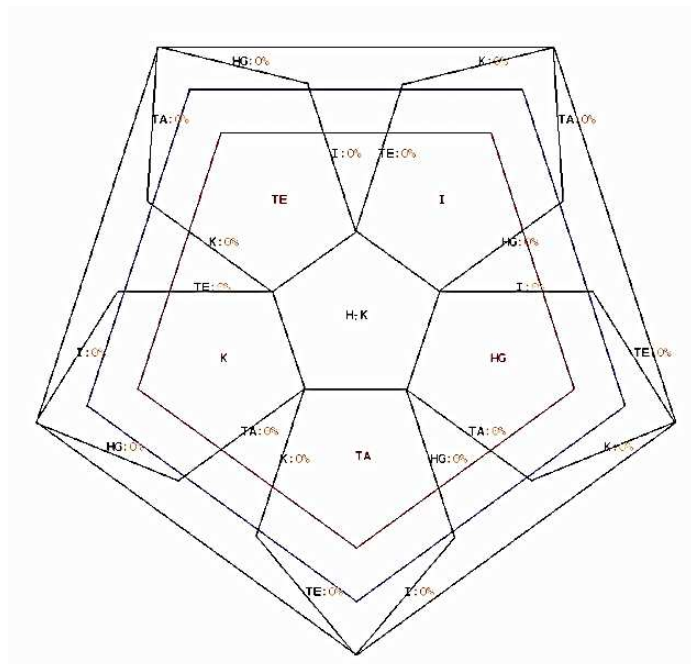
The spider web of medium entropy is a theoretical spider web, in which the relations of all the pillars have *medium entropy*, there is a fractional hole on the spider web. The relations between pillars are not clear and sometimes cannot be detected. There is a potential for sustainability within the system, but not in its current state.



The spider web with medium entropy

Source: GODA, 2012

The spider web with high entropy is a theoretical spider web where the relations of all the pillars have *high entropy*, there is a full hole on the spider web. The relations between pillars are not clear and cannot be detected. There might be a possibility of sustainability within this system but in its current state, it is unable to enhance it.



The spider web with high entropy

Source: GODA, 2012

CONCLUSION

The spider web entropy examinations on *Figure 1,2,3* can be regarded theoretical cases. There are almost innumerable possibilities of variation for relations between pillars. The outlined figures are basic categories, with the combination of which we can meet during the research work. The variation opportunities of the relations among pillars is almost endless. We can meet the combinations of the above outlined basic categories in some regional research projects. The separate examination of pillars and the spider web entropy analysis should always be made collectively because the separate explanation can be misleading. Although a lot of information can be received from both outputs, the picture will be complete only if the analysis is made together.

REFERENCES

- KÁPOSZTA, J. - NAGY, H. - ÖKRÖS, I. (2008): The examination of the macroeconomic coherences of competitiveness, concerning the transport infrastructure. International Agricultural Economics Scientific Days, Gyöngyös, 2008. 497-503 p. ISBN 978-963-87831-1-0.
- GODA, P. – TÓTH, T. – KOLLÁR, K. (2008): How to use the reductionist approach for evaluating subsystems to research the elements of the development. Bulletin of Szent István University 2008., p. 172-182., ISSN: 1586-4502
- GODA, P. (2012): Új rendszerszemléletű helyzetfeltérési módszer a vidéki területek fejlesztésében, doktori (PhD) értekezés kézirat, Gödöllő 2012.
- NAGY, H. – KÁPOSZTA, J. (2006): Economic development strategies and development zones in the European Union. SZIU Bulletin, 2006. ISSN 1586-4502 pp. 163-173
- NEMES NAGY, J. (1998): A tér a társadalomkutatásban (Bevezetés a regionális tudományba), Kiadó: Hilscher Rezső Szociálpolitikai Egyesület „Ember-Település-Régió” Budapest, 1998, 2 p.
- NEMES NAGY, J. (2009): Terek, helyek, régiók A regionális tudomány alapjai. Akadémiai Kiadó, ISBN 9789630586566
- NEMES NAGY, J. (szerk.)(2005): Regionális elemzések módszerek, MACROPOLIS, 2005 ISSN 1585-1419
- NÉMETH, N. (2005): A (területi) polarizáltság mérőszámai In: Nemes-Nagy J. (szerk.) Regionális elemzések módszerek, MACROPOLIS, 2005 ISSN 1585-1419
- PESTI, Cs. (2009): A mezőgazdasági termelés területi egyenlőtlenségeinek vizsgálata, doktori értekezés, Gazdálkodás- és Szervezéstudományok Doktori Iskola, Gödöllő, 2009

BEEKEEPING SECTOR ANALYSIS IN ROMANIA

GORUN LAURA MIHAELA, PĂUN ION OTIMAN, MIROSLAV RAICOV

* Banat's University Of Agricultural Sciences And Veterinary Medicine Timisoara,
Faculty of Agricultural Management Str.Calea Aradului Nr.117
ilauramihaela@yahoo.com

Abstract

Honey sweet food was first used by man until the discovery of sugar cane and beet sugar. Archaeological prove that the man began to eat honey since 10.000 years ago. Beekeeping practice started around the year 700 î. Hr. For centuries honey has been considered sacred items due to its sweet taste and its scarcity.

In our country, resource abundance and variety of spontaneous and cultivated bees provide honey nutrition, early spring until late autumn. In these circumstances, in recent years, beekeeping (an activity that does not require special investment) has become a profession for people whose existence is assured revenues from beekeeping.

It can be observed that both the number of bee families and the honey production have reached a significant growth.

Keywords: beekeeping, honey,types, production, cost.

INTRODUCTION

In ancient Egypt, honey was used in cooking, medicine and cosmetics.

For Romanian people, honey was so valuable that one could use to pay for taxes that were paid with gold.

Mead, an alcoholic beverage was processed with honey and highly prized by the ancients as had the name and the "nectar of the gods " .

Kings of Lower Egypt's first dynasty, considered "bee" their protective insect.

MATERIAL AND METHOD

To achieve the objectives of this work, the working method were used: data collection, processing, analysis and interpretation.

The research methodology for the theoretical part consists of consulting publications in correlation with the specific of the subject refered to in the current paper. The publications, books and brochures refer to the subject from the oldest times until present.

The research methodology for the statistical results comes from consulting data published by the INS (National Institute of Statistics) for a period of several years.

RESULTS

1. DEVELOPMENTS OF BEEKEEPIN SECTOR IN ROMANIA

Romania has a long tradition of farming and making honey bee products, beekeeping established itself like an independent occupation since ancient times, originally for the products (honey, pollen, royal jelly, propolis, beeswax and venom bees), and later, including the present, the contribution that these insects have increased yields of fruit, vegetables and seeds through pollination.

It can be observed that both the number of bee families and the honey production have reached a significant growth.

Table 1: Evolution of the number of bee colonies and honey production obtained

Years	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010 estimate
Families of bees thousands of families	614	745	781	839	888	920	975	1.086	1.109	1.110	1.280
Honey production thousand tons	11.74	12.59	13.43	17.40	19.15	18.19	18.19	16.76	20.03	21.50	23.700

Source: INS data

In Romania, the breeding of bees has grown particularly in favorable natural conditions.

2. TYPES OF HONEY

In Romania, in a normal year without weather problems, are carried about 20,000 tons of honey, the largest share being held by the multi-flower honey 50%, followed by honey locust - 35% and the made from lime, with a 15% share.

In Romania is obtained, usually high yields of honey, but are also sold on the domestic market as small amounts of honey consumption per person is among the lowest in Europe, 150 grams to 2 kg in Germany, followed The Netherlands and Belgium with 1.5 kilograms per person.

An important role in the production of bee is held by-products among which include: the pollen collected by collectors, propolis, royal jelly, beeswax, bee venom (apitoxins) and drone larvae triturations of commercial *apilarnil* known.

For the production of pollen is mentioned only a level of about 50-60 tons per year, mostly in the center and north of the country, but it can reach and even exceed 100 tons / year.

Table 2: Distribution of bee families on bee farms in 2009

Farm size (Number families)	Number of bee families	% from effective
1 – 50	627.823	56,56
50 - 150	265.676	23,94
over 150	216.501	19,50
TOTAL	1.110.000	100

Source: INS data

In the period 2007 - 2009 National Bee Program through support by the restocking of bee increased average of bee the category of holding between 1-50 from 14 families / 18 families apiary / apiary today and the remaining categories increased the number of families with 2.21% and 1.61%.

Currently, Romania is among countries with well developed beekeeping, as a consequence of this situation: large flocks of bee families we have, the amount of honey produced, diversification of production beekeeping scientific research results and training of specialists etc.

In our country, resource abundance and variety of spontaneous and cultivated bees provide honey nutrition, early spring until late autumn. In these circumstances, in recent years, beekeeping (an activity that does not require special investment) has become a profession for people whose existence is assured revenues from beekeeping.

It can be observed that both the number of bee families and the honey production have reached a significant growth.

3. FINANCIAL SUPPORT PROVIDED BY THE NATIONAL PROGRAM BEEKEEPING SECTOR APICULTURE PERIOD 2008 - 2010

In Romania, there are accredited and developed over the past two years, over 45 units bee multiplication farms providing beekeepers demand for restocking, to a single unit as it was until 2008.

Table 3: European and national financial aid for beekeeping sector apiculture, between 2008 - 2010

Years	Community Contribution	Contribution of Romania	Total amount approved and paid	Which:		%
	(€)	(lei)	(lei)	(€)	(lei)	
2008	1.985.267	6.717.150	2.493.978,28	333.417,76	1.128.119,00	16,80
2009	1.966.151	6.652.471	7.168.424,00	1.059.320,75	3.584.212,51	53,88
2010 estimate	1.975.931	6.685.562,5	12.014.808,00	1.775.500,00	6.007.404,00	89,85
Total	5.927.349	20.055.183,5	21.677.210,28	3.168.238,51	10.719.735,51	-

Sursa: date INS, Exchange: 4.2 lei

In 2007-2008 a total of 68 associative forms of payment files submitted, 65 were accepted and 3 were rejected for failure conditions of eligibility;

In 2008-2009 have submitted payment records of 79 associations and all forms have been accepted for payment;

4. HONEY IMPORTS AND EXPORTS OF ROMANIA

Principal market continues to be external, where more than 60% of local production reaches countries like: Germany, Great Britain, Italy, France, Austria and the USA, Canada, Japan or China.

Table 4: Situation of imports / exports in the period 2000-2009

SPECIFICATIONS	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
IMPORT - tons	137	506	739	232	52	21	63	315	777	515,5
EXPORT - tons	7.501	6.862	5.784	9.633	8.757	6.632	9.606	6.255	7.087	10.654

Source: INS data

Although Romanian honey is highly valued in foreign markets, it is recovered at low prices, because Honey external processors offer low prices that do not cover expenses in

beekeeping. Another reason for low price is that the romanian export honey is preferred “en gross “system.

5. HONEY PRICE DEVELOPMENTS IN ROMANIA

In 2008-2009 it was found a generally increasing trend in the price of honey in Romania. The graph shows the development “en gross” purchase price of the processor and retail prices in food markets (direct sales) in 2008 and 2009.

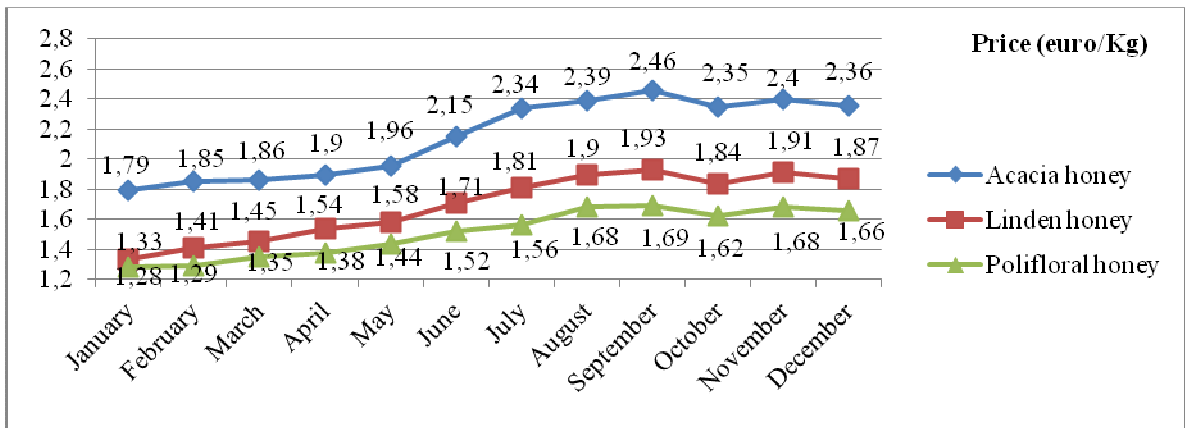


Fig. 1. Evolution of average price of honey in bulk in Romania in 2008

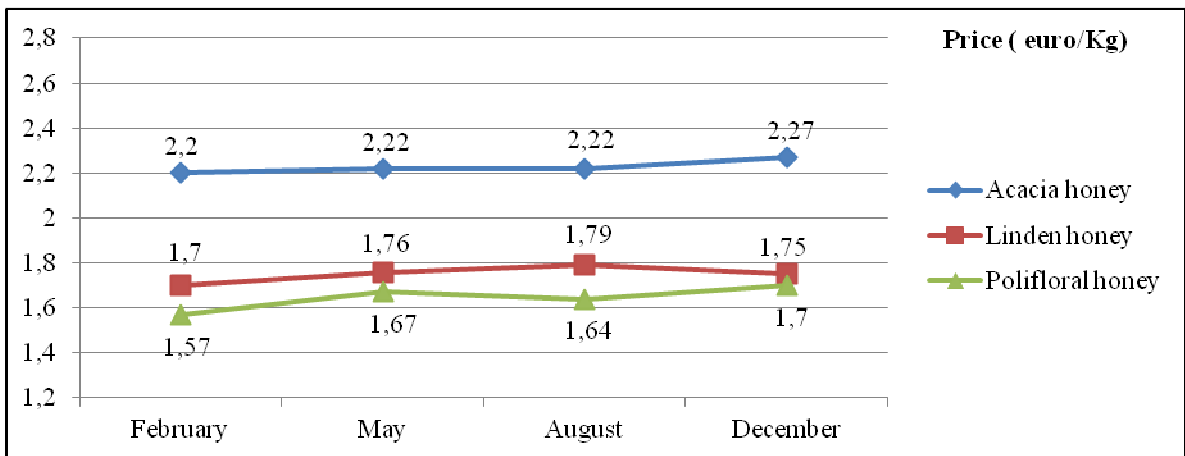


Fig. 2. Evolution of average price of honey in bulk in Romania in 2009

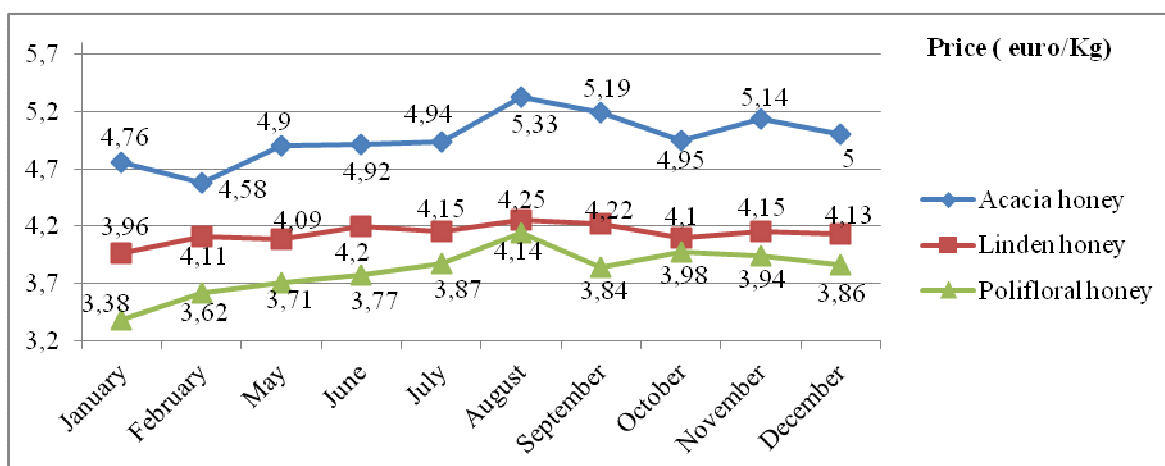


Fig. 3. Evolution of average selling price of honez paces in the market in Romania in 2008

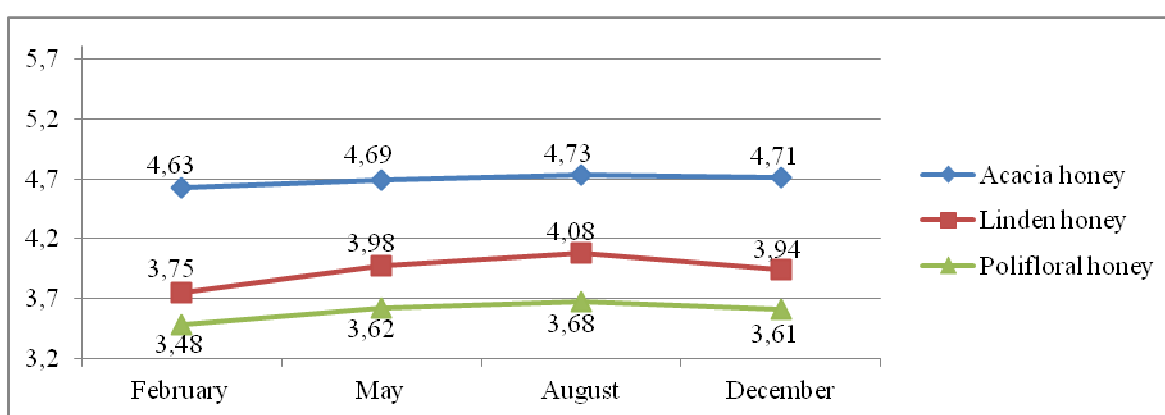


Fig. 4. Evolution of average selling price of honez paces in the market in Romania in 2009

6. THE ASSOCIATIVE FORMS OF BEEKEEPERS AND HONEY PROCESSORS

Beekeepers, honey and honey products processors honey as well as other chain partners are organized into associations, cooperatives, producer groups and federations, and are made as required by law.

Associations of beekeepers have legal personality and a local, county or national representation.

Representatives of legally established association forms hold regular meetings between beekeepers, processors and representatives of local and central governments in order to inform their members on specific legislation, on how to access forms of national or European aid.

CONCLUSIONS

Currently, Romania is among countries with well developed due to bee: large flocks of bee colonies that have the quantity of honey produced, bee production diversification, etc.. The economic benefits that help increase revenue from beekeepers are turning the key products of the hive.

In Romania, there are accredited and developed over the past two years, over 45 units bee multiplication farms providing beekeepers demand for restocking, to a single unit as it was until 2008.

The price was influenced by various factors such as general market developments globally, changes in foreign exchange, living standards, awareness of healthy nutrition in the population of Romania.

Principal market continues to be external, where more than 60% of local production reaches countries like: Germany, Great Britain, Italy, France, Austria and the USA, Canada, Japan or China.

The internal market has been characterized in recent years both in terms of a dynamic volume growth and diversification of raising the quality and assortment.

Beekeeping can be occupied an important segment of the labor force in scientific research, education, bee production and industrial sectors recovery, health and others.

Beekeepers, honey and honey products processors honey as well as other chain partners are organized into associations, cooperatives, producer groups and federations, and are made as required by law.

BIBLIOGRAFY

1. A. CHIRAN - Agricultural and food products market, Ceres Publishing House, 2004;
2. C. NEGRU - The Economics of food production, Timisoara, 2002;
3. C. VORNICU, ST. Lazar-Bee, Ed Alfa, 2007
4. D. BODESCU - Economic efficiency of beekeeping in Romania, Ed Alfa;
5. P. PIECE - Beekeeping, Ed Alexander;
6. *** Guide of good practices for organic farming

RADIATION EXPOSURE FROM THE RAW MATERIAL AND RESIDUES OF WORKERS IN THE INDUSTRIAL COMPLEX "NEWCO FERRONIKELI COMPLEX L.L.C" – DRENAS

FADIL HASANI¹, FATBARDH SALLAKU², NEXHAT BALAJ¹

¹Ministry of Environment and Spatial Planning – Prishtina, Republic of Kosovo

²University of Agriculture – Tirana, Republic of Albania

E-mail: fadil.bujanoci@gmail.com

ABSTRACT

In this study there are determined the levels of radiation doses to non enhanced materials (raw material) and the changing level of these doses of radiation after the technological enhances of the materials, respectively NORM (Naturally Occurring Radioactive Material) & TENORM (Technologically Enhanced Naturally Occurring Radioactive Material).

The directly field measurements are conducted by the detectors: Gamma spectrometer Gr-130; Inspector-EXP-Radiation Alert, TA-PUG-7A and Gama monitor- SGM-29-246. The field measurements indicate that the level of radiation dose of the natural background, raw material (ore, lignite and limestone) and residues (Converter slag, Electro filter dust, Slag from electric furnace and Sludge from electric converter gas scrubber) are from 75.00 nSv/h to 110.00 nSv/h.

Then samples from the field are treated in terms of physic-chemical aspect in the Centre of Applied Nuclear Physics in Tirana, where are determined the radionuclide's and also is determined the concentration of radiation, respectively in the laboratory of Gamma Spectrometry with Gamma instrument spectrometer - CANBERRA It is determined the Radionuclide and specific activity from Converter slag residues [Bq/kg] and the specific activity Gamma Total

Keywords: Radioactivity, Radiation, Activity, Norm, Tenorm

INTRODUCTION

The study of this research was to identify the level of potential exposure of workers in the Industrial Complex "NewCo. Ferronikeli Complex L.L.C" - Drenas. Meantime the goal was to inform and support the management of the company on their efforts to minimize radiation exposure to workers, which may occur as a source of raw materials and technological waste.

It is known that mining exploitation and technological processing minerals in the Republic of Kosovo are important industrial branches and within them are employed a large number of employees who may be subject of radiation exposure, however not only the employees but also the public near this complex and the environment in general.

Radionuclides that are in the nature are mainly classified: in primordial radioisotopes (⁴⁰K, ²²⁶Ra, ⁸⁷Rb, ²³⁸U, ²³²Th), secondary radioisotopes and cosmogenic radioisotope. The dimidiation time of primordial radioisotope is quiet a lot long and it is known that they survived since their creation, it means that their age is comparable to the age of the Universe. Secondary radioisotopes are as a product of decomposition of primordial radioisotopes while cosmogenic radioisotopes are the result of continuous bombarding of stable nucleus by cosmic rays (HOLMES-SIEDLE A., ADAMS L., 2006).

In recent decades it was a rapid technologic development and these technological products have resulted in the production of sub-products and waste so called TENORM (Technologically Enhanced Naturally Occurring Radioactive). The technical-technological

human activities have effected that with these activities to increase the level of radiation dose level to these radioactive materials, which are exposed not only to the employees directly involved in these activities, but also to the public near to these complex, and also the environment in general

Waste from TENORM are divided into four categories (EPA-ENVIRONMENTAL PROTECTION AGENCY, 1999):

1. Waste from Mining, mineral processing,
2. Waste from energy production - coal, oil, and natural gas,
3. Waste from water treatment – drinking water, industrial water, waste water,
4. Waste from consumed products.

MATERIAL AND METHOD

We performed two measurements during 2010 (April-October), direct measurements within the industrial complex. Then very carefully it has been taken the samples and their treatment in laboratories at the Center for the Nuclear Applied Physics in Tirana. In the first period we determined the level of basic radiation dose – Natural Background, then the radiation dose level of unprocessed materials and radiation dose levels after technological processes of materials, so we researched NORM - Naturally Occurring Radioactive Material / TENORM - Technologically Enhanced Naturally Occurring Radioactive Material.

Industrial Complex “New Co Ferronikeli Complex L.L.C” – Drenas

The Industrial Complex is located at a lower geographic region, namely in the Drenica region, about 30 km far away from Pristina, the capital of the Republic of Kosovo, (*Fig. 1*). It consists of two complexes, mining (1.5 km and 7.0 km the distance from the smelter) and the smelter. Currently the factory only works with one line because of the economic crisis, with a low export, but also it has not enough capacity for two lines. According to the operator’s information, the main products are Ferronikel blocks weighing 25 kg, with approximately 35% Ni content.

The production Ferronikel in Drenas includes preparing pre-metallurgical raw materials and the melting process. Therein, the material passes two ovens (rotary ovens), each with a length of 100 m and a width of 5.0 m, and then putted into the melting process in electric ovens. The capacity of the rotary oven and electric oven is around 12,000 t Ni / per year (NEWCO FERRONIKELI COMPLEX L.L.C, 2010).

Direct measurement and chemical-physical treatment of samples in Laboratories

During the measurements we performed 20-25 measurement within a short time, on a point of a material and it is calculated the average radiation dose of Gama Total of that material. At the same time, were taken the samples of waste from converter. Doses of radiation levels are measured in a height of 5 cm above the ground surface, and for the natural background in the height of 1 m above the ground surface. For this research are used the following radiation detectors: Gamma-spectrometer Gr-130; Inspector-EXP-Radiation Alert, The samples for laboratory analysis are carefully taken in the surface of 1 m² and in the depth surface of 5 cm.

The Center for Nuclear Applied Physics in Tirana, is well equipped with laboratories in

this field, starting for the laboratory of Radio-chemistry to the laboratories with spectrometric measurements. Sample has gone through the following preparations: The preparation of sample for analysis has passed through several procedures, so as they are broken in very small pieces, homogenized, dried, measured, etc. For Gamma Spectrometric measurement it is used the device gamma-spectrometer CANBERRA. Gamma-spectrometer can handle a wide range, ranging from large samples to smaller ones, in dishes from Marinelli, in bottles, filters, Petri dishes, etc. (CANBERRA- GAMMA SPECTROMETER - DETECTOR 2000).

With gamma spectrometric analysis it is determined the specific activity (Bq / kg) of the converter waste. There are identified radioisotopes and their activities.



Fig.1. Location of measurement and sampling in NewCo Ferronikeli Complex L.L.C
(FADIL 2010)

RESULTS

In the Republic of Kosovo the field of study from NORM / TENORM has not been researched a lot, unfortunately from the responsible institution - Kosovo Agency for Radiation Protection and Nuclear Safety we don't have yet any regulation which handles this field. Our researches used to deal with direct measurements that are performed near the surface of materials and treatment of sample in laboratory. The results of direct measurements are presented in *table 1*

Table 1. Data of ambient gamma dose rate measurement of natural background, raw material and residues, at the NewCo Ferronikeli Complex L.L.C (Fadil, 2010)

Location	Sample ID	Distance [m]	[nSv/h]
Natural background dose rate	FN-1	1.0	70
Ore (black and brown)	FN-2	0.05	86
Hard coal	FN-3	0.05	75
Converter slag	FN-4	0.05	110
Electro filter dust	FN-5	0.05	107

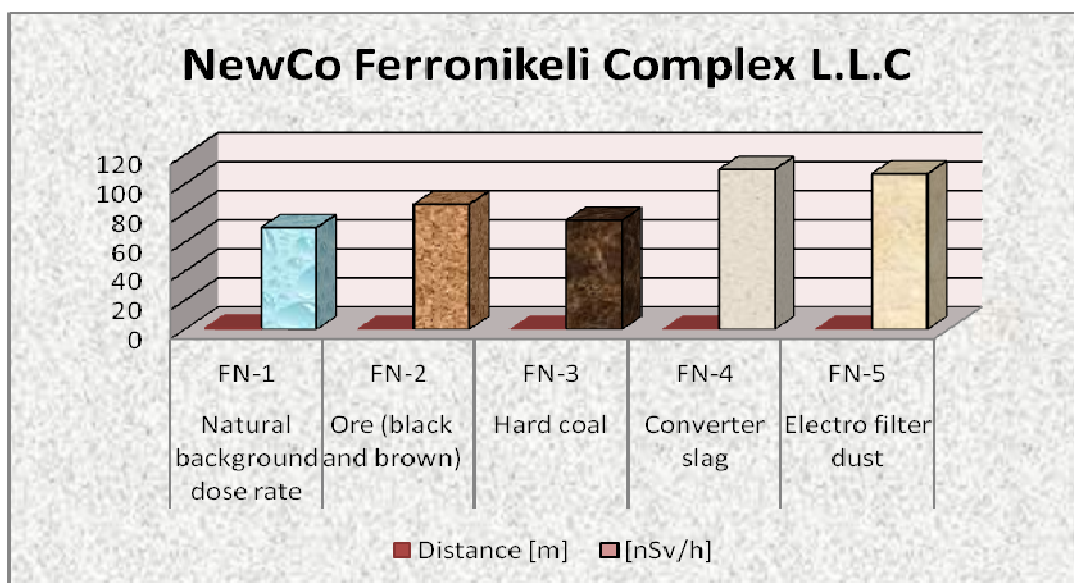


Fig.2 Data of ambient gamma dose rate measurement of natural background, raw material and residues, at the NewCo Ferronikeli Complex L.L.C - Drenas

From the obtained results it is shown that raw materials and waste are characterized by a low natural radioactivity. The results of direct measurements of levels radiation doses NORM/TENORM are within the interval of 75 nSv/h - 110 nSv/h. The worldwide average of natural background dose is about 2.4mSv/per year (UNSCEAR, 2008).

Relying on worldwide average of natural background we can assume that in a year an employee performs an average of 2000 working hours, then based on the calculations it is shown that he/she can receive a radiation dose of 0.189 mSv/year, only by the radiation of above mentioned materials (minerals, coal, waste from converter and dust from electro-filters). Based on the standards provided by the Euroatom Regulation (EURATOM 96/29, 1996), the equivalent allowed dose for professional workers exposed to radiation during an year on the average is 20 mSv/year. The maximum dose in any single year: 50mSv/year. For the public is: 1mSv/year. The measured and calculated doses on the basis of the above mentioned limits are on natural background level.

Therefore, these materials may be considered to pose no radiological concern for employees within the industrial complex and for the public that lives near the industrial complex. The sample from the field is treated in the laboratories of the Nuclear Applied Physics in Tirana, respectively in the laboratory of Gamma spectrometry (Gamma Spectrometry - CANBERRA). The determined results are presented in *table. 2*.

Table 2 Radionukleidet dhe aktiviteti specifik nga mbetjet e Konvertorit [Bq/kg] at the NewCo Ferronikeli Complex L.L.C – Drenas (FADIL, 2010)

Location	Radionuclide	⁴⁰ K	²²⁶ Ra	²²⁸ Ra	²²⁸ Th	²³² Th	²³⁸ U
Industrial Complex “Ferronikeli” Drenas Waste (scoria) from Converter	Concentration Bq/kg	37 ± 7	17 ± 4	6 ± 1	5 ± 1	5 ± 1	10 ± 3

Based on the obtained results it is shown that the values of the concentrations of all these radionuclide on the waste from converter are characterized by a very low radioactivity and can be classified as **NORM** (Naturally Occurring Radioactive Material). From the results we can see that we have increased levels of concentration since the natural background is in the interval 100 - 1000Bq/kg.

CONCLUSIONS

The overall purpose of this research, in this above mentioned industrial complex was: Determination of the level of radiation doses, detection of the presence of radioactive elements (radionuclide), their specific activity expressed in Bq/kg, analysis, review, information and assessment of potential risks. Researches in "NewCo Ferronikeli Complex L.L.C" - Drenas, in particular the radiological impacts of Technologically Enhanced Naturally Occurring Radioactive Material, especially the processing minerals and their waste, are of great interest.

Based on the results of the research we can conclude that the industrial complex "NewCo Ferronikeli Complex L.L.C" - Drenas including minerals and their waste from technologic processing in terms of radioactivity are low radiation sources. On the basis of the allowed maximum activity we come to a conclusion that these minerals and their waste can be used as construction materials or construction products.

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REFERENCES

- CANBERRA - GAMMA SPECTROMETER - DETECTOR (2000): Gamma Analyst Integrated, radiation detection, analysis software and radiation instrumentation,
- EISENBUD M. GESELL T. (1997): Environmental Radioactivity, 4th ed., Academic Press, San Diego, 135-201,
- EPA-ENVIRONMENTAL PROTECTION AGENCY (1999): Evaluation of EPA's guidelines for Technologically Enhanced Naturally Occurring Radioactive Materials (TENORM
- EURATOM 96/29 (1996): EC, Council of the European Union, Council Directive, laying down Basic Safety Standards for the Protection of the Health of Workers and the General Public against the Danger arising from Ionising Radiation, OJ No. L159 29/06/1996, Office for Official Publications of the European Communities, Brussels,
- HOLMES-SIEDLE A., ADAMS L, (2006): Handbook of Radiation Effects, 4th ed., Oxford University Press, Oxford, 19-25,

IAEA (2004): Occupational Radiation Protection in the Mining and Processing of Raw Materials, Safety Guide, IAEA Safety Standards Series No. RS-G-1.6, IAEA,
ICRP (1997): Publication 77 : Radiological protection policies for the disposal of radioactive waste, Annals of the ICRP, Vol. 27 supplement (1997),
ICRP (2007): The 2007 Recommendations of the International Commission on Radiological Protection, ICRP Publication 103, Ann. ICRP 103, Elsevier Ltd,
SOURCE: NewCo Ferronikeli Complex LLC.
UNSCEAR (2008): "Sources and Effects of Ionizing Radiation",

UNGULATE IMPACT ON DIFFERENT BEECH REGENERATION SITES

PÉTER HEJEL, KRISZTIÁN KATONA, LÁSZLÓ SZEMETHY, SZABOLCS BÉKÉSI

Szent István University, Gödöllő, Faculty of Agricultural and Environmental Sciences,
Institute for Wildlife Conservation
H-2100 Gödöllő, Páter K. street 1.
hejel.p@gmail.com

ABSTRACT

Forest game damages lead to a serious conflict between forest and game managers, both in Hungary and worldwide. For forestry units the most important source of incomes is the logging. However, ungulates can have serious local browsing pressure on reforestation sites by their normal feeding activities.

Foresters believe that the only way for reducing that damage is the radical reduction of number of large herbivorous game species (mainly red deer) in the forest. But for game managers a suitable level of ungulate density is necessary to gain incomes from hunting. As a consequence there is no agreement about the ecologically and economically sustainable ungulate density and impact. To decrease this difficult contradiction we need scientific data about the real browsing effect of large herbivores on forest vegetation of different characteristics.

In this study we investigated the available food supply and the browsing effect of ungulates on artificial and natural beech regeneration sites of different ages. Density of beech saplings and number of available and browsed sprouts of all woody species present were estimated.

We found significantly more beech saplings and sprouts and also higher browsing impact on beech in the natural than in artificial sites. Although we did not reveal a clear linear correlation, the highest browsing values (more than 20%) were detected when the proportion of the alternative food supply was less than 10%. We propose to maintain natural species diversity in beech regeneration sites from the very first period for giving chance to ungulate species not to browse target tree species. Based on our results diverse woody vegetation can have a great importance not only in artificial monospecies beech regeneration sites, but even in case of natural beech regeneration.

Keywords: forest management, game damage, deer, browsing, food supply

INTRODUCTION

Forest game damages cause serious conflicts between forest and game managers (FESTA-BIANCHET, 2007; KATONA ET AL., 2007). Forestry units obtain significant incomes from logging (FARAGÓ, 2006). However, ungulates can have serious local browsing pressure on reforestation sites by their normal feeding activities (PUTMAN & MOORE, 1998). This problem resulted in establishing more than 7500 km fences in Hungarian forests (KATONA ET AL., 2011). This kind of separation of large herbivores from their habitats should not be the best solution to prevent forest game damages. Foresters suggest that the best way for reducing those damages is the radical reduction of number of large herbivorous game species (mainly red deer, *Cervus elaphus*) in the forest (BARTHA, 2000; PUTMAN & MOORE, 1998). But for game managers a suitable level of ungulate density is necessary to gain incomes from hunting. We believe that handling this problem from both sides, by improving the habitat quality and regulating game density would be effective (KATONA ET AL., 2011).

In our recent studies we analysed and compared the “ungulate-habitat” relationship in different beech (*Fagus sylvatica*) regeneration sites. We described in all areas the forest regeneration capability, the food supply for game species and ungulate impact on forest regeneration.

We assumed that there are more beech saplings and sprouts as deer forage in the natural sites than in artificial ones and more in elder than in younger ones. This is because usually the artificial regeneration starts with much lower sapling density than natural one (e.g. 8000-10000 vs. 10000-60000 item/ha) and there should be much taller saplings with more sprouts in elder sites than in younger ones.

We hypothesised less browsing impact on beech in areas with richer and more diverse food supply. It is based on our earlier results, that alternative woody browse supply available in an area can deprive browsing impact from main target tree species (e.g. beech) not preferred by ungulates (KATONA ET AL., 2011).

In this paper, therefore, we were looking for answers for questions below:

- 1.) Is there more beech saplings (as regeneration unit) and sprouts (as ungulate forage) in the natural beech regeneration sites than in the artificial ones?
- 2.) Is there richer forage supply (more beech sprouts) to ungulates in the elder than in younger sites?
- 3.) Is there less impact on beech by ungulate browsing in the natural regeneration sites than in the artificial ones?
- 4.) Is there any positive influence of more diverse species composition on level of browsing impact?

MATERIAL AND METHOD

The study area was located in the operating area of Mátrafüred Forestry of Egererdő joint-stock company (within 3,5 km radius from a centroid with coordinates: 47°89'N, 19°93'E). This company cultivates approx. 74000 ha state owned forest in Mátra and Bükk Mountains. Those woodlands are medium quality from an economical point of view, but ecologically these are very valuable habitats; 68% of their total range is under environmental protection. The three main forest types of these areas are sessile oak forests (3443 ha, 33,7%), beech forests (2633 ha, 25,8 %) and hornbeam- oak forests (2805 ha, 27,4%).

We designated six different beech regeneration sites of even-aged forestry system for comparison. We categorized those areas by its age since year of last total harvesting (1-2; 5-6; 8-10 years) of area and regeneration type (natural or artificial). These sites were situated from each other within a distance of between 0,5 and 7 kilometers. We tried to find areas with similar environmental conditions and representative for the general view of beech regeneration sites in their vegetation and management.

Ungulate density in the hunting area containing these sites was 0,07 individual per hectare in the studied year (2009). Estimated number of large game species is as follows: 730 individuals; in detail: 150 wild boars (*Sus scrofa*), 200 mouflons (*Ovis aries*), 130 roe deer (*Capreolus capreolus*) and 250 red deer (NATIONAL GAME MANAGEMENT DATABASE).

We collected seasonal field data four times (March, May, July, November) in 2009. For field sampling we followed our methods elaborated in our previous studies (KATONA ET AL., 2011; SZEMETHY ET AL., 2004). We designated transect lines with a total number of 25-50 sampling points by 5-10 meters distances in each sampling area.

Signs of ungulate presence (tracks, bed-sites, droppings) were recorded between sampling points. At the sampling points we counted the number of sprouts of all woody species available and accessible for large herbivores and that of browsed ones in the understory layer. We had four height categories: between 0 and 50, 50 and 100, 100 and 150, 150 and 200 cm from the ground surface. We estimated the number of sprouts available and

browsed in a sample unit of 50 x 50 cm in all vertical levels within a depth of 30 cm from the front side of the quadrant. We registered the fresh and elder damages caused by ungulates separately based on the shape, pattern and colour of the damaged plant surface. We were not able to distinguish which ungulate species caused the damage. However, the dominance of red deer in these areas suggests that this species was the main consumer. We also counted the number of beech saplings at the sampling points in a quadrant of 2 m². However, we have no data on saplings from winter.

For comparison between natural and artificial regeneration sites within age classes in the same season Mann-Whitney U-tests were used after running Kolmogorov-Smirnov normality test. Age classes were compared within the type of regeneration by Kruskal-Wallis tests followed by post-hoc Dunn's multiple comparisons tests in all seasons.

RESULTS

Our results show that there were significantly more beech saplings in the natural sites than in artificial ones in most cases (except 5-year-old in summer and 10-year-old in autumn) (Mann-Whitney U-tests: $p < 0,01$) (Figure 1).

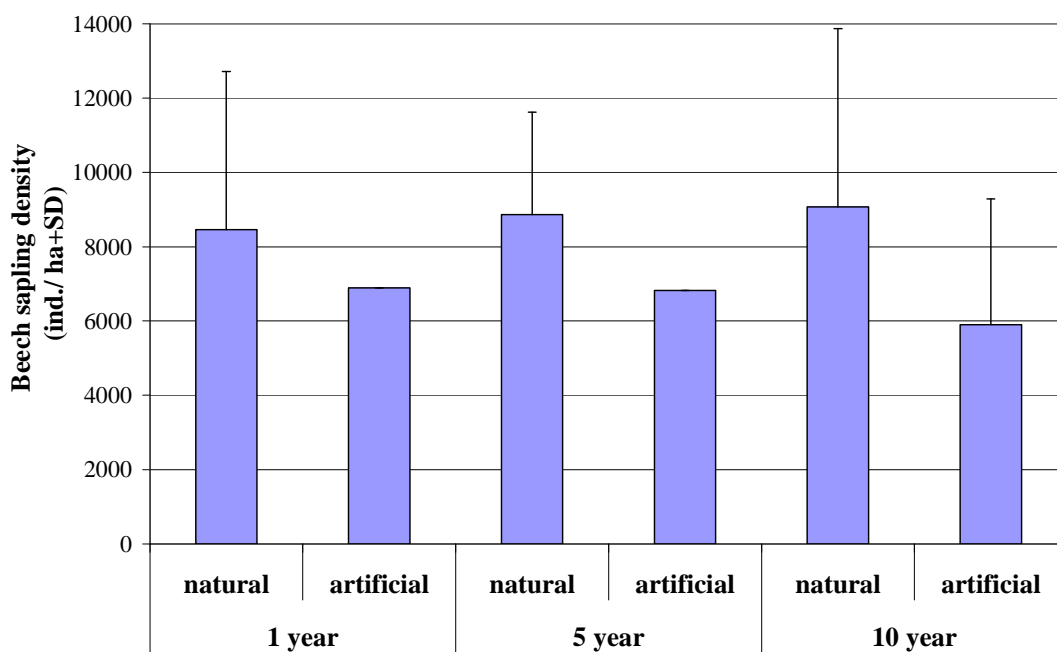


Figure 1. Density of beech saplings in natural and artificial regeneration sites of different ages

We revealed that there were significantly more beech sprouts as food supply in the natural sites than in artificial ones in most cases (except 5-year-old in summer and in winter) (Mann-Whitney U-tests: $p < 0,05$) (Figure 2). Sprout density significantly increased with the age of the regeneration sites (Kruskal-Wallis-tests: $p < 0,001$).

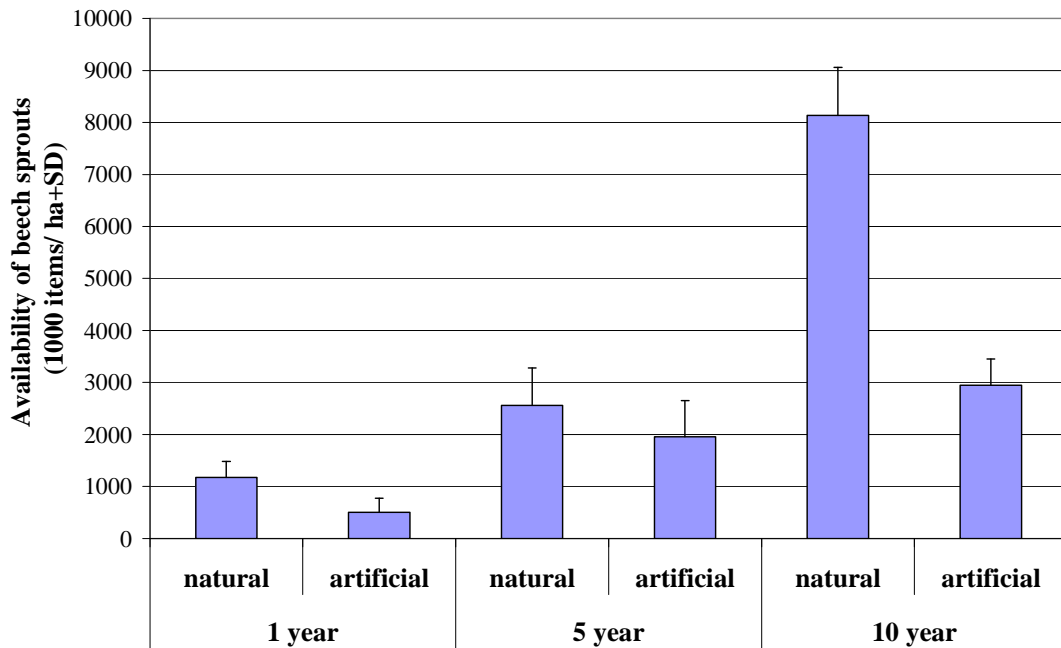


Figure 2. Availability of beech sprouts as food supply in natural and artificial regeneration sites of different ages

We found that the proportion of all (freshly and elderly) browsed beech sprouts to the total beech sprout number was significantly higher in the natural sites than in artificial ones in most cases (except 5-year old in spring and in summer and one-year old in winter) (Mann-Whitney U-tests: $p < 0,05$) (Figure 3).

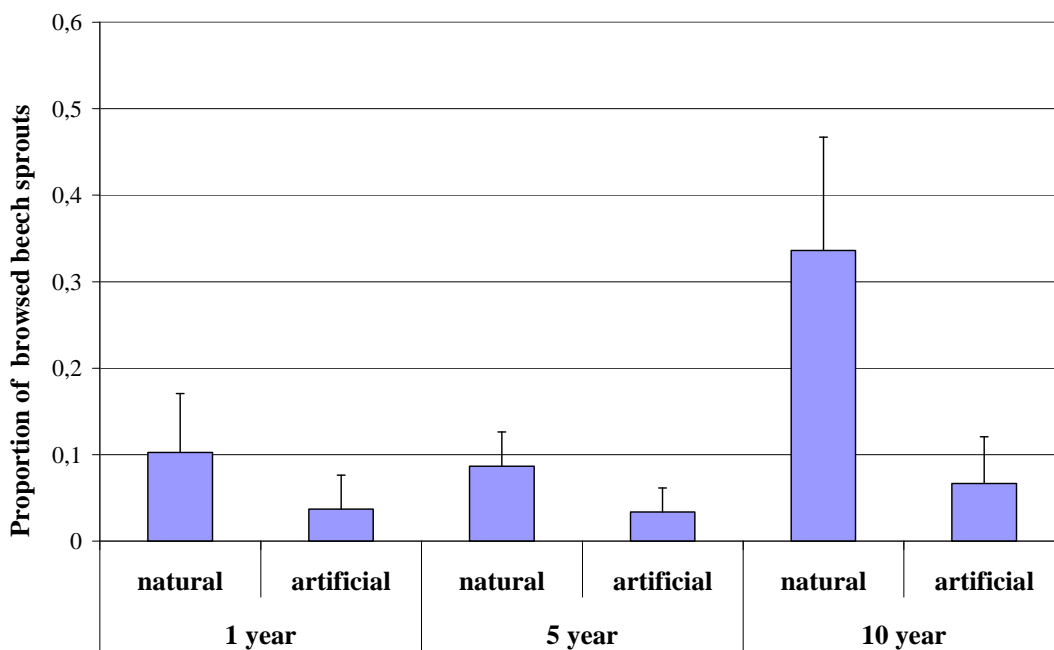


Figure 3. Browsing impact on beech in natural and artificial regeneration sites of different ages

There was no significantly strong relationship between the availability of alternative food supply (proportion of beech in the food supply) and browsing impact on beech (proportion of browsed beech sprouts) (Spearman-correlation: for all browsing: $N=24$, $R=0,32$ $p=0,13$; for fresh browsing: $N=24$, $R=-0,15$ $p=0,49$). However, in case of the highest browsing values found (more than 20%), the proportion of the alternative food supply was less than 10 % (Figure 4).

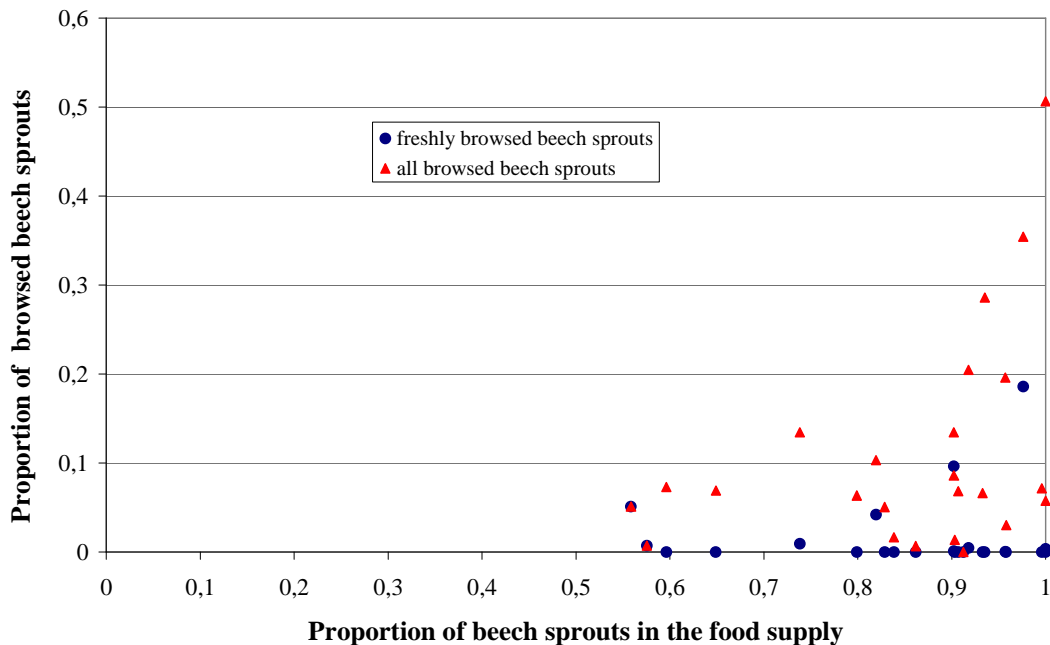


Figure 4. Relationship between availability of alternative food supply and browsing impact on target tree species (beech)

CONCLUSIONS

Our results revealed higher sapling density and sprout availability of main target tree species (beech) in natural than in artificial regeneration sites. It is not surprising, as the artificial regeneration starts with much lower sapling density than natural one because of the high costs of regeneration material and works. However, in this study the beech sapling density in the natural regeneration sites was not too high relative to another beech forest investigated in Pilis Mountains and managed by selection cutting system. There the density of beech saplings ranged within an interval of 29000 and 45000 saplings per hectare (KATONA ET AL., 2009).

Based on our earlier results (KATONA ET AL., 2011) we expected less browsing impact on beech in areas with greater and more diverse food supply (with more alternative food besides beech). We hypothesised more diverse woody species composition and less browsing effect in natural sites than in artificial ones, but we found the opposite. Availability of more various food supply in artificial sites could be a consequence of suboptimal environmental quality of those sites for beech resulting in the expansion of alternative woody species. In natural regeneration sites however, beech can benefit from the more advantageous habitat characteristics and could be able to suppress the growing of other woody species. As we found the highest browsing impact on beech in case of the highest beech proportion in the food supply, we propose to maintain natural species diversity in regeneration sites from the very first steps. It can give chance to ungulate

species not to choose our target tree species (beech) for consumption. Based on our results diverse woody vegetation can have a great importance not only in artificial monospecies beech regeneration sites, but even in case of natural beech regeneration.

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REFERENCES

- BARTHA, P. (2000): Erdőgazdálkodás a XXI. század küszöbén. Erdészeti Lapok, Volume CXXXV. Number 12. pp. 357-358.
- FARAGÓ, Z. (2006): Erdő- és vadgazdálkodás Magyarország tetején. Erdészeti Lapok, Volume CXXI. Number 12. pp. 427-428.
- FESTA-BIANCHET, M. (2007): Density dependence in deer populations: relevance for management in variable environments. In: FULBRIGHT, T.E., HEWIT D.G.: Wildlife Science, CRC Press. 384. p.
- KATONA, K., SZEMETHY, L., CSÁNYI S. (2011): Forest management practices and forest sensitivity to game damage in Hungary. Hungarian Agricultural Research, Volume 20. Number 1. pp. 12-16.
- KATONA, K., SZEMETHY, L., HAJDU, M., CSÉPÁNYI, P. (2009): A folyamatos erdőborítás és a vadállomány harmonikus kapcsolata a Pilis-tető bükkösein. Erdészeti Lapok, Volume CXLIV, Number 7-8. pp. 240-242.
- KATONA, K., SZEMETHY, L., NYESTE, M., FODOR, Á., SZÉKELY, J., BLEIER, N., KOVÁCS, V., OLAJOS, T., TERHES, A., DEMES, T. (2007): A hazai erdők cserjeszintjének szerepe a nagyvad-erdő kapcsolatok alakulásában (The role of understory in the ungulate-forest relationship, with an English abstract). Természetvédelmi Közlemények, Volume 13. pp.119-126.
- PUTMAN, R.J., MOORE, N.P. (1998): Impact of deer in lowland Britain on agriculture, forestry and conservation habitats. Mammal Review, Volume 28. pp. 141–164.
- SZEMETHY, L., KATONA, K., SZÉKELY, J., BLEIER, N., NYESTE, M., KOVÁCS, V., OLAJOS, T., TERHES, A. (2004): A cserjeszint táplálékínálatának és rágottságának vizsgálata különböző erdei élőhelyeken (Comparison of the forage availability and browsing in the understory in different Hungarian forested areas, with an English abstract). Vadbiológia, Volume 11. pp. 11-23.

EVALUATION OF THE WILDLIFE MANAGEMENT PRACTICE OF LISZT FERENC INTERNATIONAL AIRPORT

MIKLÓS HELTAI, FERENC MARKOLT, BÁLINT TÓTH, GERGELY BALÁZS, VIKTOR GRÓNÁS AND NORBERT BLEIER

Szent István University
Faculty of Agricultural and Environmental Sciences
Institute for Wildlife Conservation
H-2100 Gödöllő, Páter K. u. 1.
heltai.miklos@gmail.com

ABSTRACT

We investigated the wildlife strike data of years from 1997-2011 of Liszt Ferenc International Airport. The number of carcasses found on the airport increased till the year 2006, then, after a steep fall it became stabilized. Most of the strikes/found carcasses indicate presence of bird species, amongst these Common Kestrel (*Falco tinnunculus*) and Common Buzzard (*Buteo buteo*) have a remarkable occurrence. In the previous five years birds' trend suggests decreasing, whilst mammalian species' trend shows upward tendencies. Its reason is that the continuously growing tool-collection of the utilized management methods is mainly suitable against bird species.

Keywords: airport, wildlife strike, wildlife management

INTRODUCTION

Wildlife-aircraft collisions (wildlife strikes) cause gradually growing problems worldwide (MACKINNON, 2004; BREUER, 2005; DOLBEER & WRIGHT, 2008). Any of the airports can avoid the threats deriving of wildlife presence. For evaluation and effective management of these threats the following nine questions must be answered, according to CLEARY AND DOLBEER (2005).

1. What are the wildlife doing that make the control of their numbers or damage necessary?
2. Which species of wildlife are causing the problem?
3. Why are the wildlife species on the airport?
4. What are the daily and seasonal movement patterns of the wildlife among feeding, loafing, and roosting/nesting areas?
5. What is the legal status of the problem species?
6. What effective and legal management methods are available?
7. How selective are these control methods?
8. How much will it cost to apply the selected control methods?
9. What are public attitudes toward the problem wildlife species and the hazards that these species pose?

To mitigate the hazards at airports development and implementation of integrated wildlife hazard management plan is needed (MACKINNON, 2002; HESSE ET AL, 2010). The management plan has to include all the possible management/control strategies such as: aircraft flight schedule modification, habitat modification and exclusion, repellent and harassment techniques, and wildlife removal (CLEARY AND DOLBEER, 2005).

The relatively big body-size mammal and bird wildlife species that inhabit, move in, or temporarily occur at airports, and airfields pose increasing number of aviation safety matters at the Liszt Ferenc International Airport managed by Budapest Airport Ltd. and similarly at other important international aerodromes of other nations, and continents. Most of these species are on a particular protection level. Management of game species (such as common magpie (*Pica pica*), European (brown) hare (*Lepus europaeus*), red fox (*Vulpes vulpes*), European roe deer (*Capreolus capreolus*), or stray animals as well) may be realized under the control of the Hunting Act (Act No. LV of 1996 on the Protection of Game, Game Management, and Hunting), since management of protected species are regulated in the Nature Conservation Act (Act No. LIII of 1996 on Nature Conservation in Hungary). The Budapest Airport Ltd. has already utilized numerous different mitigation methods to date, but the effectiveness of these measurements have not been studied yet. Thus, our aim was to evaluate the efficiency of the methods used so far and to discover tools, technologies, and treatment forms, which, based on this investigation, could be further applied to practice.

MATERIAL AND METHOD

Data of 1997–2011, which were noticed by the wildlife management staff of the aerodrome, were provided to us by the Budapest Airport Ltd. Concerning this timeframe we have examined the followings:

- ▲ number of dead found animals on airport, number of mammal and bird species;
- ▲ type of the utilized methods, and time of application;
- ▲ monthly changes in wildlife strike frequencies.

RESULTS

First of all we investigated the number of dead found animals, having the presumption, that carcasses deriving from the surrounding area of runways may be considered as direct consequences of an aviation-related factor (mainly crash or collision). When looking at the whole 15 years (the last quarter of the year 2011 is missing), two periods can be distinguished. The first lasts 1997–2006, the second is the time passed since the end of the first section. These two sections may be characterized by different trend and numbers. Number of carcasses of the first period (1996–2006) is rather variable. Between 1997 and 2000 a steep rise, a fluctuating but more-less stable tendency till 2004, and a remarkably high value in 2005 were characteristic. Later comes a sharp fall till 2007, when a gradually increase starts and lasts till 2009. Within the last two years this trend broke and important to see that the numbers have not grown further. Anyway, data of the previous five years (second period) show different patterns, fairly lower values as it is in the first period. However, years between 2004 and 2006 must be highlighted as the most “dangerous” time (*Fig. 1*). Differences before and after 2007 can be very well explained with the fact that in 2007 a plenty of mitigation methods were implemented, and maintained, later on. This indicates a qualitative difference amongst the two distinguished periods (*Table 1*). Summarized numbers of wildlife strikes of every three years, in regard of belonging to birds or mammals, show clearly the definite majority of birds. Yet cannot we skip the importance of mammal species since those have become a permanent participant of the last decade’s airport wildlife hazard issues (*Fig. 2*).

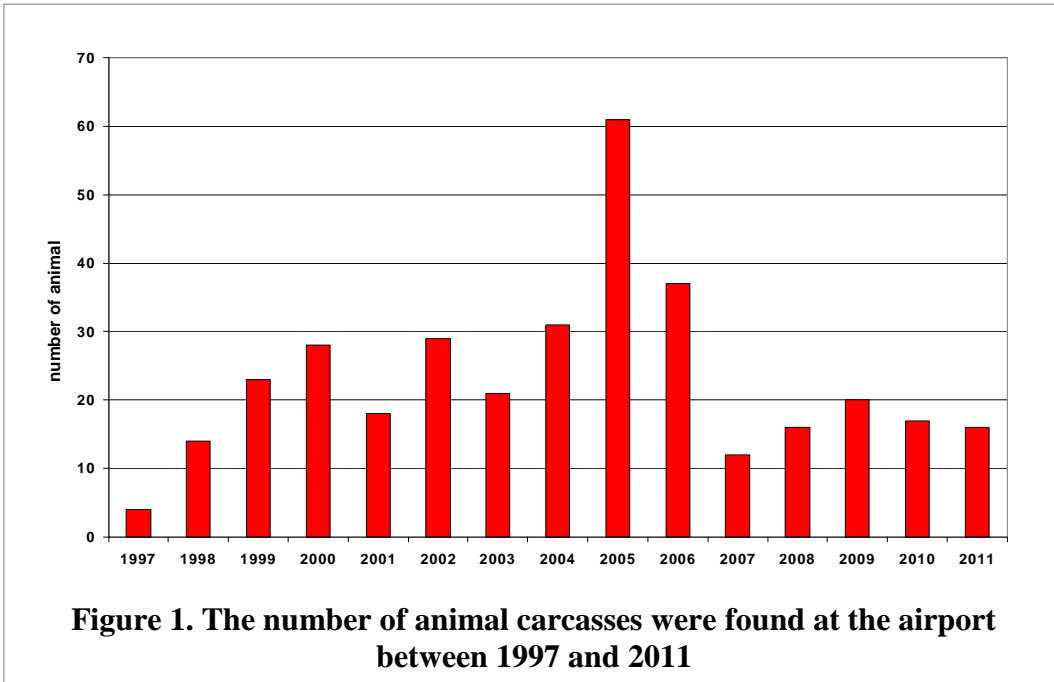
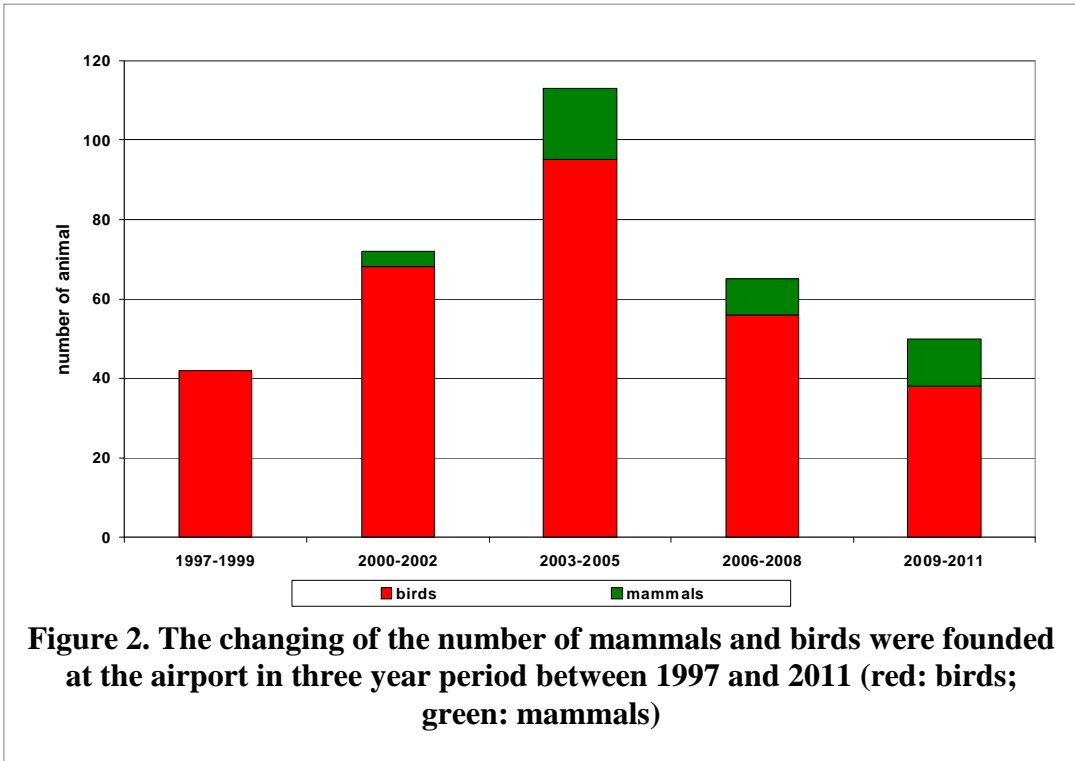


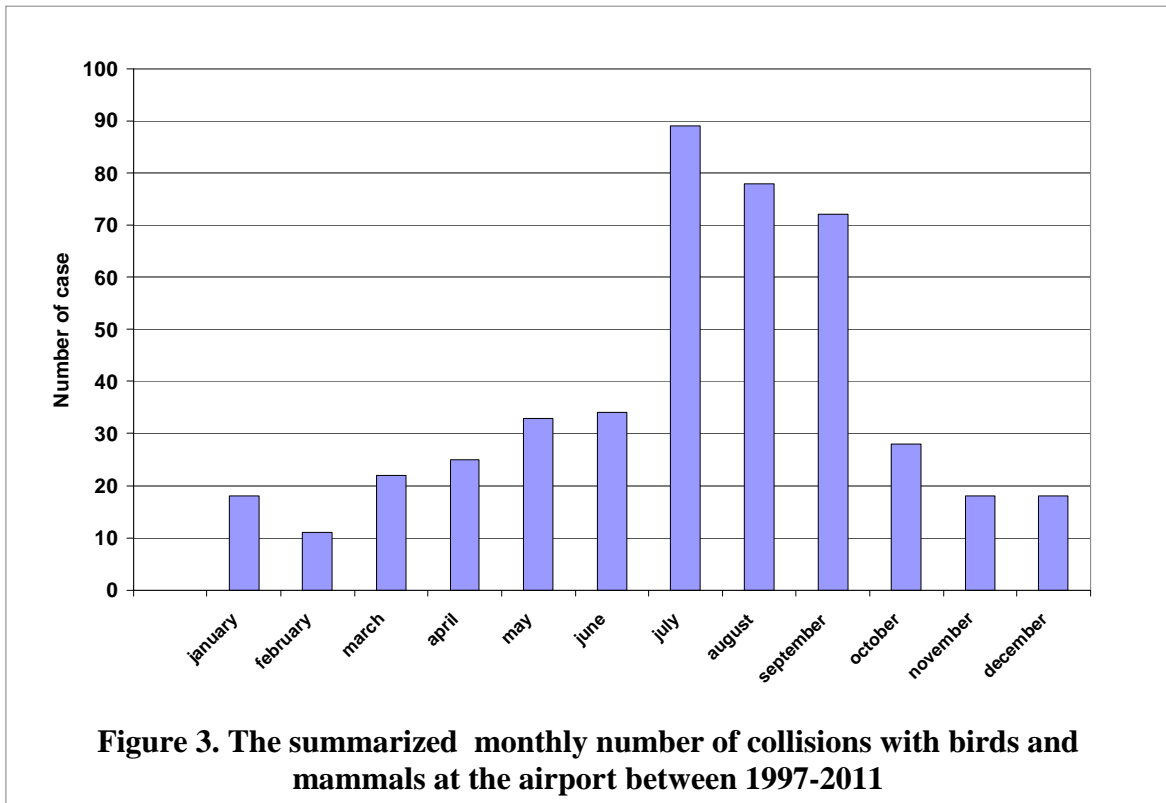
Table 1. Particular management methods, and time of application.

Methods	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Moved sound canon															
Shot gun															
Fixes sound canon															
falconry															
wingaway															
scarecrow															
traping															
Nest removal															
dog															
spike															
BC bio sonic equipment															
pyrotechnics															
Alarm gun															
Dibble (T-tree)															
Code 3															
Stone marten trap															
Larsen trap															

Found and identified bird carcasses originated from 30 different species (this includes the error of the possible mistakes at the identification). Most of these were only occasional, not regular occurrences within the whole examination period (such as white stork (*Ciconia ciconia*), European nightjar (*Caprimulgus europaeus*), white wagtail (*Motacilla alba*), etc.), so we classified them as “other species” at the analyses. Taking a look on the more frequented species allows seeing a well drawn pattern; in most of the cases carcasses of two bird species, Common Kestrel (*Falco tinnunculus*) and Common Buzzard (*Buteo buteo*), were found, according to the three-year summaries.



Wildlife strike within-year distributions are not homogeneous in the whole year. The most problematic period starts in May and lasts till the end of October. Exceptionally high numbers are characteristic in July, August, and September. Monthly frequency of finding carcasses between July and September is 2-3 fold of the annual average. This general trend applies to the whole study period, from 1996 to 2011. This can be explained by two reasons. Firstly by the inexperience of young, and on the other hand, in case of bird species that are preparing to the migration, by their gathering into larger groups, and their increased space use (*Fig. 3*).



CONCLUSIONS

The management of game and protected species at the Liszt Ferenc International Airport is strictly regulated (often limited) by the legal background. In case of protected species managers must initiate negotiation with the Inspectorate for Environmental Protection, Natural Protection and Water Management in order to ensure the unlimited removal of individuals both in time and number. In cases where the Hunting Act is relevant, managers must have exact proposals that clarify the obvious right and obligation for performing protection and mitigation measures with all the possible and suitable tools at non-hunting areas. After reviewing the scale and results of the airport wildlife hazard management measures were used to date, and the other possible measures that can be found in the international literature we have the following suggestions:

- ⤴ The toolkit of the measurement techniques must be continuously widened. Based on our results it is unambiguous that the more diverse techniques are used the larger their impact is. This is in line with the international experiences.
- ⤴ When widening the toolkit of the mitigation techniques and exceptional attention must be paid to the techniques against mammal species. Experiences so far indicate the need of improvement in this field, since, at slightly decreasing general tendencies, the number of mammal strikes are rising.
- ⤴ According to the international experiences the utilization of lethal techniques cannot be avoided due to the appropriate effectiveness. Each repellent activity should be completed by occasionally lethal techniques, which will strongly increase the impact of the protective measures.

Protective measures against bird strikes to date can be considered successful, whilst against

mammals unsuccessful – based on the analysis of the wildlife manager’s notes. As it was seen in case of managing bird strike numbers, widening the toolkit of management techniques against mammal strikes is equal important (*Table 2*).

Table 2. Summary of applied and applicable management techniques against mammals

occurred mammal species	currently used techniques	possible techniques	advised techniques
European badger	live trapping	Live trapping, lethal trapping, shooting, fumigants	implementation of lethal trapping
bat species	-	ultrasonic device	-
dog	live trapping, capturing, driving out	live trapping, lethal trapping, shooting	implementation of lethal trapping, shooting
cat	live trapping, capturing, driving out	live trapping, lethal trapping, shooting.	live trapping
brown hare	-	live trapping, lethal trapping, shooting	capturing , shooting
stone marten	live trapping	live trapping, lethal trapping, shooting	implementation of lethal trapping
roe deer	capturing, driving out	propane cannons, pyrotechnics, shooting	shooting (with non-ricocheting bullets, night-vision, noise suppresser)
red fox	live trapping, driving out	Live trapping, lethal trapping, shooting, fumigants	implementation of lethal trapping

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REFERENCES

- BREUER M. (2005): Bird strike statistics of German aviation 2003 – 2004. Bird and Aviation, Volume 25, Issue 2
- CLEARY E. C., AND R. A. DOLBEER (2005): Wildlife hazard management at airports, a manual for airport personnel (2nd edition). U.S. Department of Transportation, Federal Aviation Administration, Office of Airport Safety and Standards, Washington, DC USA. 348 pages
- DOLBEER R. A., AND S. E. WRIGHT (2008): Wildlife strikes to civil aircraft in the United States, 1990–2009. U.S. Department of Transportation, Federal Aviation Administration. Washington, DC, USA. 81 pps.
- HESSE G., REA R. V. & BOOTH, A. L. (2010): Wildlife management practices at western Canadian airports. Journal of Air Transport Management, 16, 185-190.
- MACKINNON B. (EDS.). (2002): Wildlife Control Procedures Manual. Safety and Security, Aerodrome Safety Branch. TP11500E. Ottawa, Ontario.
- MACKINNON B. (EDS.). (2004): Sharing the skies: an aviation guide to the management of wildlife hazards. Transport Canada, Aviation Publishing Division, Tower C, 330 Sparks Street, Ottawa, Ontario, K1A 0N8 Canada. 322 pps.

COMMUNITY PLANNING AS A SOLUTION FOR THE CHALLENGES OF THE SPATIAL DEVELOPMENT

IZABELLA OLÁH - HENRIETTA NAGY – IMRE ÖKRÖS

Szent István University, Faculty of Economics and Social Sciences
Institute of Regional Economics and Rural Development
H- 2100 Gödöllő, 1 Páter K. str.
olah.izabella@gtk.szie.hu

ABSTRACT

One of the weakness points of the Hungarian local development practice is that the participants of the development are not able to recognize the problems of the specific area, the objectives of the community. One of the methods of the regional development is to involve "external" experts, which has several disadvantages like the collected information are centralized in one hand and the decisions are made in that way, so not all of the local actors' expectations are realized in the final plan. The base of the community planning is the early participation of the local actors in planning process. Hereby the community interests and goals are able to integrate into the final plan. The advantage of this type of planning is that all participants agree on the process and is committed to its implementation. In our research we intended to lit up the advantages of the planning methods as well as the difficulties during their application. Based on the information accumulated, it seems that the community planning requires more energy but still, the development which can be achieved is more successful.

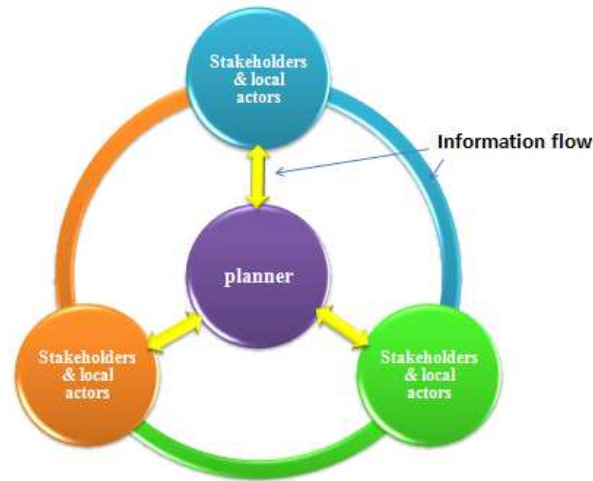
Keywords: community planning, rural areas, development

INTRODUCTION

The spatial development practice of Hungary cannot really be considered as successful as that of Western-Europe (KÁPOSZTA ET AL., 2010). Although the players of spatial development involve municipalities, local businesses, civil organizations, even the development concepts set up by them do not guarantee the success. In many cases it happens that they cannot subscribe to the aims and values defined in the plans, and they do not take the aims into account that they set earlier by themselves. In general, the local population does not have the appropriate information about planning and investments, therefore they do not identify themselves with the investments and the developments do not become an essential part of the community. Thus they do not feel that they must protect and take care of the public good that has been created (TÓTH ET AL., 2006).

MATERIAL AND METHOD

One of the basic characteristics of spatial development is the planning by "external" experts, which has a lot of shortages and its results can be questioned as well. The origin of the problem is that the planner turns to the players of the society whom he/she considers important and the information provided by them is concentrated only in the hands of the planner. On the basis of such information the decision is made by the planner alone.



Source: own editing, 2012

Figure 1: The scheme of planning carried out by external experts

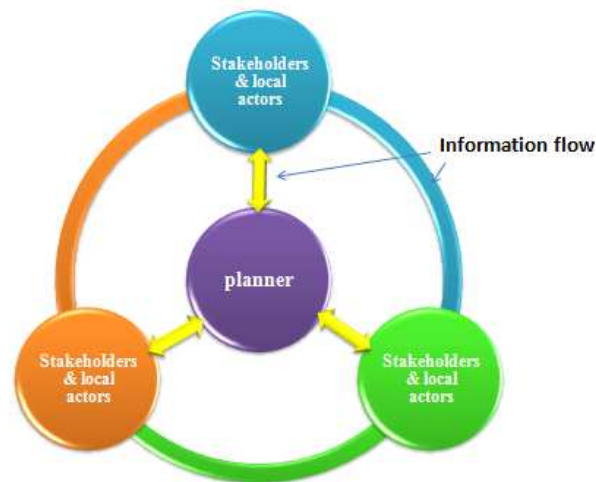
Those who questioned do not have the possibility to react on others' thoughts which would result in more various opinions. Although most of the information is from the people concerned, they do not contribute to the decision since they do not communicate with each other. Due to that, it might be more difficult to have the plan accepted by the society afterwards, since it is not sure at all that the developments planned meet the real needs of the community. If the society concerned does not accept the plan, it leads to conflict, which might mean serious difficulties for all the participants and have negative impact on the future developments (SZALÓ, 2010).

The "internal" or so called community planning is a planning process by experts meant in a broader sense. Its key elements are the activation of local players and the joint creation of future aims. During community planning, the players concerned play active role even at the beginning of the planning process. During the discovery of the situation they may get to know more each other, may share their ideas and the values they wish to achieve. It is a fact that the commitment of the players is much higher than in the planning process applying external experts and they take part in the work more actively. To have the joint plan accepted by the society is much easier, since it has been created based on a consensus with the community (SZALÓ, 2010).

RESULTS

While the goal of the planner in the expert-planning process is to get the necessary information to create a plan that can be accepted by the players concerned, the planner in the community planning intends to draw up a plan with generating local analysis meeting the needs of all the players. The two methods can also be distinguished based on the handling of the information: in the case of expert-planning all the information is concentrated in the hands of the planner, therefore it is the planner who draws up the plan documentation; in the case of community planning the information jointly collected is available for everyone and can be further used. As for the access to information, there is also a difference between the two methods. The information access is limited to those concerned during "external" planning, while in "internal" planning it is unlimited and

constant. The information flow has some phases and is not coherent during planning carried out by experts, while it is and linked to each other in the other case. The two planning processes use different planning tools (GÖRÖG ET AL., 2007).



Source: own editing, 2012

Figure 2: The scheme of internal community planning

In the case of "external" planning, it is the planner who chooses the methods to be applied. In the case of "internal" planning, the players concerned have a word while choosing the methods and they can learn how to use them. The most significant difference is, however, the attitude of local people.

The people concerned are indifferent, their attitude is dismissive or recipient during planning by experts, while their attitude is positive and cooperative in community planning. All these features greatly influence the success of planning.

CONCLUSIONS OR DISCUSSION

Community planning is not only one of the most efficient tools of spatial development, but it has positive impact on the present and future of the community. The rate of acceptance of the projects and plans by the society is much higher than during planning carried out by experts. In addition to the abovementioned advantages, its success is also due to the factors below:

- Commitment to common values: development based on issues and values that are important to the community and which can only be realized with the community involvement.
- Complex point of view: it is not enough to analyze the objective figures of statistics, but they need to be supplemented by subjective information from the community. Its essential part is to involve the community into the evaluation of the situation, which provides more various data on the relationship between the people concerned and the development planned.
- Innovative solutions: the planner is not able to discover the exact roots of the problems, therefore there is a need for conversations between the parties concerned in a joint planning process. After it, the solution schemes suggested by the planner and those of required by the community are both integrated into the planning.

- The necessity of the development: in many cases it happens that not the real needs are met in the development, thus it will not be successful. In order to avoid this, the community planning unveils the real demand and drives the development to success. The rest of the ideas can be realized with the help of other funds available.
- To prevent opposition, to achieve harmony and success: if the players concerned are involved even at the early stage of planning, a lot of conflicts can be avoided, thus time and money can be saved. The wish of the community needs to be taken into account because additional benefits can derive from it, not exclusively the success of the development itself.
- The commitment of the players concerned: it has great influence on the success of the development how much the local players are committed to the project. The more energy and time they spend on the planning and the implementation, the more they become committed. It is important and useful not only during the implementation, but later on it establishes the maintenance of the achievements as well.
- Win-win solutions: since the players concerned get to know each other's interests and point of views during community planning, they intend to bring them closer to each other. So it is easier to find solutions that are appropriate and suitable for everyone compared to plans elaborated by experts.

Community planning has several benefits for the community in long terms.

- The social capital and retention power of the community increase: the common thinking, getting to know each other create a new network within the community. Therefore the community can improve its relation to the project and the social capital can also be increased. The community members trust in each other more, they start to behave differently with each other. Stronger communities have higher retention power, providing suitable background for the community members to live their everyday life in their home village or town.
- Improved well-being and health condition: it is proven that if someone belongs to a community, it improves the individual well-being of the person and it has positive impact on his/her health as well. In settlements where the people trust in each other, they actively take part in the work of social organizations, the share of those who are religious is high, there is an active community life, the spread of self-destructing lifestyle is more rare, the people can handle stress better and the rate of mortality among middle-aged is low.
- The community becomes more active and has better ability to exercise their interest: the network of relationships strengthens the coherence of the community and the trust in each other. The joint achievements can give more energy to the community to implement additional developments, motivating them to take over the management tasks as well. In this way they can even become independent from the external factors. The plans jointly elaborated can give further go to the community. For example, they integrate the experience learned during the work into the next developments, the cooperation become stronger, allowing the strengthening of autonomy. The high rate of community involvement improves efficiency and the responsible members of the community do their jobs more consciously. Due to this, an active and efficient network of communities has at least as great significance as the to-be-investment or the tools applied. If we do not take this into account, the success of the investment can be questioned.
- Solid community, increasing equality of chances: too tight relations among the various social groups may cause negative effects as well, which is called negative

social capital. It continuously prevents the democracy, causing the widening of gap between the social groups. Therefore the creation of a network of various social groups is inevitable.

- Areal identity improves: it is determining concerning the future of the community. Local people can learn others' thoughts and values, thus they can draw up recommendations that are suitable for everyone. That is how the social capital increases and local people not to intend to leave that area (GÖRÖG ET AL., 2007).

The fields where community planning can be applied are as follows:

- Approval of and discussion on the content of spatial development plans: community planning is a perfect tool for it, since the aim is to have the plans approved by the community. If the community is involved in the planning from the beginning, the approval of the plans by the society will not be difficult.
- Self-development, the development of an area: using local resources is the basis of rural development. It cannot be achieved without the conscious self-development of the local players, the cooperation and activation of the community.
- Economic development: various techniques of community planning promote the creation of an economic community, where the local entrepreneurs are able to develop the local economy with appropriate training system, share of tasks, the use of local resources and the relation network of the community.
- The harm of community interest, community lobby: the essence of the community planning is to avoid the harm of interest of any parties. Moreover, it encourages decisions based on consensus. If a community feels that their interests are not represented in an investment, they step in to prevent it with the interference of civil organizations other communities. In case they manage to step in, they might be able to initiate a conversation with the developers, therefore they can reach a consensus. If there is no cooperation between the two parties, the community might start to protest, which is much more negative for the developers than the decision based on consensus.
- Handling the oppositions: sometimes the planner recognizes during the planning process that the interests of the parties are opposite, causing conflict. In such cases the oppositions need to be lifted to reach success. These oppositions usually do related to the concrete project plan, but accumulated from former unsuccessful developments. In such cases it is useful to have the parties known each other so that they could understand each other and to avoid prejudices. Common solutions have to be encouraged.

Community planning, as a tool of spatial development, provides solutions for several problems. Although its use is not always easy, its application greatly contributes to the success of planning. In addition to civil organizations, municipalities, local businesses, development experts, cooperation of micro-regions and planners form ministries can also apply it.

REFERENCES

KÁPOSZTA J. –NAGY H. – KOLLÁR K. (2010): Borsod-Abaúj-Zemplén és Szabolcs-Szatmár-Bereg megye leghátrányosabb helyzetű kistérségeinek településszerkezeti, foglalkoztatási jellemzői az EU-csatlakozás óta eltelt időszakban. *Területi Statisztika*, 50 (6.) 641-658 p.

- TÓTH T.–PESTI CS.–PÉTER B. (2006): Regionális elemzések módszerei. egyetemi jegyzet in.: Pesti (szerk.) SzIE Gödöllő Gazdaság- és Társadalomtudományi Kar, Gödöllő, 2006. 83 p
- SZALÓ P. (2010): Területfejlesztési füzetek 1.: segédlet a közösségi tervezéshez, Budapest 2010. 93 p.
- GÖRÖG M.–PUPOS T.–TÓTH T. (2007): A tervek kidolgozásának általános elvei és metodikai kérdései In.: Cser-Tóth (szerk.): Területi és projekttervezési ismeretek, Debrecen, 2007. 188.p.

COMPARISON OF THE SIZE STRUCTURE OF FARMS IN SLOVAKIA AND FRANCE AND THEIR POSITION IN THE FOOD CHAIN

RADOSLAV JAKUB

Slovak Agricultural University
Faculty of Economics and Management
External PhD student
Tr. Andreja Hlinku 2, 949 76 Nitra
Slovak Republic
xjakub@fem.uniag.sk

ABSTRACT

Generally, the appropriate size structure of farms is considered a positive factor towards achieving competitiveness in agricultural enterprises. The structure of farms in Slovakia shows a high share of large scale farms, established during the period of forced collectivisation, mirroring the Soviet model, when the factors of production were withdrawn from individual farmers and given to combined larger units. Older EU countries moved away from smaller scale family farms by integrating these farms into larger units in the form of producer groups, without surrendering the ownership of the factors of production. In this way they significantly increased their influence in the food chain. Therefore it should be a valid comparison to consider the size structure of farms in Slovakia and to contrast this with France, as well as to examine their position in the food chain in the dairy sector. The question as to whether the size structure of farms in Slovakia is sufficient for the long-term development of the Slovak agri-food sector, and whether there is a strong enough position of producers in the food chain in the milk sector, can also be answered. The abolition of milk quotas, price volatility in agricultural markets and increasing competition threaten the stability of farms, and it can therefore be assumed that integrated primary producer associations in the food supply chain will be able to better withstand the current challenges.

Keywords: Agriculture, Structure of farms, Milk sector, Producer groups, Food supply chain

INTRODUCTION

In the period of transformation from a centrally planned system to a market economy in most countries of Central and Eastern Europe, the old system of strong vertical integration was broken into separate units. The state had previously centrally managed vertical integration and took the responsibility for ensuring that contracts were fulfilled. Disruption of the agricultural products market, however, meant that independent private firms themselves began to vertically integrate in order to take the responsibility for contracts and to improve coordination in the supply chain (SWINNEN, 2005).

In the framework of vertical integration, Slovakia has its own particular characteristics which include farm size structure and the processing industry. While in other countries, generally, the processing industry is concentrated and primary production is fragmented, in Slovakia food industry suppliers are large farms with a relatively concentrated supply. This could imply that the bargaining position of such farms would be very high and that the power is weighted towards the agricultural sector. However, this relatively high concentration was subjected to the chronic undercapitalisation of primary production during the whole period of transformation towards a market economy (BLASS, 2005).

The vertical food chain is a set of concatenated functional and technical disciplines and activities in the production and sale of food and beverages (HUTNÍK, 2004).

Modern markets are characterised by large-scale supermarket retailers and wholesale operations. High volume and low price produce, together with strict quality control and

high safety standards characterise these markets. They are highly sophisticated, organising supplies in a way which allows them to be efficient also thanks to their vertical integration along the supply chain. They aim to meet the high turnover experience by supermarkets with maximum efficiency. Such markets are also highly dynamic, responding very quickly to price changes, consumer demand and new technological opportunities.

The objective of this paper is to compare the size structure of farms in Slovakia and France, their performance in the milk sector and to analyse the position of the primary producers in the food supply chain with a primary focus on the milk sector in view of its horizontal and vertical integration.

MATERIAL AND METHOD

Data on farm size structure were obtained from the database of Farm Structure Survey of EUROSTAT for 2007. Analysis of the gross margin of milk farms in France and Slovakia is provided, based on the FADN data published in the Milk report for 2011.

The current information on the development of producer groups in Slovakia was provided by the Slovak Agricultural Paying Agency (APA).

RESULTS

Size of farms in EU27

In Figure 1 the total Utilised Agricultural Area (UAA) of all farms for a number of countries is broken down into eight classes according to the size of the holding's UAA.

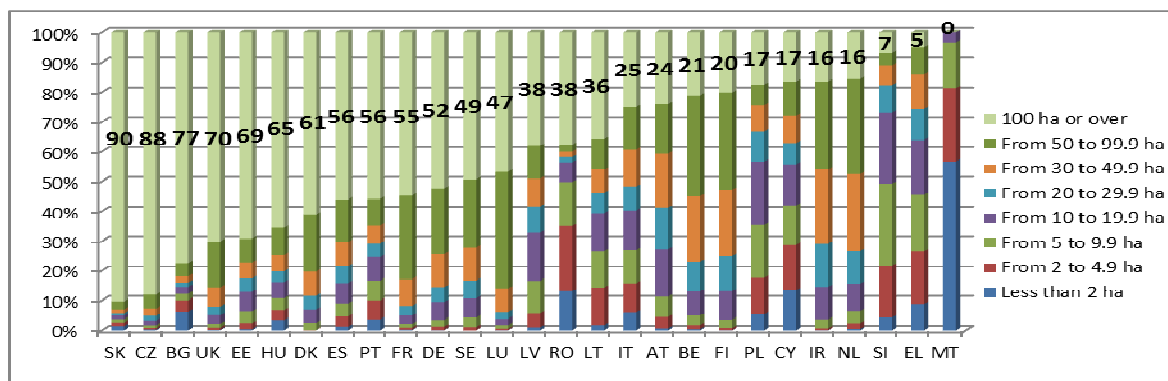


Figure 1. Distribution of UAA by UAA size of farm in the EU27, 2007

% of UAA

Source: Eurostat – Farm Structure Survey - 2007, own calculation

As we can see the distribution of the utilised agricultural area (UAA) by the size of farms varies between countries ranging from Slovakia (SK) with the biggest proportion (90 %) of UAA by farms with 100 ha and more, followed by Czech Republic (CZ) with 88 %, Bulgaria (BG) with 77 %, United Kingdom (UK) with 70 % and others, down to Malta (MT) with no farms above even 20 ha.

The distribution of dairy cows by the UAA size of farm in the EU 27 in 2007 varies between countries and the same relationship is observed as was present in the previous figure for the distribution of UAA. *Figure 2* indicates that the production inputs such as land and dairy cows are highly concentrated in holdings with 100 ha or more in SK, CZ, Estonia (EE), UK and Hungary (HU).

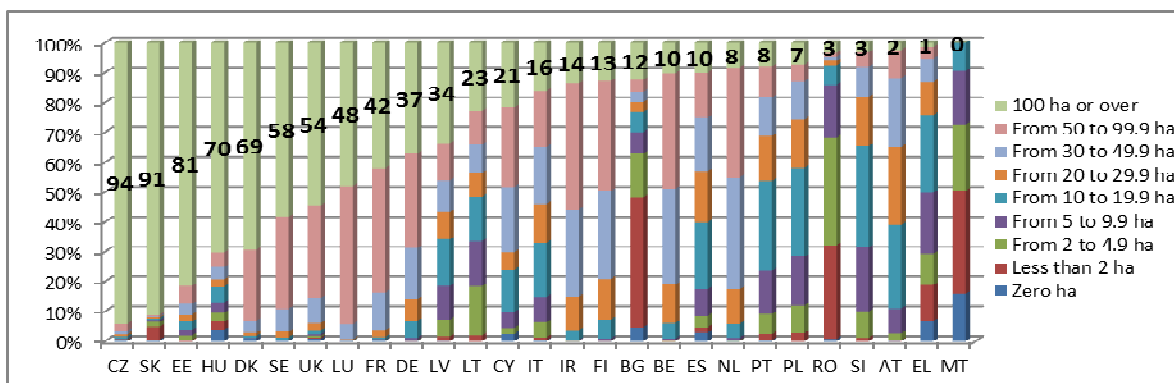


Figure 2. Distribution of dairy cows by the UAA size of farm in the EU 27, 2007
% of dairy cows

Source: Eurostat – Farm Structure Survey - 2007, own calculation

However, the real differences in the concentration of the mentioned production factors can be observed in the following *Table 1* which indicates that the average area of fodder crops and grasslands per holding with 100 ha or more and the average number of dairy cows per breeding holding with 100 ha or more of UAA is far higher in the post-communist countries than in old EU countries.

Table 1. The average area of fodder crops and grasslands per holding and average number of dairy cows per holding with more than 100 ha, 2007

farms 100 ha or more	AT	BE	BG	CY	CZ	DK	EE	FI	FR	DE	EL	HU	IR
fodder ha/farm	205	65	101	108	313	51	219	46	86	97	128	160	125
dairy cows no/farm	23	62	62	159	256	150	139	46	60	119	43	259	109
farms 100 ha or more	IT	LV	LT	LU	NL	PL	PT	RO	SK	SI	ES	SE	UK
fodder ha/farm	192	121	85	100	83	86	307	360	417	153	226	87	207
dairy cows no/farm	134	61	58	53	163	108	126	32	234	194	89	84	122

Source: Eurostat – Farm Structure Survey - 2007, own calculation; without Malta

The largest average size of fodder crops and grasslands per holding is in Slovakia (417 ha), followed by Romania (RO) (360 ha) and CZ (313 ha). The size of herd in farms with more than 100 ha was the largest in Hungary (259), followed by CZ (256) and SK (234). With the exception of United Kingdom (UK) (207 ha; 122 dairy cows), the concentration of those inputs is much lower in Western Europe countries. In France, the average size of fodder crops and grasslands is 86 ha and the average size of herds is 60 cows. The different averages of fodder crops and grasslands and the size of herds confirms a significantly higher concentration of those inputs in the milk sector in the post-communist countries which inherited this situation as a result of their collectivisation in the past.

Analysis of gross margin of milk farms in France and Slovakia

Based on the latest reports on the milk sector in 2011, a comparison of revenues and operating costs per tonne of milk produced in France and Slovakia can be undertaken. The FADN data are composed of samples of specialised farms in the milk sector, but due to difficulties in identifying those farms in Slovakia, as their activities have been significantly diversified, the sample only covers 23 % of milk production. On the other side, according to the average forage area of fodder crops (641 ha) and the size of heard of dairy cows (168) in specialised dairy farms, it is logical to conclude that the sample is in line with the analysis presented on the concentration of inputs in the large farms in Slovakia.

Revenues

Figure 3 indicates the evolution of the milk price in France and Slovakia over the last few years. They were higher in France than in Slovakia for the whole period. After accession to the EU, milk prices in Slovakia were approaching those in France until 2007. The milk price in France does not take into consideration coupled aids (12 €/t 2004 (22 €/t) in 2005). In both countries, the peak in price was in 2008 when the prices of agricultural products rose sharply. However, according to the price estimates in 2009 and 2010 the price fall in Slovakia was higher by 16 %, and the price was significantly below the price in 2004.

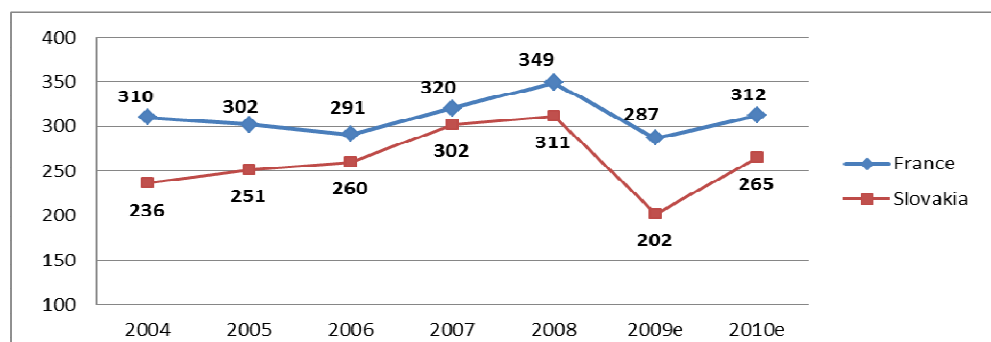


Figure 3. Price in € per tonne of milk in France and Slovakia in 2004 - 2010

Source: FADN data, own calculation, 2009 and 2010 estimates based on DG AGRI data

Production costs

Figure 4 shows that lower milk prices in Slovakia were not compensated by lower operating costs (production costs), but that these were in fact significantly higher than in France.

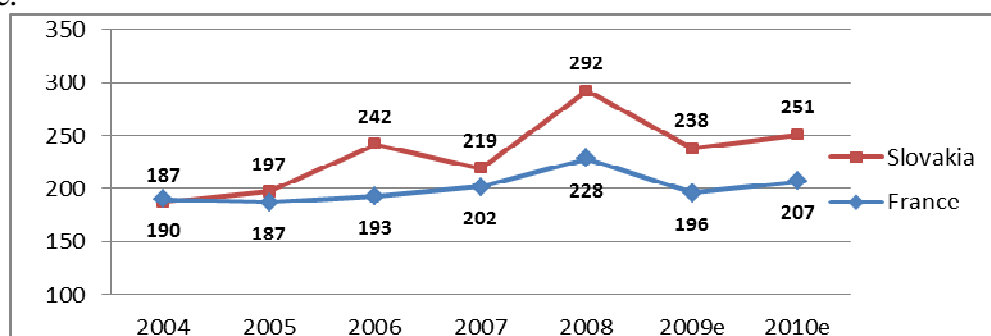


Figure 4. Total operating costs in €/t milk in France and Slovakia in 2004 – 2010

Source: FADN data, own calculation

Table 2 shows the values of specific costs which differ significantly between Slovakia and France.

Table 2. Selected specific operating costs in the milk sector in Slovakia and France

Specific operating costs	2004	2005	2006	2007	2008	2009e	2010e
homegrown feed SK	27	32	45	44	57	46	46
homegrown feed FR	33	32	32	33	36	32	31
purchased feed SK	43	43	46	64	79	50	60
purchased feed FR	47	44	46	52	64	51	59
Other specific costs SK	43	28	20	18	20	22	22
Other specific costs FR	12	12	12	12	14	14	14

Source: FADN data, own calculation

In 2008, the costs of homegrown feed, purchased feed and other specific costs were higher by 42 € in Slovakia than in France. This difference represents 13 % of the SK milk price which indicates that the income of SK holdings is negatively hit not only by lower milk

prices but also by significantly higher specific costs. Also, the volatility of input prices is higher in Slovakia than in France e.g. as regards the purchased feed costs in years 2006, 2007 and 2008.

The non-specific costs were also higher in Slovakia than in France, as shown by *Table 3*, especially concerning energy costs and other direct inputs. In 2008, they were higher by 22 € in Slovakia when compared to the presented values in France.

Table 3. Non – specific operating costs in the milk sector in Slovakia and France

		2004	2005	2006	2007	2008	2009e	2010e
SK	Energy (fuel and electricity)	32	33	45	41	49	32	36
	Other direct inputs	16	15	36	17	48	49	49
FR	Energy (fuel and electricity)	12	13	14	14	18	15	17
	Other direct inputs	35	34	35	37	39	33	33

Source: FADN data, own calculation

Gross margin

The lower prices for milk sales and the higher operating costs resulted in a significantly lower gross margin in Slovakia in the whole period, as depicted in *Figure 5*.

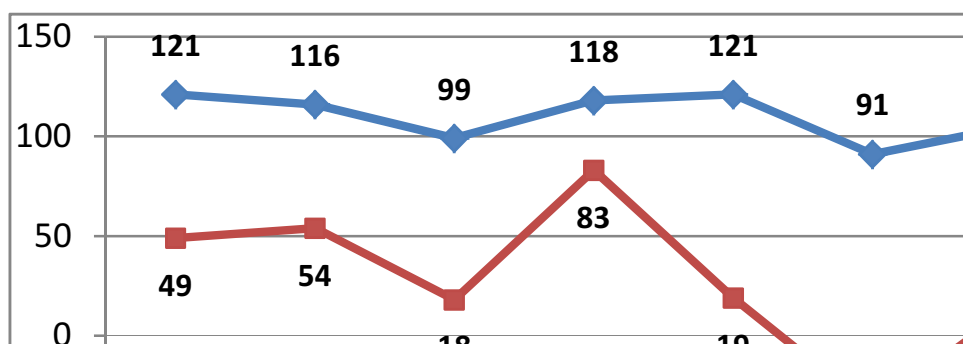


Figure 5. Gross margin in Slovakia and France in €/t

Source: FADN data, own calculation

Finally, the trends in the milk sector in Slovakia are not very positive in the last few years. The number of dairy cows decreased from 178,000 in 2008 to 161,000 at the end of 2010. The gross margin, although mostly positive in the last few years, is in fact well below the average gross margins calculated from the FADN database in EU countries.

The horizontal and vertical integration of food supply chain in the milk sector in FR and SK

According to data available on the website of COOPs in France, there are 45 000 milk producers associated to one of 260 cooperatives, out of which 200 process milk. In total they produce 55 % of the milk in France and process 35 %. These milk cooperatives are members of the organisation, the National Federation of Milk Cooperatives which protects their rights and interests. The National Federation of Milk Industry represents processors in the milk industry. These organisations jointly created a common organisation, the Association of French Milk Transformation which represents the milk sector of France at the national and European political level. In respect of the vertical integration, there are two essential aspects which play a significant role. The first one is that cooperation is not just the production and sale of milk to the processing industry, but the way in which the supply chain can be shortened. This enables the producers to be closer to final customers, and thus to increase the added value which otherwise would stay with the processing industry. The second one takes into account that more alternatives for the primary

producers create a more balanced supply chain than in the case when the whole milk production would be processed only by the processing industry.

In Slovakia, there are currently 24 milk cooperatives associated with 206 agricultural holdings with a turnover of 64 Mio € in 2009 which accounts for a 36 % share in the milk sector. These data indicate that more than 1/3 of supplies are delivered by the new milk cooperatives of primary producers in Slovakia. According to the information available from APA, none of the milk cooperatives processes the collected milk. The main advantage for members was the increase of bargaining power towards processors and suppliers of the inputs.

CONCLUSIONS

Following the analysis of the size structure of farms in the EU27, it can be anticipated that Slovak farms would have a good starting position to be competitive in the global markets. However, in-depth analysis of the revenues, costs and gross margins points out that there are significant differences between those figures in France and Slovakia. The volatility of milk prices and operating costs was higher in Slovakia which can be interpreted as representing a higher imbalance in the vertical food chain. The position of primary milk producers in Slovakia differs in both horizontal and vertical integration, as the share of milk cooperatives is lower than in France, and also the vertical integration does not include the processing of milk by their own enterprises.

Further, there is not the optimum concentration of production inputs as regards agricultural land when compared with the EU27. The larger size structure of farms does not automatically ensure better prices for outputs and lower prices for inputs. The success of any primary producers depends much more on the horizontal and vertical organisation of the relevant food supply chain. The better organisation of milk producers in France and the more sophisticated vertical organisation of the food supply chain provide a model by which to face the current challenges experienced by the milk sector in Slovakia.

Finally, from the analysis it results that the primary agricultural sector in Slovakia should move towards a more integrated vertical organisation, especially in respect of shortening the milk supply chain, increasing the bargaining power within input demand and output supply, in order to increase its competitiveness, stability and future prospects on the milk markets.

REFERENCES

- BLAAS, G. (2005): Foreword, Economics of Agriculture, Volume. V, No. 4, p. 2-3.
COOP de France (2012): <http://www.coopdefrance.coop/fr/99/presentation/>
DG AGRI(2011): FADN http://ec.europa.eu/agriculture/rica/pdf/Dairy_report2011.pdf
HUTNÍK, F. 2004: World trends of shaping the food verticals, Economics of Agriculture 4/2004, ISSN 1335-6186
EUROSTAT (2007): Farm Structure Survey, http://epp.eurostat.ec.europa.eu/portal/page/portal/farm_structure_survey/introduction
SWINNEN, J. (2005): The Dynamics of Vertical Co-ordination in the Central and East European Agri-Food Sectors. Economics of Agriculture, Volume V, č. 4, p. 7-19.

THE RIGHT OF PREEMPTION AND ARABLE LAND – NEW RULES, NEW METHODS?

PÉTER JANI

University of Szeged
Faculty of Law and Political Sciences
Department of Agricultural and Environmental Law
Szeged 6721 Rákóczi square 1.
jpeter@juris.u-szeged.hu

ABSTRACT

In Hungary like in the case of most of the European Union member states we can see particular rules regarding ownership of land. Corresponding to the special role and strategic importance law is building up a defence system that would help the protection and preservation of the soil. Fast land legislation followed the new governments step into power in 2010 along a new land policy: the Act LXXXVII of 2010 on the National Land Fund (NLF) was born which brought with it the “rethinking of land-related legislation”. The new rules, most importantly the changes in the institution of the right of preemption do not justify the high-sounding rhetoric of “the land belongs to the person working on it”. We can say that: the new regulation has not fulfilled its goal, it even brought more uncertainty for the players of the land market. So the law is still not able to handle the decade practise of pocket contracts, neither did it help to decide – despite the legislative goals – whether the government is backing family farmers or large plants. In this current study I want to show one of these restrictions regarding the new rules brought in 2010 on pre-emption right on agricultural land in the lights of the land policy goals of the new government primarily examining its constitutionality.

Keywords: agricultural law, arable land, ownership of arable land, right of pre-emption, land policy

INTRODUCTION

Fast land legislation followed the new governments step into power in 2010 along a new land policy: the Act LXXXVII of 2010 on the National Land Fund [NLF] was born which brought with it the “rethinking of land-related legislation. Is the current regulation sufficient to fulfil this goal? Doesn’t the Hungarian rule limit the freedom to property and acquisition too much? The law, which contains the modification of the Act LV. of 1994 (on Arable Land) [Land Act] which above all (for the umpteen times) changed the ranking of those entitled to purchase. In respect of sale of arable land or farmstead the state is entitled to the right of preemption the first place (contrary to its earlier last place). The list of those entitled to this right are as follows: any local person who is a party to the leasehold (share-lease, share-farming) contract pertaining to the land or farmstead in question; any local neighbor; any local resident and finally any person who is a party to the leasehold (share-lease, share-farming) contract [Land Act art. 10 (1)]. The justification of the law states that the legislator had two goals with the modification primarily: the strengthening of the right of preemption of the state is the basic tool to fulfilling the gland policy goals, by which the state can actively appear on the land market. Another basic goal is that those (natural) persons could gain land who are really have a professional bound to agriculture.

MATERIAL AND METHOD

It was in the summer of 2011 when the Act LV. of 1994 was modified again [Act CI. of 2011], which brought with it the regulation on gifting of land as well as changing the

exercise of the right of preemption: the change in the law extended the rights of the state to between co-owners sales [Land Act art. 10 (3a)]. Then the right of preemption does not apply to the sale between close relatives as defined in the Civil Law, as well as in the case of the land sale as condition to the farm transfer support of the farmers, or in the case of the sale of parcels which were considered as enclosed gardens before the Land Act came into [Land Act art. 10 (3)]. And so from now on the state has to be informed each time before the change in land owner whether it wishes to exercise its pre-emption right.

The land itself is an important economical, social and political factor. The Constitutional Court of Hungary assumes the special character of the land: the natural and financial characteristics of the land: namely the land's nature as a finite good, (land namely as a natural object is limitedly available and cannot be reproducible or substitutable with something else). Its indispensability, renewable capacity, specific risk-sensibility and its low yield gains embodies the specific social bound of the land [Decision of Constitutional Court no. 35/1994 (VI.24.)]. Consequently from the importance and specificity of the land the provisions regarding its ownership are also special, under which most governments (most EU states as well) interferes with the functioning of land markets by setting up constraints of land acquisition. The EU court does not find ownership limits always incompatible with EU law. The court case law, the development of viable farms, maintenance of green spaces, allowing the recovery of land ownership or the aims to comply with the common agricultural policy was always accepted as a legitimate reason (ANDRÉKA, 2010).

One of the key elements of this is the pre-emption right, which “means some degree of the limitation of the principle of contractual freedom” (BESENYEI, 2009), since neither the owner nor the buyer does not enjoy the principle of the freedom of partner choice. However content vies it means the limitation of the owner's right of disposal, which – where appropriate- it involves a violation of the right to property as referred to in the article XII (1) of the Fundamental Law of Hungary [“Every person shall have the right to property and inheritance. Property shall entail social responsibility”].

It is important to note that, this no doubt serious private legal restriction solely prevents the freedom of partner choice, civil harm cannot happen to the seller, since the sales contract is created with the same content as if it pre-emption right and the practitioner did not step into the process.

The rules on the sequence of pre-emption right is determined by the Civil Code (CC) [art. 97 and 145] as a *lex generalis* according to which firstly the pre-emption right established by the law can be exercised which is followed by the pre-emption right of the owner of the real estate respectively the owner of separately owned parcel on the addition to the building, and the owner of the addition to the land set by the CC. Finally the contract established re-emption right can be exercised. Regarding the land the rules of the Land Act are considered as *lex specialis* compared to the CC, since the land act specifies the circle of those eligible for pre-emption, and among them it establishes a strict hierarchy. “It should be considered natural that when the law guarantees the pre-emption right to someone, then a significant values has to be behind it” (BESENYEI, 2009). The article XIII (2) only requires the existence of public interest for the deprivation of property, so – on the principle of *argumentum a maiore ad minus* – a more stringent necessity is the ownership restriction, in this case is not a demand in the case of the pre-emption right. Approaching it from another side: the restriction on acquisition is only constitutional if the restriction is done due to the enforcement of a public policy goal, in which case the distinction is allowed and acceptable. The restriction of an element of the ownership right only comes

with the restriction of ownership if not inventible, furthermore if the limit of restriction is disproportionate to the intended purpose [Decision of Constitutional Court no. 2299/B/1991].

The Constitutional Court addressed the constitutionality of the legislation affecting the land in several of its decisions. The Constitutional Court did not find the restrictions on acquisition of land unconstitutional in any case, so not even the pre-emption right or the hierarchy established within (BOBVOS, 2004). On its own determining the ranking of competitive pre-emption rights is not objectionable [Decision of Constitutional Court no. 39/1992 (VII.16.)], since beyond the traditional non-profit and public restrictions those restrictions also meets the requirement of public interest which favours individuals, and in the meantime solves social problems [Decision of Constitutional Court no. 64/1993 (XII.22.)].

On the constitutionality of the pre-emption right the robed body noted that ensuring it is not unconstitutional till it does not lead to emptying the provision on the dispose of property on one side and making the freedom of contract impossible on the other. The order specified in the Land Act is not against the Constitution because the pre-emption right only restricts the customer choice (and not the ownership change itself) but does not apply to the purchase between close relatives and co-owners [Decision of Constitutional Court no. 7/2006 (II.22.)]. By this logic it is strongly doubtful that the new modification of the Land Act would pass through the Constitutional Court. In contrast, according to the position of the lawmaker primary pre-emption right of the state is a discount between the constitutional boundaries, because it does not touch the right to property, does not distinguish regards obtaining ownership, but establishes the ranking of the pre-emption right, so with the operation of the National Land Fund it remains within the concept of economic aspect regulation. The Constitutional Court regarding this has explained that, “the restrictions of the land act are constitutional till the reasonable explanations of adjudicated restrictions are according to objective considerations” [Decision of Constitutional Court no. 35/1994 (VI.24.)].

Based on these it is clear that amongst the rules on land the pre-emption right has an outstanding importance. But on the land market it introduces severe constraints so it is opposed to one of the key objectives of land policy, the growth of land prices and through this land traffic.

Public interest is not a concept that can be generally worded or described by abstract criteria, but a specific “target” defined by the lawmaker, which if marked where appropriate justifies the restriction of a fundamental – in our case the right to property. Regarding the constitutionality of ownership restrictions it is appropriate to examine the practice of the Constitutional Court. The Constitutional Court in lot of its decisions [Decision of Constitutional Court no. 35/1994 (VI.24.); no. 64/1993 (XII.22.); no. 7/2006 (II.22.)] names the land policy of the state as the best interest of the „public” which justifies not just the restriction, but the existence of the pre-emption right. The definition of the concept of land policy is not given, but entrusts the state.

In general, land policy if not the only, but the most important element of agricultural policy. According to Endre Tanka’s definition it is none other than the system of institutions intended to creating the best design of land, land use, land protection and the land administration – that is, the possession order (TANKA’ 2008). The principles of control

depending on the economic, social and political conditions are constantly changing. Following 1989 the transformation of ownership and the strengthening of private property was the primarily goal, while since that the correction of distorted land structure (formed in the early nineties), development of viable farm size, approximation of land ownership and use and focus on family farms. All these go together with the continuous adjustment of land acquisition and land use as well as the rethinking the role of the state in the land market processes.

RESULTS

The Act on National Land Fund specifies the new national land policy. This means that the aim of the law is to help the transformation of a agriculture that adapts to the natural conditions and managements traditions of different landscapes, furthermore builds on the decisive role of individual and small and medium sized family farms. Since this is what ensures the good master's care arising from the ownership mindset, the responsible relationship within the generations following each other, as well as the employment, quality, production, food and environmental performances, which are vital for the whole society and for the long-term survival of the rural.

If we accept, that the land policy goals defined in the Act on National Land Fund only concerns the state and National Land Fund owned land, then it is fundamentally questioned that in the case of privately owned land what are the public interest objectives that constitutionally justify the ownership restrictions.

The practice of the Constitutional Court – described above – of the implementation of state land policy interpreted it extending to the whole of the land, highlighting that the functions of public interest of the land themselves are so important, that they (without using the measure of need) justify the statutory limit of the right to property. The only question is, how does the state's pre-emption right relate to the pre-emption right to other eligible entities, and what goals does the state have by codifying the first place pre-emption right. These goals are not always in line with the land policy goals defined by the National Land Fund Act. In the legislator's view "to implement the land policy goals, efficient holding structure, the development of family farms the greater role of the state is indispensable for the stimulation of land market. Therefore the guarantee for the state for the right of preemption is necessary" (Act CXVI of 2001 National Land Fund Act, General reasoning). This statement could arise from the new National Land Fund Act; however it does not give a satisfactory answer for the questions rose above.

The stimulation of land market on itself is a goal to support. But this comes with the increase in land prices, which maintains, and even strengthens the proliferated practice of speculative land purchases against which the National Land Fund Act was brought. The other contradiction, that if the state primarily want to give the land to family farmers, young farmers then why does it give itself a right of preemption preceding everyone else. The land acquisition of the state is in many ways justified; above all it is a great investment besides the surely occurring increase of land prices, but it has no evidence to the government goal, which is to grant lands to the preferred groups, since the state is not required to supply anyone with property. It this is the goal than it is surely unconstitutional. Only the demise can be an option.

Under the National Land Fund Act the majority of the current public land users does not

belong to the “priority” category, so for the land to get into the targeted production circle’s use, they needed to be taken away from the current tenants. And with this the state would undermine the majority of the commercial tenants of state land – practically it would “pull the land from under them”. A further effect of this can be the decrease of agricultural employment and production volumes, which can’t be the goal of the state, particularly in the light that besides the land policy goals stable land use and “stabilizing the situation of land users” are also there.

The lease of state lands can be justified in the case when it partly affects the land, which will become the property of the state in the future. There is a small chance for major land acquisition with the current fiscal position. Since the mentioned changes of legislation National Land Fund Management Organization rather rarely lived with its pre-emption rights, in which besides the lack of resources the fifteen days exercise time also played a part.

CONCLUSIONS

According to the practice of the Constitutional Court the rules introduced the last one and a half years related to new agricultural land does not always meet the demand of constitutionality. In addition, some measures, goals are so full of contradictions that there are strong doubts that they can be implemented. The renewal of the moratorium on the ban on foreigners receiving ownership gave the last chance for the lawmaker to settle the land market situation and by creating stable legislation actually preparing the Hungarian agriculture for the effects of the termination of the moratorium. The decision was given, but due to political reasons it has not been decided.

The new rules, most importantly the changes in the institution of the right of preemption do not justify the high-sounding rhetoric of “the land belongs to the person working on it”. On this basis we can say that: the new regulation has not fulfilled its goal, it even brought more uncertainty for the players of the land market. So the law is still not able to handle the decade practise of pocket contracts, neither did it help to decide – despite the legislative goals – whether the government is backing family farmers or large plants. The duality was maintained in land policy.

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REFERENCES

- Act LXXXVII of 2010 on the National Land Fund
Act LV. of 1994 on Arable Land
Act CXVI of 2001 on the National Land Fund Act, General reasoning
Act IV of 1959 on the Civil Code (Hungarian Civil Code)
ANDRÉKA, T. (2010): Birtokpolitikai távlatok a hazai mezőgazdaság versenyképességének szolgálatában, In: CSÁK, Cs. (ed.): Az európai földszabályozás aktuális kihívásai, Novotni, Miskolc, pp. 7-19.

BESENYEI, L. (2009): A tulajdonjog korlátozásáról, In: BOBVOS, P (ed.): *Reformator iuris cooperandi*. Tanulmányok Veres József 80. születésnapja tiszteletére, Pólay Alapítvány Szeged, pp. 99-106.

BOBVOS, P. (2004): *A termőföldre vonatkozó elővásárlási jog szabályozása*, Officina Press, Szeged, pp. 1-25.

Decision of Constitutional Court no. 35/1994 (VI.24.); no. 64/1993 (XII.22.); no. 7/2006 (II.22.)

TANKA, E. (2008): *Van Megoldás – Földtörvény*, Barankovics Alapítvány, Budapest, pp. 100-152.

The Fundamental Law of Hungary (25 April 2011)

THE IMPORTANCE OF PLANT GENETIC RESOURCES IN AGROECOSYSTEM

**JELENA BOŠKOVIĆ, VESELINKA ZEČEVIĆ, TAMARA GALONJA COGHILL, SLOBODAN
MILENKOVIĆ, ZDRAVKO HOJKA, TIBOR KÖNYVES, GORDANA DOZET**

Faculty for Biofarming, Megatrend University
M. Tita 39, Backa Topola, Serbia
jboskovic@biofarming.edu.rs

ABSTRACT

Monitoring and conservation of plant genetic resources are essential for the development of modern agricultural production. Biodiversity of plant resources in agriculture is a biological basis for ensuring quality world food, acting as the basis for creating new varieties through conventional crossing process or application of biotechnology. Since the laboratory and field experiments can not assume all the possible interactions that may occur in the ecosystem, monitoring is necessary in natural environment, bringing to light the necessity of collaborative interdisciplinary involvement and research.

Keywords: biodiversity, plants, genetic resources, agroecosystem

INTRODUCTION

The plant genetic resources in agriculture include wild relatives of cultivated species, varieties and hybrids, as well as breeding material, horticultural, medicinal, aromatic and other plants that can be used for breeding in agriculture, providing food for both animals and humans. It is well known that agriculture affects natural biological resources, but it also uses these resources to obtain varieties and hybrids, the reciprocal relationship leading to increased economic benefits and sustainability.

Extensive agriculture is known for the preservation of local varieties, soil and woody plants, while intensive agriculture is characterized by a decrease in biodiversity, plant species rotation and quick replacement of plant varieties (CONWAY, 1993). Therefore, monitoring and conservation of plant genetic resources are essential for the development of modern agricultural production.

The great problem of biodiversity conservation is a growing demand for food due to the continuous population growth, and decrease of arable land caused by industrialization and urbanization (BOSKOVIC ET AL., 2010). Moreover, only thirty plant species provide 95 percent of human food, and only four: rice, wheat, corn and potatoes provide more than 60%. It is essential to preserve biodiversity (SWIFT et al., 2004), especially in Vojvodina, which is, according to the Fao data, the most deforested European area comprising of 80% agricultural land (BOSKOVIC et al., 2010).

Agroecosystem differs from natural ecosystem in several aspects. In natural ecosystems, solar energy is the main functional driver, while agroecosystem consumes fossil fuel energy as well as human and animal labour. For the maintenance of agroecosystem, human management is crucial, especially today following the development of biotechnology and increasing use of GM plants (KONSTANTINOVIĆ AND BOSKOVIC, 2001; PRETTY, 2001; GARCIA AND ALTIERI, 2005; PRIJIĆ et al., 2008).

Monitoring the impact of GM plants on the environment is of particular importance (BOSKOVIC et al., 2001, 2003, 2004, FERRY AND GATEHOUSE, 2009). Agrobiodiversity consists of two components: the planned biodiversity that is, depending on production management, introduced by farmer on purpose, (choice of crop variety or hybrid), and associated biodiversity, which includes all other flora, fauna, and microorganisms.

Biodiversity management is only possible through an integrative framework that meets the needs of different interest groups (local, regional and national) and various stakeholders (small farmers, indigenous groups, civil society, research institutions, public agencies and private investors) at different levels (CALLO-CONCHA 2003, 2009, MCNEELI 2004).

THE IMPORTANCE OF GENETIC RESOURCES

The importance of genetic resources can be demonstrated in a number of ways. It provides wealth and food diversity for humans and animals, fiber, fuel, medicinal plants, affects water regulation in nature, prevents soil erosion and degradation, allows the development of sport, recreation and ecotourism (CONSTANZA et al., 1997). Today's global economy poses a direct threat to biodiversity because it treats the services of nature as worthless (MILOSEVIC et al, 2009).

Loss of genetic diversity (genetic erosion) was observed in many cultivated species. One of the reasons is loss of local populations and their wild relatives. The loss of wild relatives is related mainly to the reduction or loss of habitat due to land use for agriculture, urbanization and industrialization. Genetic richness of forests in Serbia according to the number of species, their diversity and number of received gen-center, unique in Europe. And in this important segment of the biodiversity present genetic erosion.

These human activities have led to pollution of water, soil and air, and thus the extinction of many plant and animal species, which eventually leads to serious damage in world economy. One example is the bee plague due to the use of some pesticides. It is believed that the value of bee pollination is 1.3-5.2 billion euros, thus bee extinction is not a problem for beekeepers only, but for the whole society (MILOSEVIC et al, 2009). While about 10,000 varieties of wheat were grown in China in 1949, that number decreased to 1000 in 1970. In Mexico today only exist about 20% of local maize varieties that were known in 1930.

The loss of genetic diversity in traditional upland rice germplasm in northern Thailand, due to the replacement of a large number of traditional varieties with a smaller number of modern varieties, but also because of gene flow from distinct cultivars to landraces.

Finally, the continued erosion of crop genetic diversity hampers agro-ecosystem functioning and its provision of services (i.e. pest and disease control, pollination, soil processes, biomass cover, carbon sequestration and prevention of soil erosion) as well as potential innovation in sustainable agriculture (WIEBE AND GOLLEHON, 2006, BOSKOVIC et al. 2010).

AGROECOSYSTEM MANAGEMENT

Agroecosystem management with the aim to reduce soil degradation and loss of agrobiodiversity prevention is complex and requires an integral approach. The difference between integrated and conventional systems is in methodology and strategy (*Table 1*).

The aim of genetic resource management is the enhancement of conditions for the continual evolution of the species, which is the defensive mechanism of the organisms in the struggle with environmental changes.

Table 1. Comparison between conventional and integral approach to ecosystem

Aspect	Conventional approach	Integral approach
Perspective	Natural ecosystems viewed as a free source of inputs (land, fertility, etc.) for current and future production	Natural ecosystems viewed as a set of interdependent parts, which provides a wide range of valuable goods and services
Products	Only a few products and services	wide range of goods and services
Strategy	The desire for a bigger yield, the intensification of land, labor and capital use	Optimization of total products, goods and ecosystem services
Methodology	Reduced to the minimum number of factors	System-oriented, including quantitative and qualitative characteristics with particular attention to interactions, gene flow, establishing a balance
Approach to biodiversity	Reduced biodiversity with more predictable results	Biodiversity is given the importance for a better use of resources, meeting as many needs, preservation of biodiversity - more secure and reducing the risk
Means of impact	Political and ownership links	Ecosystem, social and biophysical
Role of science	The use of science focused on biophysical resources and high technology	The combination of biophysical and social analysis, including creation and design of specific models and prototype development processes for a particular local environment

METHODS OF CONSERVATION AND PROPER USE OF GENETIC RESOURCES

Bearing in mind all of the above mentioned, it can be concluded that conservation and preservation of nature and genetic resources presents the preservation of future. The goal of conservation is to enable sustainable development by protecting and using biological resources without compromising the wealth of genes and species. There are two basic methods of genetic resources conservation: *in situ* and *ex situ*.

In situ conservation is the preservation and maintenance of the plant population in its natural environment. Evolutionary processes and plant population adaptability are present. It can be considered as conservation of ecosystems and the natural environment and the recovery of existing populations of species in their natural environment. This type of conservation is very sensitive and, for example, can be endangered by fires, extreme weather conditions, etc. (ALTIERI AND MERRICK, 1987).

Ex situ conservation is the preservation of genetic resources outside of the environment and is mainly used for saving endangered species. This type of conservation methods includes: seed storage, DNA storage method, pollen storage, *in vitro* conservation, botanical gardens, cryoconservation (freezing plant material mainly in

liquid nitrogen at -196° C), molecular marker technology. Seed storage is one of the simplest methods for long-term preservation of plant genetic material. For long term storage of vegetative plant material favourable method is cryoconservation (TANDON ET AL., 2009). Maize *ex situ* germplasm collections include landraces (maize races), improved populations (synthetic and varieties, cycles of selection), inbreds (early generation lines and homozygous lines), reference hybrids. The future maize genetic diversity and maize evolution through gene pools that the farmers and the breeders manage, are supported by the conservation activities of *ex situ* maize genebanks.

In the past, access and transfer of genetic material was limited, because the old varieties were kept solely as *in situ* collections. The data indicate that *in situ* conservation is now less used, and that far more research is done by *ex situ* methods. Differences in the methods are shown in Table 2.

It is necessary to supplement the in-situ conservation measures by maintaining *ex-situ* locations and implementation of *ex-situ* conservation measures.

Often *ex situ* conservation will be used as a complement to, or substitute for, *in situ* conservation of unique populations that are threatened in their natural habitat.

Table 2. Differences between *in situ* and *ex situ* conservation, expressed manifested through interest and costs

In situ conservation		Ex situ conservation	
Importance	Costs	Importance	Costs
Genetic resources are used in production	Paid by the farmer	Some genotypes are difficult to conserve	Mainly centralised
Evolutionary processes continue	Can lower farm productivity	Large portion of different germplasm can be expected	High cost regeneration through longer period
Can be better adjusted to particular farmers' needs	Demands land	Germplasm can be available to larger number of breeders	Danger of targeted selection can lower the value of a collection
Better for certain germplasm, e.g. plant with vegetative reproduction	Through the selection, targeted genotypes can be lost	Highly protected storage area can protect from many diseases	In practice, many collections are under-funded and insufficiently organized and documented.
Existing wild relatives can be kept outside the collection.			

GENE TRANSFER (GENE FLOW)

Vertical gene transfer is the process of transferring genes from parents to offspring by classical reproduction. Horizontal gene flow (HTG) is the transfer of genetic material between cells or genomes belonging to different species, both of which are different from conventional reproduction (POPPY AND WILKINSON, 2005, RICHARDSON AND PALMER, 2007; PONTIROLI ET AL., 2009, ANDERSSON ET AL. 2010). In nature, bacteria are known to act as carriers of genes between species (DANIELL, 2002). Genetically modified plants are a potential environmental risk due to the possible horizontal gene transfer. It has already been confirmed in experiments

that genes for resistance to antibiotics incorporated in GM plants can cross to soil bacteria and fungi. Marker kanamycin resistance gene was transferred from tomatoes, tobacco, sugar beet and potatoes to soil bacteria *Acinetobacter*. It was confirmed that the genetic material taken from dead and living cells is resistant to environmental conditions, does not disappear and is not destroyed, as was thought previously (LU AND SNOW, 2005). A particular problem is the monitoring of GM plants (BOCK, 2009).

MONITORING

Genetically engineered plants have become a reality, spreading over increasingly larger areas of the world each year (CLIVE, 2008, 2009). Since the experiments in the laboratory and the field can not fully assume all the possible interactions that may occur in the ecosystem, monitoring is necessary in natural environment after the release of GM plants (KHACHATOURIANS ET AL., 2002, BOSKOVIC ET AL., 2003). Monitoring should be performed in different environmental conditions over a longer period of time (ALTIERI AND NICHOLLS, 1999, ALTIERI, 2000), which is very expensive. The obtained data should be used for future monitoring in which experts from various fields including agronomy, forestry, ecology, protection etc. are to participate.

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REFERENCES

- ALTIERI, M.A., MERRICK L.C. (1987): In situ conservation of crop genetic resources through maintenance of traditional farming system. *Economic Botany*, Volume 41, Number 1, pp. 86-96.
- ALTIERI, M., NICHOLLS, C. (1999): Ecosystem function and insect pest management in agricultural systems. In: Collins WW and Qualset CO (eds), *Biodiversity in Agroecosystems*. CRC Press, Boca Raton, US.
- ALTIERI, M.A. (2000): The ecological impacts of transgenic crops on agroecosystem health. *Ecosystem Health*, Volume 6, pp. 13-23.
- ANDERSSON, M.S., CARMEN DE VICENTE, M. (2010): Gene flow between crops and their wild relatives. Baltimore, Md.: Johns Hopkins University, 564 pp.
- BOCK, R. (2009): The give-and-take of DNA: horizontal gene transfer in plants. *Trends in Plants Science*, Volume 15, Number 1, pp. 11-22.
- BOŠKOVIĆ, J., BOŠKOVIĆ, M., MIĆANOVIĆ, Ž., JERKOVIĆ, Z. (2001): Interakcija genetski modifikovanih biljaka i spoljašnje sredine. I Međunarodni simpozijum "Hrana u 21 veku". Zbornik rezimea, pp. 190.

- BOŠKOVIĆ, J., BOŠKOVIĆ, M., IVANC, A., MIĆANOVIĆ, Ž. (2003): Genetske modifikovane biljke i životna sredina. In: Bošković, J., Ivanc, A., Simić, J. (Eds.), Temetska celina u monografiji "Održivi razvoj poljoprivrede i zaštita životne sredine", Beograd, pp. 145-207.
- BOŠKOVIĆ, J., BOŠKOVIĆ, M., HOJKA, Z., SIMIĆ, J., MIĆANOVIĆ, Ž. (2004): Genetically modified plants and environment. International Conference on Sustainable Agriculture and European Integration Processes, September 19-24, Novi Sad, Serbia and Montenegro. Abstracts, pp. 56.
- BOŠKOVIĆ, J. V., ISAJEV, V. V., PRIJIĆ, Ž. S., ZEČEVIĆ, V. M., HOJKA, Z. M., DOZET, G. K. (2010): Assessing ecological risks and benefits of genetically modified crops. *Journal of Agricultural Sciences*, Volume, 55, Number 1, pp. 89-101.
- CALLO-CONCHA, D. (2003): Servicios Ambientales por Sistemas Agroforestales. In: Ayala SC, Pérez NJ and Mejía JM (eds). *Proceedings VI Congreso Nacional Agronómico. Por una Revaloración del Campo Mexicano*. Universidad Autónoma Chapingo, Departamento de Fitotecnia. Chapingo, México
- CALLO-CONCHA, D. (2009): An approach to environmental services assessment: functional biodiversity in tropical agroforestry systems, ed. Paul L.G. Vlek, *Ecology and Development Series No 65*.
- CLIVE, J. (2008): Global status of commercialized biotech/GM crops: 2008. ISAAA Brief No. 39. ISAAA: Ithaca NY.
- CLIVE, J. (2009): A global overview of biotech (GM) crops. Adoption, impact and future prospects. www.landesbioscience.com.
- CONWAY, G.R. (1993): Sustainable agriculture: the trade offs with productivity, stability and equitability. In ed. Barbiered. *Economics and Ecology: New frontiers and sustainable development*, pp. 46-65. Chapman and Hall, London, UK
- COSTANZA, R., DE ARGA, DE GROOT, R. (1997): The value of the world's ecosystem services and natural capital. *Nature*, Volume 387. pp. 253-260.
- DANIELL, H. (2002): Molecular strategies for gene containment in transgenic crops. *Nature Biotechnology*, Volume 20, pp.:581-586.
- FERRY, N., GATEHOUSE, A. (2009): Environmental impact of genetically modified crops. Wallingford Oxfordshire, UK, Cambridge, 432 pp.
- GARCIA, M.A., ALTIERI, M.A (2005): Transgenic crops: implications for biodiversity and sustainable agriculture. *Bulletin of Science, Technology and Society*, Volume 25, Number 4, pp. 335-353.
- KHACHATOURIANS, G.G., MC HUGHEN, A., SCORZO, R., KIT NIP, W., HUI, Y.H. (2002): *Transgenic plants and crops*. CRC Press, 1st edition, pp 888 pp.
- KONSTANTINOVIĆ, B., BOŠKOVIĆ, J. (2001): *Biotehnologija u zaštiti bilja*. Poljoprivredni fakultet, Novi Sad i Stylos, Novi Sad, 362.
- LU, B.R., SNOW, A.A. (2005): Gene flow from genetically modified rice and its environmental consequences. *BioScience*, Volume 55, pp.669-678.
- MCNEELY, J.A. (2004): Nature vs. nurture: managing relationships between forests agroforestry and wild biodiversity. *Agroforestry Systems*, Volume 61, pp.155-165.
- MILOŠEVIĆ, M, DRAGIN, S., STEGIĆ, M. (2009): *Biljni genetički diverzitet u poljoprivredi*. Poljoprivredni fakultet, Novi Sad.
- PONTIROLI, A., RIZZI, A., SIMONET, P., DAFFONCHIO, D., VOGEL, M.T., MONIER, J.M. (2009): Visual evidence of horizontal gene transfer between plants and bacteria in the phytosphere of transplastomic tobacco. *Applied and Environmental Microbiology*, Volume 75, Number 10, pp.3314-3322.

- POPPY, G.M., WILKINSON, M.J. (2005): Gene flow from GM plants. Biological Sciences Series. Wiley- Blackwell, Revised Edition, 256 pp.
- PRETTY, J. (2001): The rapid emergence of genetic modification in world agriculture contested risks and benefits. Environmental Conservation, Volume 28, pp.248-262.
- PRIJIĆ, Ž., BOŠKOVIĆ, J., JUGOVIĆ, Z. (2008): Uticaj genski modifikovane hrane na zdravlje ljudi. Međunarodna konferencija „Bezbednost u postmodernom ambijentu”. Prolom banja, 26-28 septembar. Zbornik radova, pp. 474-479.
- RICHARDSON, A.O., PALMER, J.D. (2007): Horizontal gene transfer in plants. Journal of Experimental Botany, Volume 58, Number 1, pp.1-9.
- SWIFT, M.J., IZAC, A.M.N. NOORDWIJK, M. (2004): Biodiversity and ecosystem services in agricultural landscapes- are we asking the right questions? Agriculture, Ecosystems and Environment, Volume 104, pp. 113–134.
- TANDON P., KUMARIA, S., NONGRUM L. (2009): Conservation and management of plant genetic resources of Northeast India, Indian Journal of Traditional Knowledge, Volume 8, Number 1, pp. 29-34.
- WIEBE K., GOLLEHON, N. (2006): Agricultural Resources and Environmental Indicators *Edition / EIB-16* Economic Research Service/USDA.

THE EXAMINATION OF MAJOR ECONOMIC COHERENCES IN THE HUNGARIAN LEAST-DEVELOPED MICRO-REGIONS

JÓZSEF KÁPOSZTA - KITTI KOLLÁR – LÁSZLÓ PÉLI

Szent István University, Faculty of Economics and Social Sciences
Institute of Regional Economics and Rural Development
H- 2100 Gödöllő, 1 Páter K. str.
kaposzta.jozsef@gtk.szie.hu

ABSTRACT

The examination of disadvantaged areas has a long history, which is greatly influenced by the continuous change of the natural, economic and human resources. Therefore, while investigating the disadvantaged regions, new and new coherences occur. Today's regional policy needs to face the issue whether the past years' regional funds have been efficient enough and whether the land-use of such areas influence the competitiveness of the given region. These issues are raised every day while examining the efficiency of the regional policy of the last 20 years. The topic is very actual, since there are inequalities existing in the world, and also in the member states of the European Union. There are significant imbalances between the urban and rural areas. The focus of our research was on the economic and social dimensions of the territorial imbalances in the micro-regions, with special focus on the complex relationships among them.

Keywords: **disadvantaged micro-region**, periphery, locality, demand-oriented strategy, low quality of human resource potential

INTRODUCTION

The main reason for the creation of spatial differences is that the economic and social processes are always restructured in the space and time (HARSÁNYI et al., 2005, RITTER, 2008). This restructuring can be observed in **Hungary**, in the **Carpathian basin**, in **Central-Eastern-Europe**, as well as in the **European Union and in the world**. In order to get a real picture about today's spatial processes, it is necessary to learn the processes resulting in the spatial imbalances as well as their impacts on the change of spatial structure. These discrepancies can be observed at various territorial levels. During micro-regional investigations researchers carry out researches in larger areas than the town-village dichotome, however, in a narrower territory compared to the West-East investigations (MOLNÁR, 2007).

Territorial inequalities in Hungary

In our opinion, the topic is timely because the usefulness of the research is important ranging from **rural development**, to spatial planning and the **elaboration of local and regional development strategies**. Spatial discrepancies in Hungary cause the disadvantage of rural areas, contributing to their lagging behind compared to the urban areas (MISKÓ, 2006, TÓTH, 2009). Disadvantaged rural areas are the location of agricultural farming and forestry, therefore I considered it important to investigate land-use distribution.

Past years' regional policy has also put great emphasis on the development of the disadvantaged rural areas and the efficiency of distribution of funds, established also by the **Barca report** published in 2009 (BARCA, 2009). **Fabrizio Barca, Italian economist** highlights the fact, in a direct and indirect way, that the funds should be channeled to the old (developed) member states. Regarding my topic, it is important whether the Hungarian

least-developed micro-regions or the more-developed ones should be supported in the future in order to achieve dynamic development.

The general features of the disadvantaged areas are the low **infrastructural supply**, low **quality of services**, and there are **shortages of jobs**. As a consequence, there is high unemployment rate and the wages are low. It is also a common phenomenon that young people migrate from these disadvantaged rural areas, contributing to the aging population in long terms (KÁPOSZTA et al., 2010).

The change in the economic structure starting in the 1990s also contributed to the territorial inequalities to a large extent, since **dynamically developing centres and peripheral territories lagging behind** have been created (DUSEK, 2001). The targets of my research, i. e. the least-developed micro-regions are also located on these peripheral areas. Hungary is a one-centered country, there are only few large or middle-sized town and there are a lot of small villages in the countryside.

Due to the lack of roads and highways the accessibility of rural areas is difficult, so they are isolated from the major economic and social streamlines. As it has been mentioned before, the least-developed micro-regions are the places of agricultural farming and forestry, raising the question **what breaking out potentials they have in Northern-Hungary, Northern-Great Plain, Southern-Great Plain and Southern-Transdanubia?** While evaluating the land-use and the agricultural economy of Hungary, we can state that our most important natural resource is the **agricultural land** (NAGY, 2009). Spatial development and rural development programs of the past years have turned the focus to the micro-regions were not able to break out of their stagnating status **despite of the development programs and funds available**.

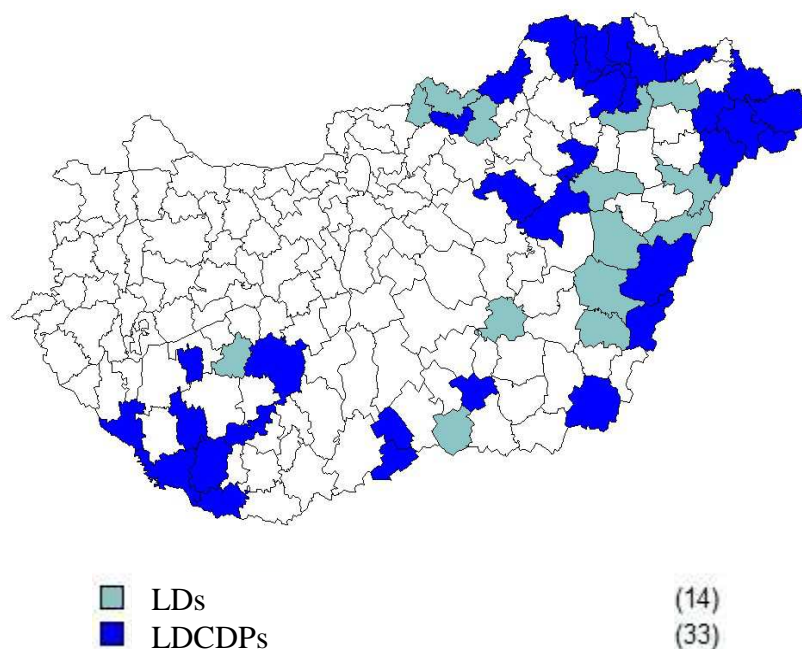
While examining the least-developed micro-regions, a question raises: what micro and macro factors play important role in their stagnation or breaking off? In our study we highlight the relationships between the economic and social conditions of the 47 least-developed micro-regions.

MATERIAL AND METHOD

The territorial categories of the NUTS system changed on 1 January 2008. The Hungarian classification is based on the **Parliamentary provision No. 2007/67** and the **Governmental Act No. 2007/311**. The researches carried out by our Institute have focused on the 47 least-developed micro-regions, with special attention given to the 33 micro-regions requiring complex development programs.

In our study we shall use the following abbreviations for the areas in question:

- LD: least-developed micro-regions
- LDCDP: least-developed micro-regions requiring complex development programs



Source: own editing based on CSO data (2011).

Figure 1: The distribution of the Hungarian LDs and LDCDPs

In our research, we intended to find answers to the following questions:

1. What economic and social characteristics can be observed in the 47 least-developed micro-regions concerning their competitiveness?
2. Which are the economic and social factors that led to the stagnation or breaking off of these areas?
3. Is there a relation between the spatial competitiveness ranks, the efficiency of support, the social diversity and the human resource available in the micro-regions examined?
4. Are there LDCDP micro-regions which could break out from their current category?

RESULTS

As a general conclusion, we can state that the least-developed micro-regions are on the periphery of the country and it is necessary to prevent their economic and social break off. The classification in the Governmental Act No. 2007/311 requires a review. My research has highlighted that there are micro-regions which do not belong to the least-developed micro-regions any more, while there are some which would require complex development assistance. Based on our research findings, it is clear that they lag well behind the national average regarding both economic and social indicators.

In our opinion, the following factors have contributed much to their break off:

1. **The low quality of human resource:** it is characteristics to almost all the micro-regions that the share of population with 0 classes finished is high among those 14-x years, the share of population passed school leaving exam is low among those over 18, therefore there is no appropriate qualified human resource potential in the micro-regions in question.
2. **High rate of migration:** there are only 2 micro-regions where the rate of migration was positive, meaning that the share of active population is not favorable at all in any of the micro-regions.
3. **Inappropriate infrastructural background:** due to their peripheral location, their accessibility is not appropriate, the quality of roads is bad.
4. **Social groups:** the disadvantaged social groups represent high share within the society, who do not usually have the expected qualification either.

CONCLUSIONS

Our researches have proven that the performance of the Hungarian least-developed micro-regions well lag behind the expected level even compared to the level of the 1990s. We believe that it is because a lot of jobs were lost (most of which was in the industry), causing the creation of lasting **crisis zones**. Nowadays, in addition to the large-scale companies, most of the small-sized operating enterprises have been **set up as a must**.

The signs of development can only be observed along the highways, especially in larger cities. Our research also proved that micro-regions that are located in the **gravitation zones** of developing cities show more positive picture regarding their competitiveness than those out of such zones. All these justify that the development of **business environment** encouraging the location of new enterprises needs to be supported in the least-developed micro-regions, the **setting up of enterprises** should also be encouraged, creating new jobs in the micro-regions. The improvement of competitiveness of industries that are based on local traditions and high knowledge may lead to the development of the micro-regions examined. In our opinion, the future strategies of the micro-regions should be adjusted to the strategic priorities included in the operative programs, e.g. the improvement of the innovation abilities of the regions and businesses that could increase the local added value.

In our opinion, the low qualification of the human resource, the **high unemployment rate** among the disadvantaged social groups and the **poor funds absorption ability** of the peripheral areas are key problems. We think that all development programs aiming at the increase of employment and improving the quality of human resources in the micro-regions should be supported and preferred. According to us, such developments have to be carried out which can mitigate the social tension caused by the lasting unemployment. In order to achieve the common goals, as emphasized in the regional operative programs as well, cooperation is inevitable between the SMEs and the Economics Development Operative Program (which promotes job creation), as well as the Social Development Operative Program which improves the employability.

Moreover, in our opinion, the New Hungary Rural Development Program can provide specific support for the rural, peripheral areas. In addition, the regional operative programs also highlight the fact that the Hungarian disadvantaged areas have several internal features (e.g. landscape protection areas) which could serve as a basis to strengthen the touristic potential. The **Tokaji and Tiszafüredi** micro-regions are outstanding due to their popularity and traditions on which the tourism could be developed. Considering the characteristics of the micro-regions, the targeted development of some sectors of tourism could contribute to the economic development efficiently.

REFERENCES

- BARCA, F. (2009): Barca-jelentés: A kohéziós politika reformjáról, Róma (vitaanyag)
- DUSEK, T. (2001): A területi mozgóátlag, In.: Területi Statisztika. 2001. 3. 215-229. p.
- HARSÁNYI, E. - HARSÁNYI, G. - NAGY, A. (2005): Területi fejlettségi különbségek Magyarországon és az Észak-Alföldi Régióban, Agrártudományi Közlemények, 2005/18. , Debrecen
- KÁPOSZTA, J. – NAGY, H. – KOLLÁR, K. (2010): Borsod-Abaúj-Zemplén és Szabolcs-Szatmár-Bereg megye leghátrányosabb helyzetű kistérségeinek településszerkezeti, foglalkoztatási jellemzői az EU- csatlakozás óta eltelt időszakban. Területi statisztika, 50 (6) 641-658. p.
- NAGY, H. (2009): Regionális politika. Szent István Egyetem, Gazdaság- és Társadalomtudományi Kar, 2009.
- MOLNÁR, M. (2007): Területi egyenlőtlenségek In.: Káposzta József szerk. (2007): Regionális gazdaságtan. Tankönyv. DE Kiadó Debrecen, 2007. ISBN 978-963-9732-79-7, 300 p.
- MISKÓ, K. (2006): A Leader-Program, mint vidékfejlesztési lehetőség, Doktori értekezés, Szent István Egyetem, Gazdálkodás- és Szervezéstudományok Doktori Iskola, 161 p.
- RITTER, K. (2008): Agrárfoglalkoztatási válság és a területi egyenlőtlenségek, Doktori értekezés, Szent István Egyetem, Gazdálkodás és Szervezéstudományok Doktori Iskola, 164 p.
- TÓTH, T. (2009): Regionális gazdaságfejlesztés és menedzsment, Szent István Egyetem, Gazdaság- és Társadalomtudományi Kar, 2009.

AGE-DEPENDENT CHANGES OF ANTLER SIZE IN RED DEER IN TWO CONTRASTING HABITATS IN HUNGARY

TAMÁS KOLEJANISZ, KRISZTINA SONKOLY AND SÁNDOR CSÁNYI

Szent István University, Institute for Wildlife Conservation
2100 Gödöllő, Páter Károly utca 1.,
[email: tkolejanisz@gmail.com](mailto:tkolejanisz@gmail.com)

ABSTRACT

The purpose of the study was to analyse age-dependent changes of antler size in red deer (*Cervus elaphus*) in two contrasting habitats. The study involves the area of Gemenc-Hajós ("excellent habitat") and the Börzsöny Mountains ("poor habitat"). We statistically analysed the trophy evaluation data, population estimates and harvest data of local game management units.

We also compared the two study areas on the basis of the most important antler characteristics of different age groups (antler mass, antler length, number of antler tines). Mean antler masses in the area of Gemenc-Hajós exceeded that of in Börzsöny Mountains during the entire study period. The difference is insignificant in the case of young stags; however, considering the middle-aged, even more the old age groups, the age-dependent deviations of the averages between the two different habitats show an increasing trend.

The differences in the mean antler lengths show a similar trend, however, the growth is not as considerable as in the antler masses. In turn, considering young stags the differences are negligible. Finally, taking into account the mean number of tines, we can report similar differences as in the case of antler lengths.

The results indicate that antler sizes of young stags shot in the area of Gemenc-Hajós on average are very similar to that of the stags shot in the Börzsöny Mountains, which can be attributed to the contrasting habitats and the diverse harvest per age group. From the middle-age the differences of averages are increasing as the better habitat allows red deer stags to develop larger antlers.

Keywords: red deer, age distribution, habitat differences, antler size and characteristics, Hungary

INTRODUCTION

So far, few studies have focused on the comparison of antler size of red deer living in contrasting habitats in Hungary (TÓTH ET AL., 2010). Therefore, it is important to compare statistically the antler characteristics of red deer populations to reveal the factors that can cause the differences between populations living in contrasting habitat conditions and the ways they are manifested.

Antler is a super-product, which determines the competition and mating success of stags (CLUTTON-BROCK, 1982; CLUTTON-BROCK ET AL., 1982). It shows the social rank in stags honestly advertising male reproductive quality (MALO ET AL., 2005) and females prefer males with the largest, more branched antlers, and all things considered, prefer males in excellent condition (CLUTTON-BROCK, 1982; CLUTTON-BROCK ET AL., 1982; KRUK ET AL., 2002; MYSTERUD ET AL., 2002; MYSTERUD ET AL., 2005).

Changes of antler size are closely related to age (KRUK ET AL., 2002). The species-specific antler mass, antler length, and antler development itself are hereditary characteristics; their manifestation is regulated by the neuroendocrine system, and performed by metabolic processes. However, these processes are influenced by environmental factors affecting hereditary characteristics (CSÁNYI, 2007; KRUK ET AL., 2002; MYSTERUD ET AL., 2005; SZEMETHY ÉS BIRÓ, 2005; TÓTH ÉS MTSAL, 2010).

According to LEHOCZKI (2011), the most important environmental factors influencing antler development in roe deer are body weight, nutritional status, population density, land use, land cover, climatic conditions, parasite load, and also soil characteristics. These environmental factors also influence antler development in red deer (KRUUK et al., 2002).

MATERIALS AND METHODS

Description of study areas

The area of Gemenc-Hajós

The size of the area is 69989 hectares, which is partially located in South Bács-Kiskun and South Baranya game management districts (III/1 Plan of South Baranya Game Management District, 2004; III/2 Plan of South Bács-Kiskun Game Management District, 2004). The sample area possesses good-quality soil, intensive agriculture; furthermore, Gemenc has a great variety of floodplain forests, which allows outstanding conditions for red deer. The quality of red deer population in the area regarding trophy production is excellent. The number of red deer reported and harvested is presented in *Figure 1*.

The area of Börzsöny Mountains

This is the part of Börzsöny-Nógrád-Gödöllő game management district, which is situated in the North Central Mountains game management area (II/1. Plan of Börzsöny-Nógrád-Gödöllő Game Management District, 2004). The study area covers 66225 hectares including the whole Börzsöny Mountains. This area possesses poor quality soils, lower yields, less biomass produced; on the whole, we can count on lower quality population of red deer. The number of red deer reported and harvested is presented in *Figure 2*.

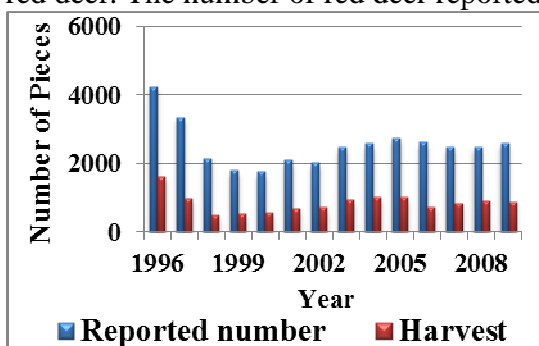


Figure 1. Reported population number and harvest of red deer in the area of Gemenc-Hajós

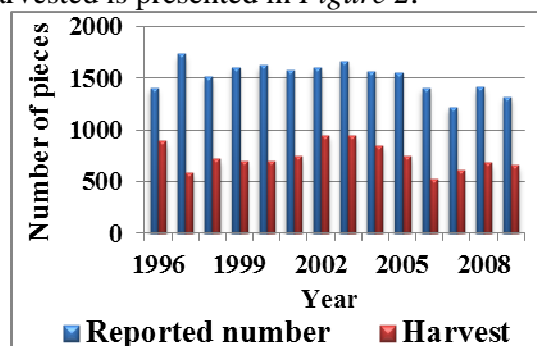


Figure 2. Reported population number and harvest of red deer in the area of Börzsöny Mountains

Data and statistical methods

Our study is based on the trophy evaluation data, population reports (estimates) and game harvest data of local game management units, which were provided by National Game Management Database, located in Gödöllő, Hungary. For the study we used trophy evaluation data from 1990-2009 (N= 3948 for Börzsöny Mountains and N= 4307 for Gemenc-Hajós). Stags were grouped as young between 1-5 years, middle-aged between 6-10 years and old over 11 years.

We used antler parameters measured in trophy evaluation as the mean antler mass (kg), right and left antler lengths (cm) and number of right and left antler tines. Antler measurements were made according to the CIC system of trophy evaluation (CIC, 2010).

We calculated the means and standard deviations and made the diagrams with Microsoft Excel 2010. We used t-test to analyse differences between the study areas (Graphpad Instat 3).

RESULTS

Changes of antler masses in the two habitats by age groups

In most cases, means of antler masses of stags in Gemenc-Hajós are greater than in Börzsöny Mountains (*Figure 3, Figure 4, and Figure 5*). According to t-test, means of antler masses of stags between the two habitats differ significantly in case of young ($p < 0,001$; $t = 4,175$; $df = 38$), middle-aged ($p < 0,001$; $t = 12,831$; $df = 38$) and old ($p < 0,001$; $t = 11,133$; $df = 38$) age groups. Visually explored, between the young age groups, there are hardly any differences (*Figure 3*), while trophy evaluation data of the middle-aged (*Figure 4*) and old (*Figure 5*) age groups show an increasing difference between the two study areas (habitats).

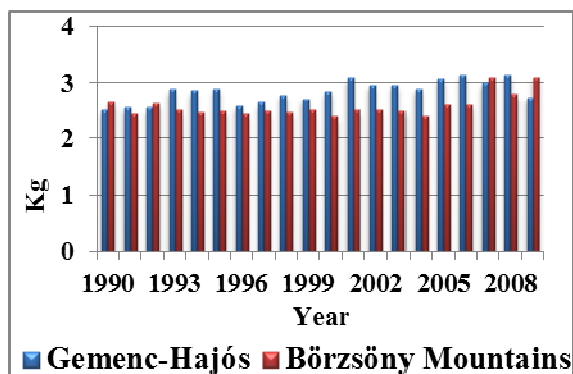


Figure 3. Means of antler masses in young stags in the study areas

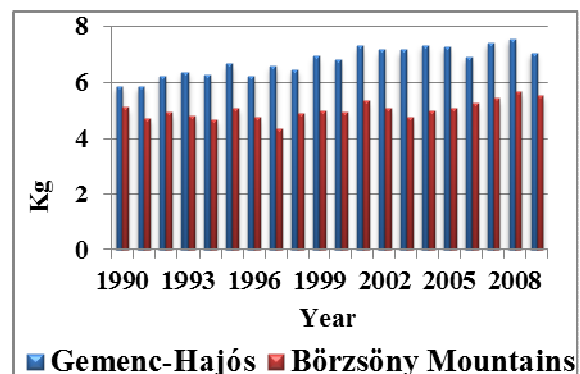


Figure 4. Means of antler masses in middle-aged stags in the study areas

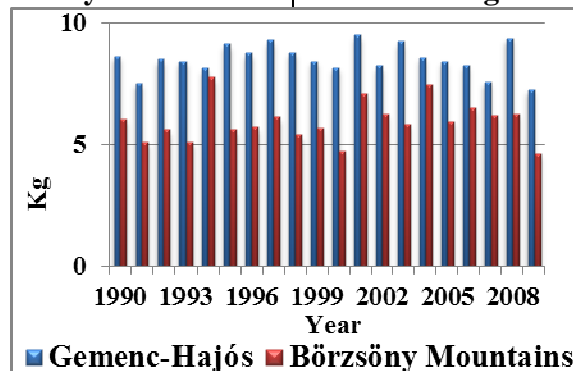


Figure 5. Means of antler masses in old stags in the study areas

Changes of antler lengths in the two habitats by age groups

Regarding the means of antler lengths in the two habitats, there is no considerable difference between young age groups as we have seen in case of antler masses (*Figure 5*). However, considering middle-aged (*Figure 6*) and old (*Figure 7*) age-groups, the means of antler lengths are much greater in the Gemenc-Hajós study area. According to the t-test, the means of antler lengths of young stags between the two habitats do not differ significantly ($p = 0,1738$; $t = 0,2164$; $df = 38$), while in case of middle-aged ($p < 0,001$; $t =$

9,931; $df= 38$) and old ($p<0,001$; $t= 4,626$; $df= 38$) age groups the differences are significant.

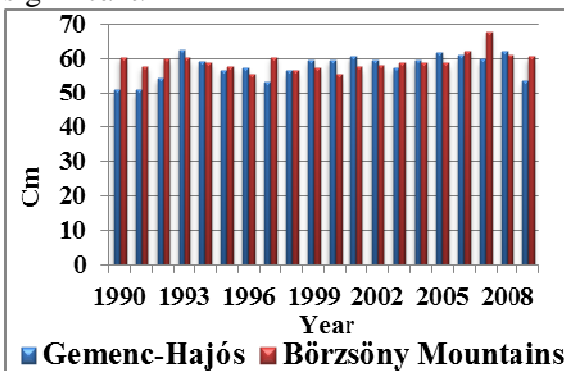


Figure 6. Means of antler lengths in young stags in the study areas

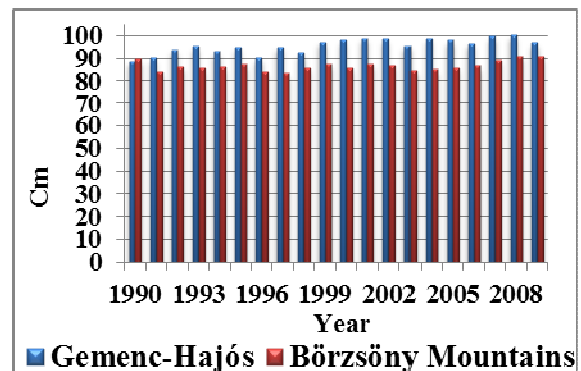


Figure 7. Means of antler lengths in middle-aged stags in the study areas

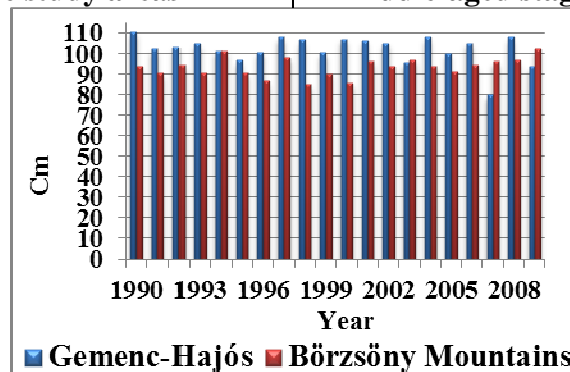


Figure 8. Means of antler lengths in old stags in the study areas

Changes in the number of tines in the two habitats by age groups

Regarding the means of antler tines the tendency is the same as we have seen in the case of antler lengths (Figure 9, Figure 10, and Figure 11). According to the t-test, the average number of tines of young stags do not differ significantly ($p=0,8298$; $t= 0,2164$; $df= 38$) between the two habitats, while in the case of middle-aged ($p<0,001$; $t= 9,848$; $df= 38$) and old ($p<0,001$; $t= 8,025$; $df= 38$) age groups the difference is statistically significant.

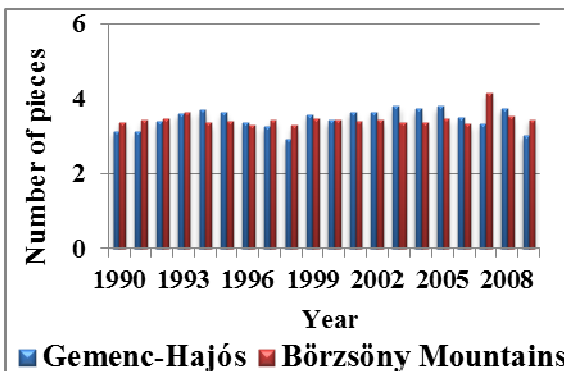


Figure 9. Means of antler tines in young stags in the study areas

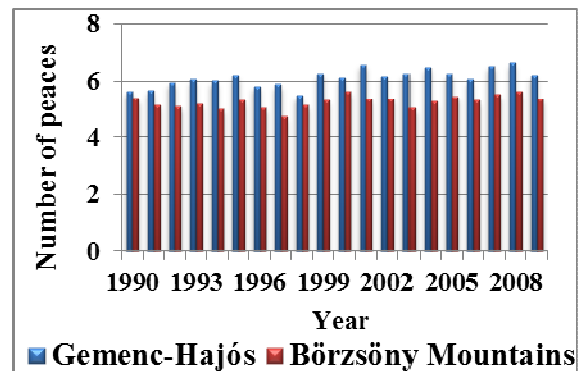


Figure 10. Means of antler tines in middle-aged stags in the study areas

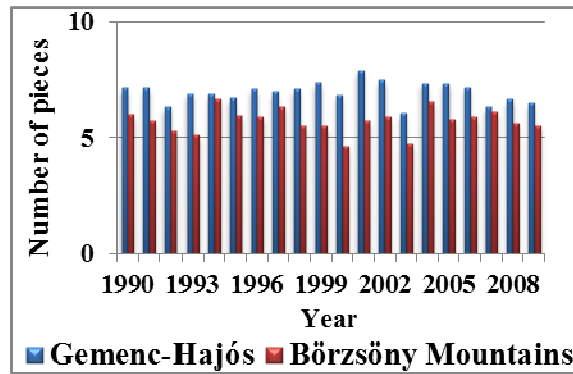


Figure. 11 Means of antler tines in old stags in the study areas

Age distribution and comparison of age groups in the two different habitats

We made the comparison of age groups by trophy evaluation data. It is obvious that the proportions of young stags among evaluated trophies are considerably greater in the area of Börzsöny Mountains, than in the area of Gemenc-Hajós. This means the share of the young age group was at least twice larger in the Börzsöny area in the past 20 years (*Figure 12 and Figure 13*).

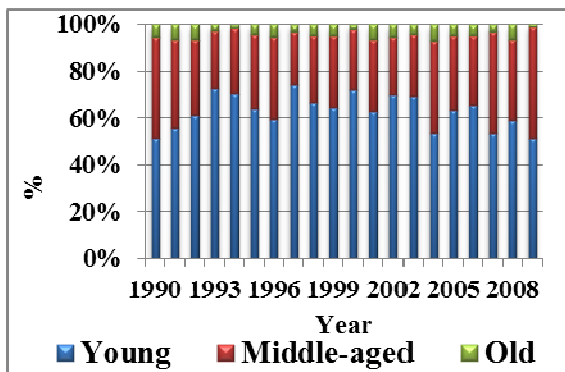


Figure 12. Age distribution of stags in the area of Börzsöny Mountains

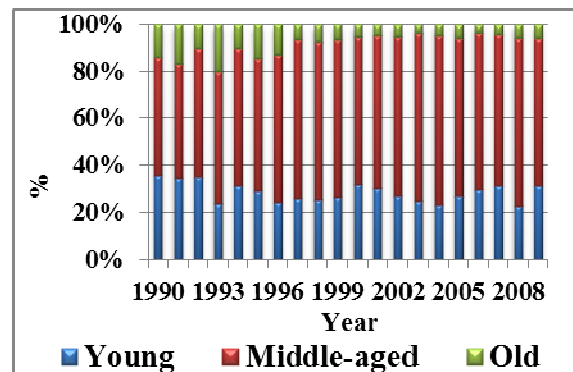


Figure 13. Age distribution of stags in the area of Gemenc-Hajós

CONCLUSIONS

We found significant differences between antler masses of all age groups analysed in the two contrasting habitats. The differences in the young age group were not significant; meanwhile those of the middle aged and the old stags were statistically significant. TÓTH ET AL. (2010) reported different findings in young red deer stags living in 5 different habitats; they found significant differences in antler masses, antler lengths and the number of antler tines.

As far as we can see, the small statistical difference between the antler masses of young age groups is the result of the selective shooting of young males. In both areas young stags under a minimum (and not defined) antler weight are removed by hunters. The slower antler development in the poor areas accounts for the fact that more small antlered males are removed in Börzsöny. At the same time, in the excellent area of Gemenc-Hajós the antler development of the young is better and most of them "escape" early shooting since

they have “promising” antlers. As a result, in Börzsöny Mountains the proportion of young stags shot was twice as large as in Gemenc-Hajós (*Figure 12 and Figure 13*). In answer to better conditions more middle-aged stags can be shot in this area. Furthermore, it is traceable that after the young age the antlers of stags in the area of Gemenc-Hajós are increasing faster, though culmination is reached at very similar ages (9-10 years) in both regions (*Figure 14 and Figure 15*). The steeper increase in the excellent habitat can be attributed to better habitat conditions in the first place.

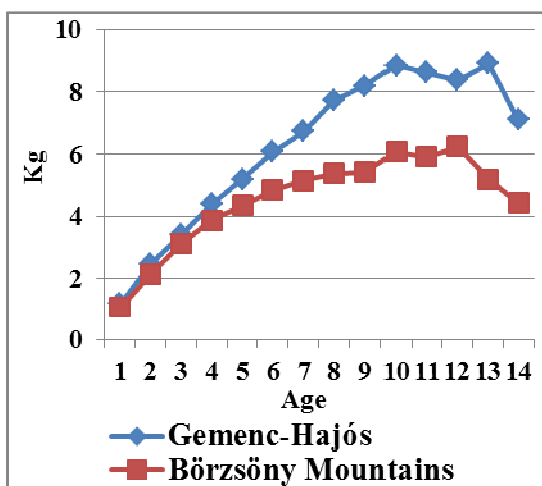


Figure 14 Age-dependent changes of antler masses in stags in the study areas

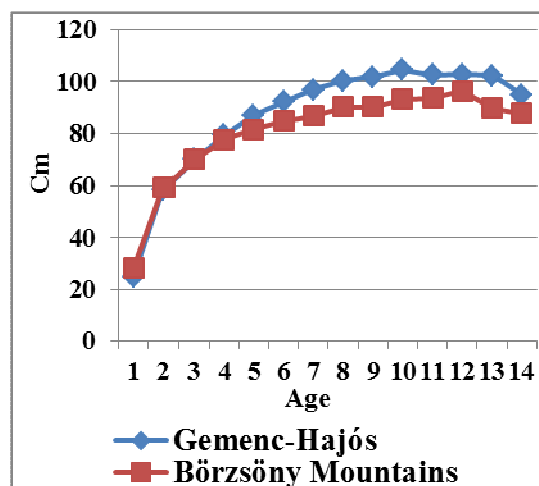


Figure 15 Age-dependent changes of antler lengths in stags in the study areas

ACKNOWLEDGEMENTS

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REFERENCES

- CLUTTON-BROCK, T., H. (1982): The function of antlers, *Behaviour*, Vol. 79, No. 2/4 (1982), pp. 108-125
- CLUTTON-BROCK, T., H., GUINNESS, F., E., ALBON, S., D. (1982): *Red deer: behavior and ecology of two sexes*, Edinburgh University Press, Edinburgh.
- CSÁNYI, S. (2007): *Vadbiológia*, Mezőgazda Kiadó, Budapest
- KRUUK, L. E. B., SLATE, J., PEMBERTON, M., J., BROTHERSTONE, S., GUINNESS, F. AND CLUTTON-BROCK, T., H. (2002): Antler Size in Red Deer: Heritability and selection but no evolution, *Evolution*, Vol. 56, No. 8., pp. 1683-1695
- LEHOCZKI, R. (2011): Az őz agancsminőségét befolyásoló egyes környezeti tényezők hatása, Doktori (PhD) értekezés, Szent István Egyetem, Mezőgazdaság- és Környezettudományi Kar, Gödöllő
- MALO, A. F., ROLDAN, E. R., GARDE, J., SOLER, A. J. ÉS GOMENDIO, M. (2005): Antlers honestly advertise sperm production and quality. *Proceedings of the Royal Society B: Biological Sciences*, 272: 149-157

- MYSTERUD, A., LANGVATN, R., YOCCOZ, N. G. AND STENSETH, N. C. (2002), Large-scale habitat variability, delayed density effects and red deer populations in Norway. *Journal of Animal Ecology*, 71: 569–580.
- MYSTERUD, A., MEISINGSET, E., LANGVATN, R., YOCCOZ, N. G. AND STENSETH, N. C. (2005): Climate-dependent allocation of resources to secondary sexual traits in red deer. *Oikos* 111: 245-252.
- ORSZÁGOS VADGAZDÁLKODÁSI ADATTÁR (2004): II/1. Börzsöny-nógrád-gödöllői nagyvadas körzet vadgazdálkodási terve, Szent István Egyetem, Gödöllő
- ORSZÁGOS VADGAZDÁLKODÁSI ADATTÁR (2004): III/1 Dél-baranyai nagyvadas körzet vadgazdálkodási terve, Szent István Egyetem, Gödöllő
- ORSZÁGOS VADGAZDÁLKODÁSI ADATTÁR (2004): III/2 Dél-bács-kiskuni körzet vadgazdálkodási terve, Szent István Egyetem, Gödöllő
- SZEMETHY, L. ÉS BIRÓ, ZS. (2005): Emlősök anatómiája és élettana. Egyetemi jegyzet. Szent István Egyetem, Vadgazda Mérnöki Szak-Vadbiológiai és vadgazdálkodási tanszék, Gödöllő
- TÓTH, CS., BENE, SZ. ÉS SUGÁR, L. (2010): Fiatal gímszarvasbikák testnagyságának és agancsjellemzőinek alakulása eltérő élőhelyi viszonyok között, *Vadbiológia* 14: 29-36

ANALYSIS OF GENETIC STRUCTURE OF SOME NATIVE TURKISH GOAT BREEDS BY 20 MICROSATELLITE MARKERS

ÖZGECAN KORKMAZ AĞAOĞLU¹, OKAN ERTUĞRUL²

¹Mehmet Akif Ersoy University, Faculty of Veterinary Medicine,
Department of Animal Science, Istiklal Location, 15030,
Burdur, Turkey

ozgecanagaoglu@mehmetakif.edu.tr

²Ankara University, Faculty of Veterinary Medicine,
Department of Genetics, Irfan Bastug Street, Diskapi, 06110
Ankara, Turkey

ertugrul@veterinary.ankara.edu.tr

ABSTRACT

Genetic diversity, genetic relationship and bottleneck were evaluated in Angora, Kilis, Honamli, Hair and Norduz goat breeds using 20 microsatellite markers. Analyses revealed that the average number of alleles per locus (15.65 allele/locus) and levels of heterozygosity (0.5192–0.9400) were fairly high. The calculated overall FIS value for all populations was 0.03656 ± 0.033 and it was not significant. All the populations were in the Hardy–Weinberg equilibrium. Gene exchange among populations was consistently high, its rate being $N_m = 8.07$ migrants per generation. According to FST values, a medium level of genetic diversity was found between the Angora goat breed and other breeds. Among the other breeds, genetic diversity was low and this diversity was statistically significant. Results of various analyses, such as allelic variation analysis, heterozygosity analysis, F statistics, STRUCTURE test and factorial correspondence analysis, indicated that the Angora goat breed is different than the other goat breeds. Furthermore, analysis showed that the other native goat breeds could not be distinguished from each other; these breeds were grouped together. The results obtained from the analysis of 20 microsatellite loci indicated that goat breeds other than the Angora goat breed cannot be genetically distinguished from each other.

Keywords: Genetic Diversity, Microsatellites, Native Turkish Goat Breeds, Population Structure, Bottleneck

INTRODUCTION

Goats (*Capra hircus*) are an important domestic animal because they were one of the first animal species to be domesticated (LUIKART et al., 2001; FERNANDEZ et al., 2006) and because of their ability to rapidly adapt to different environmental conditions. Goat breeding is one of the most important agricultural activity and source of livelihood in rural areas in Turkey (ERTUĞRUL et al., 1995). Native goat breeds in Turkey include the Angora, Kilis, Honamli, Hair and Norduz goat breeds (AKÇAPINAR, 1994). The Kilis, Honamli, Hair and Norduz goat breeds have some phenotypic similarities, but the Angora goat breed is different. Molecular genetics characterization with adequate number of microsatellite loci has not yet been done for these breeds. Hence, it is essential to genetically characterize and describe the genetic diversity of these native breeds. Many studies (DALVIT et al., 2008; CHAUDHARI et al., 2009) have been conducted to investigate the genetic diversity of farm animals, namely cattle and sheep, but studies on the genetic diversity of goat breeds are only recently being done in greater numbers. Some Turkish goat breeds have been used in different studies (LUIKART et al., 1999; CANON et al., 2006), but those studies either had a low number of samples or they had less than 20 microsatellite loci. Furthermore, new studies on genetic diversity that included these goat breeds have become more interesting to the scientific world because the earlier studies did not evaluate any breeds specific to Turkey, such as the Norduz goat, and because Anatolia is geographically close to major domestication centers. Turkey has rich genetic diversity because it is located between the

continents of Europe, Asia and Africa and functions as a bridge between them. Goat stock in Turkey numbered around 6,293,233 head (TUIK, 2011), which is almost 20% of small ruminants in Turkey. However, the number of goats has decreased dramatically since the 1990s (TUIK, 2011). The first step for the conservation and exploitation of domestic animal biodiversity is comprehensive knowledge of the existing genetic variability and how this variability is divided among breeds (IAMARTINO et al., 2005). For this reason, it is important and urgent to determine the genetic diversity of native Turkish goat breeds. The purpose of this study was to use 20 microsatellite markers to determine genetic diversity, genetic relationships and bottleneck in 5 native goat breeds raised in Turkey. The goal of this trial was to contribute to population genetics studies in Turkey using microsatellite markers and to make sure the method can be executed in the laboratory. The goal was also to achieve preliminary molecular identification using 20 microsatellite markers on the primary DNA gene bank, which was created by TURKHAYGEN-I project staff and which contains most of the native Turkish animal genetic resources.

MATERIAL AND METHOD

A total of 251 blood samples were collected from 5 different goat breeds in natural habitats. The sample size for each breed was: 50 Angora goats, 51 Kilis goats, 49 Honamli goats, 52 Hair goats and 49 Norduz goats. The goats were not blood related (according to animal pedigrees and breeders informations). Blood samples collected from the goat breeds were placed into an EDTA tube. Genomic DNA was extracted from 10 ml blood samples using the standard phenol chloroform method (SAMBROOK et al., 1989). Multiplex PCR methods were used (KORKMAZ AĞAOĞLU et al., 2010, 2011). Fragments were resolved on a Beckman Coulter CEQ-8000 Genetic Analyser. The following were calculated for each of the 20 microsatellite loci analyzed: the number of alleles (nA), frequencies of alleles and null alleles, average number of migrants per generation (Nm) ($Nm \approx (1 - F_{ST}) / 4F_{ST}$) (ALLENDORF AND LUIKART 2007), observed (H_o) and expected heterozygosity (unbiased – H_e, H_{nb}), Wright's F-statistics (WEIR AND COCKERHAM, 1984), polymorphic information content (PIC) (BOTSTEIN et al., 1980), Hardy–Weinberg equilibrium (HWE), genetic distances, phylogenetic tree (NEI et al., 1983), factorial correspondence analysis (LEBART et al., 1984), the STRUCTURE test, and the Bottleneck test. Genetix (v4.05) (BELKHIR et al., 2004), PowerStats V12 (BRENNER AND MORRIS, 1990), Genepop (RAYMOND AND ROUSSET 1995), STRUCTURE (PRITCHARD et al., 2000), Bottleneck v1.2.02 (CORNUET AND LUIKART, 1996) etc. programs were used for analysis.

RESULTS

In this study, a total of 313 alleles were observed. *Table 1* shows the observed number of alleles, observed and expected heterozygosities, PIC values as well as null allele frequencies for all the populations.

The average number of alleles per locus was 15.65. In native Turkish goat breeds, the number of observed alleles varied from 10.45 (Honamli goat breed) to 11.8 (Angora goat breed). The values were higher than observed in goat breeds from the Czech Republic (JANDUROVÁ et al., 2004) and in Egyptian and Italian goat breeds (AGHA et al., 2008). It is also higher than the values reported for other Indian, Chinese and Swiss goat breeds (FATIMA et al., 2008; QI et al., 2009; GŁOWATZKI-MULLIS et al., 2008). The average observed heterozygosity between the populations was 0.78. This value in this study was

higher than that reported for the Kutchi breed of goat (0.59) (DIXIT et al., 2008), the Gohilwari breed of Indian goat (0.505) (KUMAR et al., 2009) and the Gujarat (India) goat breed (0.61) (FATIMA et al., 2008).

Table 1. Genetic variability parameters in native Turkish goat breeds.

Lokus	NA ^a	Hnb	Ho	PIC ^b	NAF ^c
BM1818	14	0.8526	0.8327	0.83	0,0235
CSR247	16	0.8617	0.8487	0.84	0,0139
HSC	19	0.9046	0.8400	0.89	0,0335
ILSTS11	10	0.7589	0.7697	0.72	0,0175
ILSTS30	16	0.8513	0.7810	0.83	0,0342
INRA005	9	0.6351	0.6145	0.57	0,0254
INRA23	14	0.8754	0.8691	0.86	0,0083
MAF65	21	0.8445	0.8166	0.82	0,0225
MAF70	12	0.8318	0.8218	0.80	0,0198
OARAE54	16	0.8373	0.8244	0.81	0,0111
OARCP34	15	0.8540	0.8520	0.83	0,0060
OARFCB20	13	0.7598	0.6822	0.72	0,0423
OARFCB48	13	0.8358	0.8396	0.81	0,0071
OARFCB304	24	0.7750	0.7449	0.75	0,0133
SRCRSP1	19	0.7883	0.7331	0.75	0,0311
SRCRSP5	13	0.8538	0.8284	0.83	0,0355
SRCRSP8	16	0.7815	0.7290	0.75	0,0352
SRCRSP15	14	0.7280	0.7057	0.69	0,0211
SRCRSP23	19	0.8505	0.8238	0.83	0,0117
TGLA53	20	0.7979	0.7338	0.77	0,0327
Mean	15.65	0.8139	0.7846	0.78	0.0212

^aNumber of alleles, ^bPolymorphic information content, ^cNull allele frequency estimated

The statistical evaluation of informativeness of a marker is defined by PIC values, which varied between 0.57 (INRA005) and 0.89 (HSC) with a mean PIC of 0.78 across the populations. Genetic markers exhibiting PIC values higher than 0.5 are considered to be informative in genetic population analysis (BOTSTEIN et al., 1980). For this reason, genetic diversity studies may prefer these loci. The Wright's F-statistics for each breed, the genetic distance between populations and gene flow (Nm) in brackets were as shown in *Table 2*.

Table 2. Estimated pairwise F_{ST} and Nm between populations in brackets (above diagonal) and Nei's D_A genetic distance (below diagonal).

	Ankara	Kilis	Honamli	Kil	Norduz
Ankara	-	0.05734***(4.11)	0.05788*** (4.07)	0.05790*** (4.06)	0.06196*** (3.78)
Kilis	0.1520	-	0.01382*** (17.84)	0.01025*** (24.14)	0.01059*** (23.36)
Honamli	0.1589	0.0813	-	0.00492*** (50.56)	0.01470** (16.76)
Kil	0.1481	0.0643	0.0587	-	0.00587*** (42.34)
Norduz	0.1570	0.0712	0.0803	0.0592	-

*** (P < 0.001)

Gene exchange among populations was consistently high, its rate being Nm = 8.07 migrants per generation greater than the critical value of Nm = 1.0. The gene flow ranges from 3.78 to 50.56 between pairs of populations. The highest Nm value (50.56) was observed between Honamli and Hair breeds, indicating high rate of genetic flow between the populations. The lowest Nm values were estimated between Angora and Norduz breeds, indicating minimal genetic flow between Angora and Norduz. F_{IS} was calculated from the data values and the values were between 0.01621 and 0.04951. The calculated overall F_{IS} value for all populations was 0.03656 ± 0.033 and it was not significant. All

the populations were in the Hardy–Weinberg equilibrium. According to Nei's D_A genetic distance values, the highest level of genetic distance was found between the Angora goat breed and other breeds. This result is compatible with the other test results. For STRUCTURE analysis, the most appropriate number of clusters for modeling the data was five. The axes in the FCA test also indicated that the Angora goat breed is grouped separately from the other breeds. The native Turkish goat breeds (except for Angora) are not completely separated from each other. The result of this analysis is similar to those obtained from other analyses (Fig. 1).

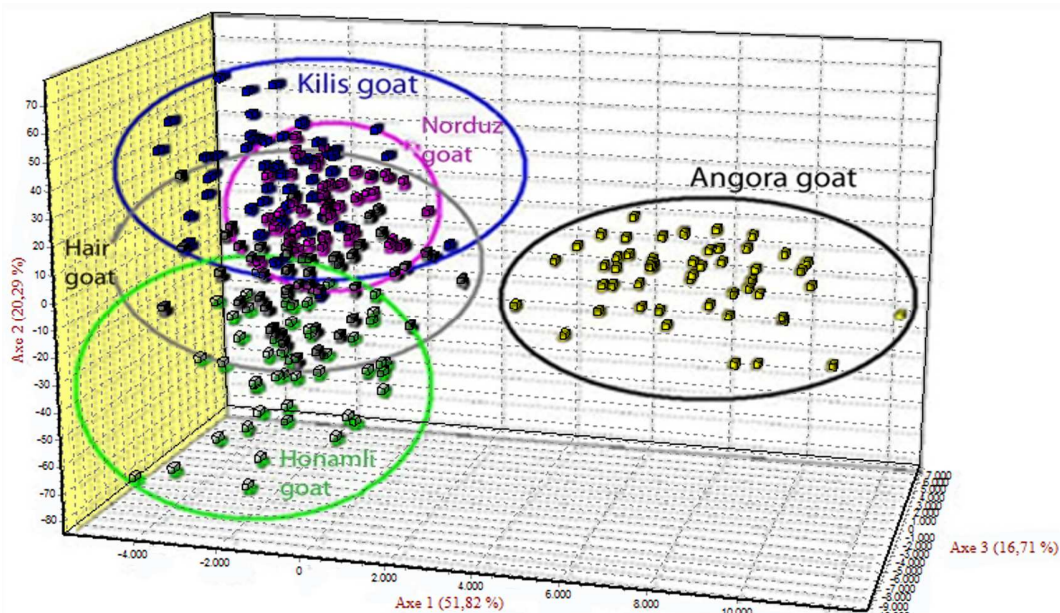


Figure 1. Graphic representation of the factorial correspondence analysis of five populations from Turkey.

The two phase mutation model under Wilcoxon's signed rank test and shift mode test were used to investigate any recent bottleneck (heterozygosity excess) in native Turkish goat populations. In a population at mutation-drift equilibrium, there is approximately an equal probability that a locus shows genetic diversity excess or deficit. GLOWATZKI-MULLIS et al. (2008) reported genetic bottleneck in the Valais Blackneck goat breed. Bottleneck has not been reported in Zalawadi and Gohilwadi goat populations, whereas mild bottleneck has been reported recently for the Surti breed by FATIMA et al. (2008). It is vital that native Turkish goat breeds have high genetic diversity. Unfortunately, the number of native goat breeds is continually decreasing due to numerous factors, including certain procedures performed by breeders in Turkey to increase efficiency (uncontrolled mating etc.), certain breeding programs that have been implemented, population growth, the diminished importance of certain yield factors (such as the yield of Angora goat mohair), and the fact that the value of goats has dropped because they are said to be harmful to forest vegetation. Native Turkish goat breeds have not undergone bottleneck according to the Wilcoxon sink-rank test in TPM and the mode shift test. However, numbers of native Turkish goats (especially the Angora, Honamli and Norduz goat breeds) have decreased significantly in recent years. In this regard, registered breeds should be kept pure, and breeders should be informed about this issue.

CONCLUSIONS

The data from this study showed that a considerable amount of information regarding genetic diversity and relationships in native Turkish goat breeds can be determined using microsatellite markers recommended by ISAG/FAO. Furthermore, the genetic material stored in the DNA bank made it possible to ascertain molecular characterization through the use of microsatellite markers. Moreover, this data provided important information for conservation programs and could be utilized to define breeding strategies.

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REFERENCES

- AGHA, S.H., PILLA, F., GALAL, S., SHAAT, I., D'ANDREA, M., REALE, S., ABDELSALAM, A.Z.A., LI, M.H., (2008): Genetic diversity in Egyptian and Italian goat breeds measured with microsatellite polymorphism. *J. Anim. Breed. Genet.* 125, 194–200.
- AKÇAPINAR, H., (1994): Keçi Yetiştiriciliği Ders Notu. A.Ü. Veteriner Fakültesi Zootečni Anabilim Dalı.
- ALLENDORF F.W., LUIKART G., (2007): Conservation and the Genetics of Populations, 1st edn. MA, USA: Wiley-Blackwell.
- BARKER, J.S.F., (1994): A global protocol for determining genetic distance among domestic livestock breeds. In: Proceedings of the 5th World Congress on Genetics Applied to Livestock Production, vol. 21, pp. 501–508.
- BELKHIR, K., BORSA, P., CHIKHI, L., GOUDET, J., BONHOMME, F., (2004): GENETIX 4.05 Windows™ Software for Sample Genetics. Laboratoire Genome, Populations, Interactions. University of Montpellier, France, Université Montpellier II//www.univ-montp2.fr/~genetix/genetix/genetix.htm//December 2004.
- BOTSTEIN, D., WHITE, R.L., SKOLNICK, M., DAVIS, R.W., (1980): Construction of a genetic linkage map in man using restriction fragment length poly-morphism. *Am. J. Hum. Genet.* 32, 324–331.
- BRENNER, C., MORRIS, J., (1990): Paternity index calculations in single locus hypervariable DNA probes: validation and other studies. In: Proceedings for the International Symposium on Human Identification 1989, Promega Corporation, Madison, WI, pp. 21–53.
- CANON, J., GARCIA, D., GARCIA-ATANCE, M.A., OBEXER-RUFF, G., LENSTRA, J.A., AJMONE-MARSAN, P., DUNNER, S., (2006): Geographical partitioning of goat diversity in Europe and the Middle East. *Anim. Genet.* 37 (4), 327–334.
- CHAUDHARI, M.V., PARMAR, S.N.S., JOSHI, C.G., BHONG, C.D., FATIMA, S., THAKUR, M.S., THAKUR, S.S., (2009): Molecular characterization of Kenkatha and Gaolao (*Bos indicus*) cattle breeds using microsatellite markers. *Anim. Biodivers. Conserv.* 32 (2), 71–76.
- CORNUET, J.M., LUIKART, G., (1996): Description and power analysis of two tests for detecting recent population bottlenecks from allele frequency data. *Genetics* 144, 2001–2014.

- DALVIT, C., SACCA, E., CASSANDRO, M., GERVASO, M., PASTORE, E., PIASENTIER, E., (2008): Genetic diversity and variability in Alpine sheep breeds. *Small Ruminant Res.* 80, 45–51.
- DIXIT, S.P., VERMA, N.K., AHLAWAT, S.P.S., AGGARWAL, R.A.K., KUMAR, S., CHAN-DER, R., SINGH, K.P., (2008): Molecular genetic characterization of Kutchi breed of goat. *Curr. Sci.* 95 (7), 946–952.
- ERTUĞRUL, M., AKMAN, N., ELİÇİN, A., ARIK, Z., (1995): Küçükbaş, hayvansal ürünler tüketim projeksiyonları ve üretim hedefleri. In: TMMOB Ziraat Mühendisleri Odası, Türkiye Ziraat Mühendisliği IV, Teknik Kongresi, Ankara, pp. 753–770.
- FATIMA, S., BHONG, C.D., RANK, D.N., JOSHI, C.G., (2008): Genetic variability and bottleneck studies in Zalawadi, Gohilwadi and Surti goat breeds of Gujarat (India) using microsatellites. *Small Ruminant Res.* 77, 58–64.
- FERNANDEZ, H., HUGHES, S., VIGNE, J.D., HELMER, D., HODGINS, G., MIQUEL, C., HANNI, C., LUIKART, G., TABERLET, P., (2006): Divergent mtDNA lineages of goats in an Early Neolithic site, far from the initial domestication areas. *PNAS* 103, 15375–15379.
- GLOWATZKI-MULLIS, M.L., MUNTWYLER, J., BAUMLE, E., GAILLARD, C., (2008): Genetic diversity measures of Swiss goat breeds as decision-making support for conservation policy. *Small Ruminant Res.* 74, 202–211.
- IAMARTINO, D., BRUZZONE, A., LANZA, A., BLASI, M., PILLA, F., (2005): Genetic diversity of Southern Italian goat populations assessed by microsatellite markers. *Small Ruminant Res.* 57, 249–255.
- JANDUROVÁ, O.M., KOTT, T., KOTTOVÁ, B., CZERNEKOVÁ, V., (2004): Seven microsatellite markers useful for determining genetic variability in White and Brown Short-Haired goat breeds. *Small Ruminant Res.* 52, 271–274.
- KORKMAZ AĞAOĞLU, Ö., ÇINAR KUL, B., AKYÜZ, B., ÖZKAN, E., ERTUĞRUL, O., EROL, H., (2010): Keçi Türünde Mikrosatellit Polimorfizminin Belirlenmesinde Farklı Çoklu-PZR (Multiplex PCR) Sistemleri. *Vet. Hekim. Der. Derg.* 81 (2), 21–27.
- KORKMAZ AĞAOĞLU, Ö., ÇINAR KUL, B., AKYÜZ, B., ÖZKAN, E., ERTUĞRUL, O., (2011): Different four PCR-multiplex systems via twenty microsatellite loci in goat. *Curr. Opin. Biotechnol.* 22 (Suppl. 1), S51.
- KUMAR, S., DIXIT, S.P., VERMA, N.K., SINGH, D.K., PANDE, A., KUMAR, S., CHANDER, R., SINGH, L.B., (2009): Genetic diversity analysis of the Gohilwari breed of Indian goat (*Capra hircus*) using microsatellite markers. *Am. J. Anim. Vet. Sci.* 4 (3), 49–57.
- LEBART, L., MORINEAU, A., WARWICK, K., (1984): *Multivariate Descriptive Statistical Analysis*. John Wiley and Sons, New York, USA.
- LUIKART, G., BIJU-DUVAL, M.P., ERTUGRUL, O., ZAGDSUREN, Y., MAUDET, C., TABERLET, P., (1999): Power of 22 microsatellite markers in fluorescent multiplexes for parentage analysis in goats (*Capra hircus*). *Anim. Genet.* 30 (6), 431–438.
- LUIKART, G., GIELLY, L., EXCOFFIER, L., VIGNE, J.D., BOUVET, J., TABERLET, P., (2001): Multiple maternal origins and weak phylogeographic structure in domestic goats. *Proc. Natl. Acad. Sci. U.S.A.* 98, 5927–5932.
- NEI, M., TAJIMA, F., TATENO, Y., (1983): Accuracy of estimated phylogenetic trees from molecular data. *J. Mol. Evol.* 19, 153–170.
- PRITCHARD, J.K., STEPHENS, M., DONNELLY, P., (2000): Inference of population structure using multilocus genotype data. *Genetics* 155, 945–959.
- QI, Y., LUO, J., HAN, X.F., ZHU, Y.Z., CHEN, C., LIU, J.X., SHENG, H.J., (2009): Genetic diversity and relationships of 10 Chinese goat breeds in the Middle and Western China. *Small Ruminant Res.* 82, 88–93.

- RAYMOND, M. AND ROUSSET, F. (1995): GENEPOP (version 1.2) population genetic software for exact tests and ecumenicism. *J. Heredity*, 86: 248-249. (website: <http://www.cefe.cnrs-mop.fr/>).
- RYDER, M.L., (2001): Textile fibres from goats. In: Reeve, E.C.R. (Ed.), *Encyclopedia of Genetics*. Htzroy Dearborn Publishers, USA, pp. 379–381.
- SAMBROOK, J., FRITSCH, E.F., MANIATIS, T., (1989): *Molecular cloning: A laboratory manual*, vol. 3., 2nd ed Cold Spring Harbor Laboratory, Cold-Spring Harbor, New York.
- TUIK, (2011): *Tarım İstatistikleri*. <http://www.tuik.gov.tr> (accessed 20.10.2011.).
- WEIR, B.S., COCKERHAM, C.C., (1984): Estimating F-statistics for the analysis of population structure. *Evolution* 38 (6), 1358–1370.
- YALÇIN, B.C., (1990): *Koyun Keçi Hastalıkları ve Yetiştiriciliği Kitabı*. TÜM VET Hayvancılık Hizmetleri Yayınları 2 (456), Teknografik Matbaası, İstanbul.

SUSTAINABLE DEVELOPMENT MACRO INDICATORS

BALAZS KOTOSZ

University of Szeged
Faculty of Engineering
H-6724 Szeged, Mars tér 7.
kotosz@mk.u-szeged.hu

ABSTRACT

Few concepts appear to have captured the public and political imagination more than that of 'sustainable development'. The concept is intended to embrace the idea of ensuring that future generations inherit an Earth which will support their livelihoods in such a way that they are no worse off than generations today. GDP shortcomings, as an index for measuring socio-economic progress, feature again prominently in the public debate, following years of benign neglect. Such criticisms are almost as old as the concept itself and national accountants have repeatedly warned about limitations of GDP as a welfare indicator. The list of alternative indicators is long; the focus of the article is on six widely known measures. The main dimensions of these measures are different (economic, social and environmental), but only a measure that is balanced in the three dimension can satisfy the requirements about an ideal index. Even, the famous Stiglitz-commission could not solve the problem, but to conceive 12 recommendations that may transform thinking.

Keywords: Stiglitz-report, measures, SDI, HDI, ESI

INTRODUCTION

GDP shortcomings, as an index for measuring socio-economic progress, feature again prominently in the public debate, following years of benign neglect. Such criticisms are almost as old as the concept itself and national accountants have repeatedly warned about limitations of GDP as a welfare indicator.

“Indicators of sustainable development need to be developed to provide solid bases for decision-making at all levels and to contribute to a self-regulating sustainability of integrated environment and development systems.” United Nations (1992, Agenda 21, Chapter 40.4)

Increasing concerns have been raised since a long time about the adequacy of current measures of economic performance, in particular those based on GDP figures. Moreover, there are broader concerns about the relevance of these figures as measures of societal well-being, as well as measures of economic, environmental, and social sustainability.

Reflecting these concerns, President Sarkozy has decided to create this Commission, to look at the entire range of issues. The Commission on the measurement of economic performance and social progress has been created at the beginning of 2008 on French government's initiative. Its aim was to identify the limits of GDP as an indicator of economic performance and social progress, to consider additional information required for the production of a more relevant picture, to discuss how to present this information in the most appropriate way, and to check the feasibility of measurement tools proposed by the Commission.

The Commission was chaired by Professor Joseph E. Stiglitz, Columbia University. Professor Amartya Sen, Harvard University, was Chair Adviser. Professor Jean-Paul Fitoussi, Institut d'Etudes Politiques de Paris, President of the Observatoire Français des Conjonctures Economiques (OFCE), was Coordinator of the Commission. Members of the Commission are renowned experts from universities, governmental and intergovernmental

organizations, in several countries (USA, France, United Kingdom, and India). Its final report has been made public on 14 September 2009.

THE CHARACTERISTICS OF GOOD INDICATORS

As Meadows (1998) summaries, a good indicator, measure, or index should fulfill at least 15 requirements:

Clear in value: no uncertainty about which direction is good and which is bad.

Clear in content: easily understandable, with units that make sense, expressed in imaginable, not eyeglazing, numbers.

Compelling: interesting, exciting, suggestive or effective action.

Policy relevant: for all stakeholders in the system, including the least powerful.

Feasible: measurable at reasonable cost.

Sufficient: not too much information to comprehend, not too little to give an adequate picture of the situation.

Timely: compliable without long delays.

Appropriate in scale: not over or under-aggregated.

Democratic: people should have input to indicator choice and have access to results.

Supplementary: should include what people can't measure for themselves (such as radioactive emissions, or satellite imagery).

Participatory: should make use of what people can measure for themselves (such as river water quality or local biodiversity) and compile it to provide geographic or time overviews

Hierarchical: so a user can delve down to details if desired but can also get the general message quickly.

Physical: money and prices are noisy, inflatable, slippery, and unstably exchangeable.

Since sustainable development is to a large extent concerned with physical things — food, water, pollutants, forests, houses, health — it's best wherever possible to measure it in physical units. (Tons of oil, not dollars' worth of oil; years of healthy life, not expenditures on health care.)

Leading: so they can provide information in time to act on it.

Tentative: up for discussion, learning, and change.

THE GROSS DOMESTIC PRODUCT

The Gross Domestic Product (GDP) is the sum of the gross value added by all resident producers in the economy plus any product taxes and minus any subsidies not included in the value of the products. (United Nations, 2009) However, this measure is calculated without making deductions for depreciation of fabricated assets or for depletion and degradation of natural resources.

It is easy to see why GDP is inadequate as an index of sustainable development. An economy's productive base will shrink if its stock of capital assets depreciates, and its institutions are not able to improve sufficiently to compensate for that depreciation. The term GDP is an acronym for *gross* domestic product. The word "gross" means that GDP ignores the depreciation of capital assets. It is certainly possible for a country's productive base to grow while its GDP increases, which is no doubt a path of economic development we all would like to follow. However, it is also possible for a country's productive base to *shrink* during a period when GDP grows. The problem is that no one would notice the shrinking if everyone's eyes were riveted on gross domestic product. If the productive base

continues to shrink, economic growth will, sooner or later, stop and reverse sign. The standard of living will then decline, but no one would have suspected that a fall was forthcoming. Thus, growth in GDP per head can encourage us to think that all is well when in fact it is not. (Dasgupta, 2007)

England (1997) reviews the needs that have come forward from these different critiques on the GDP as a welfare measure: it is necessary ...

- to specify the distinction between intermediate and final output
- to distinguish between 'goods' and 'bads' in consumption expenditures
- to account for asset depreciation in a comprehensive manner, including both manufactured and natural assets
- to divide net output between consumption and capital accumulation
- to take account of non-marketed goods and services (e.g. household services)
- to take account of the welfare implications of various forms of social inequality

ALTERNATIVE INDICATORS

There is not a collective consensus of what sustainability means and of what constitutes sustainable development. The development solution to global environmental problems while described under one name 'sustainable development' is understood and defined in different ways. By Defra National Statistics (2010), sustainable development is about enabling people to satisfy their basic needs and enjoy a better quality of life, without compromising the quality of life of future generations. It combines important social, environmental and economic goals.

Nonetheless, interest in alternatives or complements to GDP resumed progressively during the 90s. Emblematic of this new trend was the creation of the United Nations « human development index » (HDI) that combines GDP with measures of health (proxied by life expectancy) and educational achievement. This very simple index only synthesizes a limited amount of information. It is also more relevant for comparisons of developing countries than for comparisons of more advanced countries but it remains one of the few indexes that are regularly compiled and widely disseminated by international organizations to allow systematic cross-country comparisons. It also played a large role in raising the profile of important non-economic dimensions of the quality of life.

The ecological footprint (EF) measures the demands humans place on nature. It provides a quantitative assessment of the biologically productive area (the amount of nature) required to produce the necessary resources (food, energy, and materials) and to absorb the wastes of a given population. If the human load exceeds the productive capacity of the biosphere then consumption patterns are clearly not sustainable given current circumstances. The human load can vary depending on population, technology, and eco-efficiency. The ecological footprint therefore, ultimately measures the sustainability of human consumption patterns. (Wilson et al, 2007)

The surplus biocapacity (SB) measure also assesses the sustainability of consumption patterns. Specifically, the SB is the difference between a country's ecological footprint and its domestic production area of ecologically productive land and water.

The environmental sustainability index (ESI) is a composite index targeting environmental, socio-economic, and institutional indicators as a means to assess sustainability. The ESI incorporates 20 indicators, each of which combines two to eight variables, for a total of 68 underlying datasets. The core components of the ESI include: environmental systems,

reducing stresses, reducing human vulnerability, social and institutional capacity, and global stewardship.

The wellbeing index (WI) is a composite index evaluating human and ecosystem wellbeing. This metric is based upon the philosophy that assessing the combination of these two elements offers insight into how close a country is to becoming sustainable. The WI is an equally weighted average of the human wellbeing index (HWI) and ecosystem wellbeing index (EWI). Both consist of five dimensions, the former comprising health and population, household and national wealth, knowledge and culture, community, and equity, while the latter consists of land, water, air, species and genes, and resource use (Prescott-Allen, 2001).

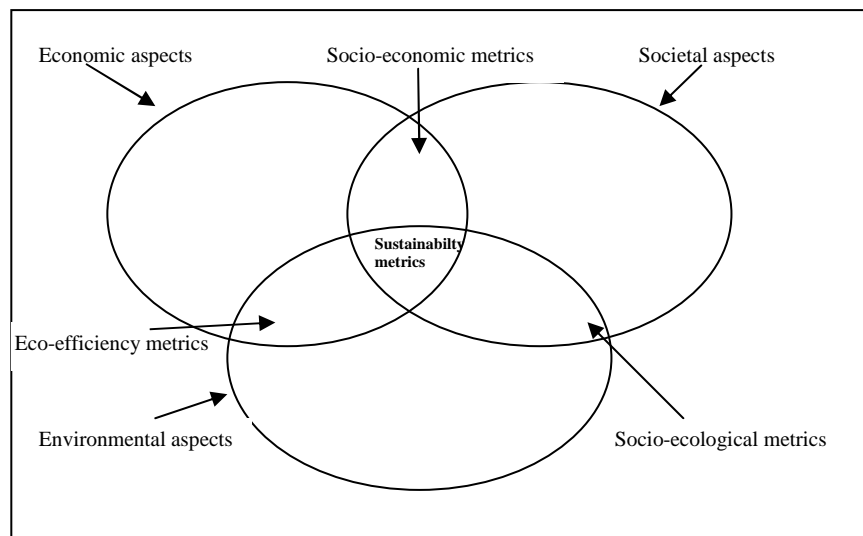


Figure 1. Sustainability metrics

Source: SIKDAR (2003)

Based on a cross sectional dataset of 132 countries, Wilson et al (2007) found that EF is negatively correlated with other metrics (except for SB), with strong negative relationship in the case of WI, HDI and GDP. The ESI, WI, HDI and GDP are pairwise positively correlated; and there is not significant correlation in other relations. These results are not so surprising, as the standard dimension of EF, SB, and WI is the environmental, of ESI, HD is the social, while of the GDP is the economic. Furthermore, a real measure of sustainable development should balance the three dimensions, as Sikdar (2003) shows (see *Figure 1*).

CONCLUSIONS

In the long run and at the macro level, happiness and subjective well-being are not correlated with income or GDP. This finding is known as the Easterlin paradox, since it has been first pointed out and updated by Easterlin (1974 and 1995). Economic welfare and well-being are static, while development and sustainability are dynamic phenomena. All indicators are based on past facts or on questionable forecasts that do not facilitate measuring the dynamic dimension.

REFERENCES

- BARTELMUS, P. (2008): Quantitative Economics. Springer, Heidelberg. 325 p.
- DASGUPTA, P. (2007): Measuring Sustainable Development: Theory and Application. *Asian Development Review*, vol. 24, no. 1, pp.1-10
- DEFRA NATIONAL STATISTICS (2010): Measuring Progress. Sustainable development indicators 2010. Defra National Statistics, London.
- EASTERLIN, R.A. (1974) "Does economic growth improve the human lot? Some empirical evidence", in David, R. and Reder, R. (Eds) *Nations and Households in Economic Growth: Essays in honor of Moses Abramovitz*, New York, Academic Press.
- EASTERLIN, R.A. (1995) "Will raising the incomes of all increase the happiness of all?", *Journal of Economic Behavior and Organization*, vol. 27, pp. 35-47.
- ENGLAND, R. (1997): Alternatives to Gross National Product: a Critical Survey. In: ACKERMAN, Frank et al (eds). *Human Well-Being and Economic Goals*. Washington DC: Island Press, pp. 373-405.
- MEADOWS, D. (1998): Indicators and Information Systems for Sustainable Development. The Sustainability Institute, Hartland.
- PRESCOTT-ALLEN, R. (2001): *The Well-Being of Nations: A Country-by-Country Index of Quality of Life and the Environment*. Island Press, Washington, DC.
- SIKDAR, S. K. (2003): Sustainable Development and Sustainability Metrics. *AIChE Journal*, Vol. 49, No. 8, pp. 1928-1932.
- STIGLITZ, J. E., SEN, A., FITOUSSI, J-P. (2009): Report by the Commission on the Measurement of Economic Performance and Social Progress. http://www.stiglitz-sen-fitoussi.fr/documents/rapport_anglais.pdf
- UNITED NATIONS (1992): *Agenda 21: The United Nations Programme of Action From Rio*. United Nations, New York.
- UNITED NATIONS (2009): *System of National Accounts 2008*. United Nations, New York.
- WILSON, J., TYEDMERS, P., PELOT, R. (2007): Contrasting and comparing sustainable development indicator metrics. *Ecological Indicators* 7 , pp. 299–314.

PHENOTYPIC CHARACTERIZATION AND MILK QUALITY VARIATION OF TWO TYPE TSIGAI SHEEP BREED

KÖNYVES TIBOR¹, IVANC ALEKSANDAR², KIRÁLY CSABA¹, MIŠĆEVIĆ BRANISLAV¹

¹ Megatrend University Belgrade Faculty of Biofarming Department of Animal Science and Nutrition

24300 Backa Topola, Marsala Tita 39. Serbia

wiwat36@hotmail.com

² State University of Novi Pazar, Department of Biomedical Sciences, 36300 Novi Pazar, Vuka Karadzica bb., Serbia

aivanc@np.ac.rs

ABSTRACT

In this study the phenotypic characterization and milk quality variation of two type Tsigai sheep breed, Cokan and Pivnicki are presented. The Cokan type mostly prevailing in Banat region (East part of Vojvodina), the Pivnicki could be located between river Tisa and Danube. The study was carried out on several sheep farms in Central-Backa region. From every flock, from each type 30 sheep were selected. Phenotypic characteristics of Pivnicki Tsigai type were: the average value of forehead spread 12.25 cm, height at withers 76.62 cm, body length 87.6 cm, bust size 102.87 cm and shinbone size 9.62 cm, and for the Cokan type the following values were determined: forehead spread 12.25 cm, height at withers 76.62 cm, body length 87.62 cm, bust size 102.87 cm and shinbone size 9.62 cm. The fat content in milk from Pivnicki type - 10.25%, was higher than that from Cokan type, 9.28%. In the case of all other milk substances lower average values were recorded in milk from Pivnicki Type. Significant differences ($P < 0.05$) were found in density, minerals, milk protein and freezing point values.

Keywords: Tsigai breed, phenotypic characterization, milk quality, Cokan, Pivnicki.

INTRODUCTION

Local sheep breeds have preserved and held up as unique genetic resource because of their better adaptability and unpretentious to the condition of breeding. On the other hand, including the local sheep breeds in breeding schemes as a basis to create new breeds and lines has accounted for object of researches (ALEXIEVA, 1979; NEDELČEV AND STOJANOV, 2004). The *Tsigai* sheep is one of the oldest Southeast European sheep breed, used for milk, meat and wool production and is associated with local traditions and food culture. The breed might have originated from Turkey and subsequently spread to the Balkan region, Hungary, Slovakia, Czech Republic, Moldavia and Russia (RYDER, 1983). *Tsigai* sheep arrived in the former Yugoslavia in the 18th century, (OGRIZEK, 1948). During the 20th century, both officially recorded governmental and poorly documented private sheep sectors existed in the former Yugoslavia. In Serbia, the governmental farms raised purebred *Tsigai* sheep, which form the core of the current Old *Tsigai* type, (ĆINKULOV, 2008). ANTUNOVIĆ et al. (2011) determined the phenotypic characterization of Croatian Tsigai sheep in organic breeding. In Hungary KUKOVICS and JÁVOR (2002) investigated the Tsigai breed characteristics. The most prevalent Tsigai types in Central –Europe are described. The aim of this study was to present phenotypic characteristics and milk quality variation of two type Tsigai breed: the Cokan and the Pivnicki (Sombor) type.

MATERIAL AND METHOD

The study was carried out on several sheep farms in Central-Backa region. Nowadays the pure Tsigai breed is very rare in Vojvodina. The Cokan type mostly prevailing in Banat region (East part of Vojvodina), the Pivnicki could be located between river Tisa and Danube.

The production system of both type are based on seasonal use of communal flood basin pastures – from April to November. In winter period the sheeps are indoors. The use of Alfalfa hay, grass hay, corn silo, beet pulp, as well as the barley, oat and grits are traditional. The shepherds are mostly owner of the flocks, the manpower is familiar. The size of flocks approximately are between 50 – 350 head.

Measuring of phenotypic characteristics were carried out by using of Lidtyn stick and tape measure. From every flock, from each type 30 sheep were selected. The following measurements were recorded: forehead spread, height at withers, length of body, bust size and shinbone size. The milk quality analysis was made by LACTOSCAN Milk analyser, Standard automat SA – Milkotronic Ltd. calibrated for sheep milk. As a material for milk examination we have taken ewes at different ages, different lactation, in period of march – april – may. The obtained results were analysed statistically using the “Microstat” statistical software package programme by Ecosoft Inc.

RESULTS AND DISCUSSION

The measurement results of different Tsigai types are presented in next tables. Table 1. shows the exterior characteristics of Pivnicki type.

Table 1. Measured exterior characteristics (cm) of Pivnicki type

Exterior characteristics/cm	Min.	Mean \pm SD	Max.
Forehead spread	10	12.25 \pm 1.67	15
Height at withers	70	76.62 \pm 4.47	84
Length of body	80	87.62 \pm 9.13	103
Bust size	96	102.87 \pm 4.55	110
Shinbone size	9	9.62 \pm 0.52	10

It was observed that the average value and standard deviation of forehead spread was 12.25 \pm 1.67, height at withers 76.62 \pm 4.47, length of body 87.62 \pm 9.13, bust size 102.87 \pm 4.55 and shinbone size 9.62 \pm 0.52 cm.

Table 2. present the measurement results of Cokan type. The results indicate that mean and standard deviation of exterior characteristics were for forehead spread 12.25 \pm 1.67, height at withers 76.62 \pm 4.47, length of body 87.62 \pm 9.13, bust size 102.87 \pm 4.55 and shinbone size 9.62 \pm 0.52 cm.

Table 2. Measured exterior characteristics (cm) of Cokan type

Exterior characteristics/cm	Min.	Mean \pm SD	Max.
Forehead spread	13	13.75 \pm 0.87	15
Height at withers	65	71.50 \pm 5.93	84
Length of body	71	74.86 \pm 2.54	78
Bust size	97	112.12 \pm 8.15	123
Shinbone size	8	8.50 \pm 0.53	9

It was reported that average value of height at withers for Tsigai ewes and hoggets was in range of 67 – 75 cm, (BALIĆ, 2010). Different values were recorded by ANTUNOVIĆ et al. (2011), in organic breeding. Means of phenotypic characteristics were as follows: height at withers 81.20±0.81cm, body length 91.21±0.82 cm and bust size 111.67±0.96.

Varying records of exterior characteristics in neighboring countries were described by several authors, (GASPARDY et al., 2001; ĆINKULOV et al., 2003; JOITOIU, 2004; POPOVICI, 1954 and NIKOLIĆ, 1937.).

The average values for the milk composition in different Tsigai breed milk are listed in the table 3. Considering the milk components of examined milk samples the fat content in Pivnicki type - 10.25 %, was higher than these from Cokan type, 9.28 %. At the same time in the case of other milk substances lower average values were recorded in Pivnicki Type, as follows: non fat dry matter 9.3 %, lactose 5.36 %. Significant differences ($P < 0.05$) were found in density, minerals, milk protein and freezing point values. Compared to our results milk fat and lactose content achieved in our experiment (9.28, 5.58 %) were higher than that established by ALEKSIEV (2011), (5.74 and 5.38 %) in morning and afternoon milk.

Table 3. The milk composition of Cokan and Pivnicki Tsigai breed

Milk quality	Cokan	Pivnicki
	Mean ±SE	Mean ±SE
Fat (%)	9.28±0.34	10.25±0.52
Non fat dry matter (%)	9.54±0.08	9.30±0.35
Density (%)	28.97±0.74 ^a	26.52±0.78 ^b
Lactose (%)	5.58±0.04	5.36±0.14
Minerals (%)	0.91±0.01 ^a	0.87±0.02 ^b
Protein (%)	3.00±0.04 ^a	2.76±0.08 ^b
Freezing point °C	- 0.74±0.01 ^a	- 0.66±0.01 ^b

Mean values of the same parameter with different letters in superscript are significantly different ($p < 0.05$)

Similar lower values for milk fat percentage were described by SPÁNIK et al. (1996), 8.72%, by MARGHETÍN et al. (1998), 8.70%, and ORAVCOVÁ et al. (2005), 8.0%. The same authors found higher protein content: 5.97, 5.70 and 6.0%. Comparing the milk components variability from Hungarian Tsigai ewes CSANÁDI et al. (2006) concluded average values for milk fat: 7.05%, non fat dry matter: 11.27%, lactose 4.81%, minerals: 0.97% and protein: 5.49%.

CONCLUSION

Based on research carried out on two type of Tsigai sheep breed the following conclusions could be made:

Determined were phenotypic characteristics of different Tsigai types: for the Pivnicki type It was observed that the average value of forehead spread was 12.25 cm, height at withers 76.62 cm, length of body 87.6 cccm, bust size 102.87 cm and shinbone size 9.62 cm.

For the Cokan type the average values were: for forehead spread 12.25 cm, height at withers 76.62 cm, length of body 87.62 cm, bust size 102.87 cm and shinbone size 9.62 cm.

The fat content in milk from Pivnicki type, 10.2 5%, was higher than that from Cokan type, 9.28 %.

In the case of all others milk substances lower average values were recorded in milk from Pivnicki Type.

Significant differences ($P < 0.05$) were found in density, minerals, milk protein and freezing point values.

ACKNOWLEDGEMENTS

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REFERENCES

- ALEKSIEV, Y. (2011): The effect of spring shearing on milk yield and milk composition in Tsigai ewes. *Biotechnology in Animal Husbandry* 27 (2), p 241-249 ,
- ALEXIEVA, S. (1979): Comparative Characterization of Some Local Sheep Breed in Bulgaria with Connection of Preservation of Genetic Resources in the Sheep Breeding. Thesis, Sofia.
- ANTUNOVIĆ Z., NOVOSELEC J., STEINER, Z., SAMAC, D. (2011): Fenotipske odlike cigaje u ekološkom uzgoju Proceedings. of 46th Croatian and 6th International Symposium on Agriculture. Opatija. Croatia (p.823-827)
- BALIĆ, S. (2010): Eksterijerne odlike cigaje. Završni rad. Poljoprivredni fakultet Sveučilišta J. J. Strossmayera u Osijeku, str. 29.
- CINKULOV, M., TAPIO, M., OZEROV, M., KISELYOVA, T., MARZANOV, N., PIHLER I., OLSAKER I., VEGARA, M., KANTANEN, J. (2008): Genetic differentiation between the Old and New types of *Serbian Tsigai* sheep *Genet. Sel. Evol.* 40 p. 321–331
- ČINKULOV, M., KRAJINOVIC, M., PIHLER, I.: (2003): Phenotypic differences between two types of Tsigai breed of sheep. *Lucrari stiintifice Zootehnie si Biotehnologii*, vol. XXXVI, Timisoara, Rumunija, *Lucr. St. Zoot. Biot. Timisoara*, XXXVI: p.295-299.
- CSANÁDI, J., FENYVESSY, J., BAJÚSZ, I. (2006): Cigája anyajuhok tejtermelésének és a tej összetételének vizsgálata. X. Agrárökönómiai Tudományos Napok. Gyöngyös. Full text in Conference CD p. 1-6. ISBN 963 229 623 0.
- GASPARDY, A., ESZES, F., BODO, I., KOPPANY, G., KESZTHELYI, T., MARTON, F. (2001): A cigája (berke) juh fajta hazai változatainak alkattani összehasonlító vizsgálata. *Állattenyésztés és Takarmányozás* 50 (1): 33-42.
- JOITOIU, R. (2004): Cercetari asupra oilor carabase din Teleorman. Disertacija.
- KUKOVICS, S., JÁVOR, A. (2002): A cigája fajta és jövője. (The Tsigai breed and its future) In JÁVOR A., MIHÓK S. (Eds.), *Génmegőrzés: Kutatási eredmények régi háziállatfajták értékeiről*. Debreceni Agrártudományi Centrum, Debrecen. Pp. 103-145.
- MARGETIN, M., HLAVATY, Š., PŘIBYL, J. (1998): Effect of genetic and non-genetic factors on milk composition in ewes of Improved Valachin and Tsigai breeds. *J. Farm Anim. Sci.*, XXXI, 29–36.
- NEDELICHEV, D., STOYANOV, B. (2004): Breeding Program for Karakachan Sheep. Breeding Association of Local Breeds in Bulgaria. Bioselena. Foundation for Organic Agriculture, p. 58-85.
- NIKOLIĆ, D. (1937): Prilog poznavanju cigaja ovce. Disertacija. Beograd.
- OGRIZEK, A., (1948): Ovčarstvo, Poljoprivredni nakladni zavod, Zagreb, Croatia.
- ORAVCOVA, M., GROENEVELD, E., KOVAČ, M., PEŠKOVIČOVA, D., MARGETIN, M. (2005): Estimation of genetic and environmental parameters of milk production traits in Slovak purebred sheep using test-day model. *Small Rumin. Res.*, 56, 113–120.
- POPOVICI, S. (1954): Contributii la cunoasterea oilor Tsiagi buculai din partea de vest a Banatului. *Prob. Zoot. Vet.* 11:29-36.
- RAYDER, M.L. (1983): *Sheep and man*, London: Duckworth.
- ŠPANIK, J., KAČINCOVA, A., MARGETIN, M., ČAPISTRAK, A., KALIŠ, M. (1996): Dependence of sheep milk quality on somatic cell counts. *Farm Anim. Sci.*, 29, 111–116.

CHALLENGES AND OPPORTUNITIES OF THE BEEKEEPING FAMILY FARMS MEASURED BY THE IDEA MODEL

KATALIN OLGA, KUJANI¹ - HAJNALKA, VARGA²

¹Szent István University, Ph.D student, Hungary 2103 Gödöllő, Práter K. u.1.;

kujanikatalin@gmail.com

West Hungarian University, Faculty of Agricultural and Food Sciences, Ph.D student,
Hungary, 9200 Mosonmagyaróvár, Vár 2.

vargahajni25@gmail.com

Abstract

Since composing the report of Brundtland (November 1987) several sustainability models and theories have been published which analyse the economic branches in detail from ecological, economic and social perspectives. More methods analyse the agriculture as a system but it shows a lack of micro-level analysis of farms and modelling of their sustainability. The French IDEA method was a response for this demand which means Farm Sustainability Indicators (*Indicateurs de Durabilité des Exploitations Agricoles*).

After the detailed examination of the foreign researches and the applied methods, our goal was to prove the applicability of the model in Hungarian relationships. For this objective we chose a small sector, the apiary, where we could collect exact data about the methodology of the management, sustainability and the realization. The results could answer the question if this model is adoptable in the research methods of the Hungarian farms and how sustainable the Hungarian apiaries are. It can show where the outstanding results and bottlenecks are.

Keywords: sustainable farm, indicators of sustainability, apiary, family farm

INTRODUCTION

One of the opposite effects of the spread of workshop sized farmyards and the rise of competitiveness is the fact that the need of environmental resources plays a bigger and bigger role. Having examined the rise of industrialized agriculture and the results of organic concentration, brings up the significance and sustainability of the livable and environmental model. The role of bee-keeping excels among the small, family-like homestead entrepreneurs, which can properly balance out the negative effects of industrial production and helps on the more and more popular and expected environmental thinking. The incessantly changing climatic conditions and the volatile market permanently challenge the people of bee-keeping sector. The Hungarian bee-keeping belongs to the very few agricultural sectors, which can achieve outstanding results under appropriate environmental conditions. In Hungary 88 percents of honey producers keep bees as a hobby or as a part time job and they are helped in physical work by their family members in 93 percent. (ÁRVÁNÉ, 2011)

During our research, we were curious if the homestead apiaries of Western Transdanubian region meet the criteria of integrated sustainability. (Ecologically, socially and economically) During our study made by the so-called French IDEA Model (*Indicateurs de la Durabilité des Exploitations Agricoles*), which is the abbreviation of the Indicators of Sustainable Agricultural Entrepreneurship we were looking for the answers to the following hypotheses:

Hypothesis 1: The beekeepers use developed technology that is why their production is economic

Hypothesis 2: The self-employed beekeepers generally use family workforce, which contributes the inheritance of the apiaries between generations, so the apiary branch socially sustainable.

Hypothesis 3: Thanks for the closeness of the Austrian border the honey in barrels is well realizable for export sale that is why direct sale is not used. The farmers do not take part in farm tourism, and do not contribute to the development of rural regions.

Hypothesis 4: The examined apiaries are ecologically sustainable, because they comply with the regulations and possess the tool, which are capable of conducting bee migration.

MATERIAL AND METHOD

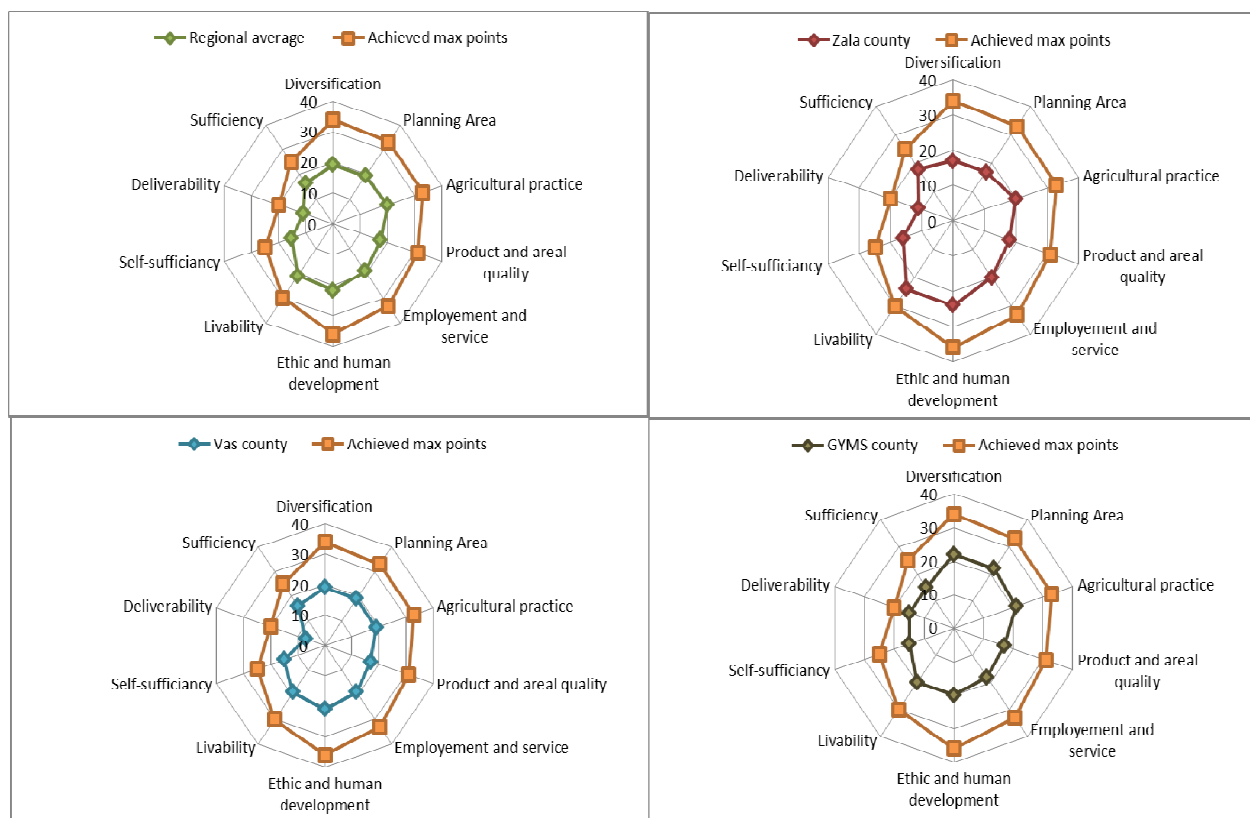
1. table: Scheme Adaptation of IDEA model in specific of the bee-keeping branch

Factor	Indicators	Points
Diversification	Migration	8
	Permanent Premises	7
	Annual diversity of culture	5
	Preservation of ecological habitats by pollination	8
	Preservation and protection of genetically diversity	6
	<i>Subtotal:</i>	<i>34</i>
Planning area	Method of farming	8
	Using up organic materials	6
	Protection of Nature Reserve	6
	Planning the bee-keeping year	8
	Number of families	5
	<i>Subtotal</i>	<i>33</i>
Agricultural practice	Type of hive	7
	Frame size	4
	Acaricides and materials used in veterinary	9
	Nutrition supply (of the bees)	5
	Energy dependency (independency)	8
	<i>subtotal:</i>	<i>33</i>
Quality of areas and products	Quality of produced food	12
	Local evaluation	6
	Productivity of bee families	12
	Social mobility	1
	<i>Subtotal:</i>	<i>31</i>
Employment and services	Retail	5
	Services and pluriactivity	5
	Promoting employment	11
	Age	3
	Long-term planning	9
	<i>Subtotal:</i>	<i>33</i>
Ethic and human development	Co-operative sale	1
	Qualification and experience	7
	Work intensity	7
	Life quality	6
	Being informed	9
	Developing opportunities	6
	<i>Subtotal</i>	<i>36</i>

Livability	Profitability	20
	Forms of Economic (additional costs)	10
	<i>Subtotal:</i>	30
Self-sufficiency	Economic self-sufficiency	15
	Reducing the sensitivity of direct subsidies	10
	<i>Subtotal:</i>	25
Deliverability	Deliverability	20
Efficiency	Efficiency of producing processes	25

Source: Based on Villain, own edit

RESULTS



1. picture: Average regional and the averages of counties by the IDEA method (Source: Based on Villain, own edit)

We examined the results of IDEA in division of counties (see the 1. picture). The results are well explained in a cobweb diagram, which helps recognizing the strengths and weaknesses of the given farmyards.

As for Győr-Moson-Sopron county, it is shown that the deliverability is high, which means that bee-keeping is dealt with family farms, in which the young have high hopes for farming. The well-developed direct selling can raise the independency, hereby the economic sustainability. The developed infrastructure of the bee-keeping families contributes to process of migration that promotes the diversity and the ecological sustainability. As for Vas County,

the average points of deliverability differ from the regional average, which is explained by the farmers' ageing, and the lack of investments. After all the livability and the social approaches are acceptable thanks to the good market possibilities. These farmers are mainly "hobby bee-keepers". These people typically work or own only a few hives. Their main attraction is an interest in ecology and natural science.

In Zala county, the bee-keepers are generally the big farmers who have numerous territories for pasture lands. Their income are higher because of the cooperation's' realization. The infrastructure is well-developed so they are able to produce in volume of barrels.

CONCLUSION AND SUGGESTIONS

According to the results of the research the first hypothesis is partly acceptable, that the Western Danubian apiaries' production is economical, but it is not thanked just for the investments but for the bee meadows as well.

The second hypothesis can be accepted only in the case of Győr-Moson-Sopron County. In the case of the other counties we are talking about more the 50 year old farmer who are pursuing this bee-keeping as an additional one that way they are unable to hand the farmyards over the young.

The third hypothesis is acceptable, that the bee-keepers mostly producer for export, which means of the challenges of the family farms. In some cases the production of apiaries are not so varied, this way they are exposed to the international market's versatility. In order to decrease this threat it would be recommended producing other products and their processing, which could be done by the bees' productivity.

In ecological view (fourth hypothesis) the problems of the branch requires bigger attention. Although the indicators are considered to be average and good, still in some cases (for example in Vas county) the lack of technological development is detected. Besides, it is turned out from the questionnaires that so many bee family destructions happened, which can be due to the lack of information and weak expert opinions.

BIBLIOGRAPHY

- CSERÉNYI, P.- FEKETE, J. (2004): A mézpiac helyzetéről. *Méhészet*. 52. 1.7.p.
- HAJDÚ, Z. (1999): A méz termelésének szabályozása az Európai Unióban.125.p.
- LANDAIS, E. (1998): Agriculture durable: les fondements d'un nouveau contrat social? *Le courrier de l'environnement* (33): 15.
- LÁNG, I. (2008): A Brundtland Bizottság és a fenntartható fejlődés; *Egyenlítő c. folyóirat* 2008/11
- NYÁRS, L. (2003): A méztermelés szabályozása. [http:// www.agrarkamara.bekescsaba.hu/eu/piac/mez.doc](http://www.agrarkamara.bekescsaba.hu/eu/piac/mez.doc)
- ŐRÖSI, P. Z. (1951): *Méhek között*. Mezőgazdasági Kiadó, Budapest.635.p.
- PFAU, E.- SZÉLES, GY. (2001): *Mezőgazdasági Üzemtan II. Mezőgazdasági Szaktudás Kiadó, Budapest.507.p.*
- VICZE, E. (1997): *Tanuljunk méhészkedni*. Magyar Méhészek Egyesülete, Budapest.

VILAIN L., GIRARDIN P., MOUCHET C., VIAUX P., ZAHM F. (2008): La méthode IDEA;
Educagri édition, Dijon

THE ROLE OF THE STOCK EFFECT IN THE DEVELOPMENT OF HINDERING OF THE PAPRIKA POWDERY MILDEW (*LEVEILLULA TAURICA* *ARN.*) INFECTION

¹LANTOS F., ²YILDIRIM I., ³ALBERT R.

¹University of Szeged Faculty of Agriculture Hungary

²Onsekiz Mart University Canakkale Turkey

³Szent István University Gödöllő Hungary

lantos@mgk.u-szeged.hu; yismet96@gmail.com

Abstract

The powdery mildew is a frequent fungi infection appearing in the intensive paprika growing, which causes rather serious economic loss despite of the integrated plant defense. The leaf necrosis it brings about appears within 20 days as a result of the high humidity (80-90%), and 26-30 °C temperature, mostly in foil-covered growing facilities irrespectively of the forcing periods. Following this, the plants and the development of the fruits cease. In our experiment, we used a cherry shaped pepper as rootstock that was selected from a substance growing wild in Mexico only (*Capsicum annuum* var. *cerasiforme* L.). It showed a significant resistance against the infection of the paprika powdery mildew (*Leveillula taurica* Arn.). Under the experimental conditions no powdery mildew infection appeared on the leaves of the scion paprika during the whole growing period. The stock's root system had a low AM-type mycorrhiza contact.

Keywords: grafting, powdery mildew, mycorrhizal contact, reactive oxygen species

INTRODUCTION

The pathogen paprika powdery mildew (*Leveillula taurica* Am) is present in Hungary since 1972 primarily causing economic size damages in the paprika growing, but does not appear in open field growing (GLITS & FOLK, 2000). The asexual form of the pathogen is *Oidiopsis taurica*. It is an endophytic parasite. The symptoms appear on the leaves only. The conidia penetrate through the stomata into the leaf tissues (PALTI, 1988). The resistance capacity is increased by the fact that the stock's adaptational ability brings about better nutrient and water utilisation, increased vigor and a bigger yield in the scion. In this mechanism the activity of the mycorrhiza fungi penetrating into the tissue of the roots then living in symbiosis with them play an important role. The mycorrhiza fungi can grow in the root's rhizosphere and concerned rhizoplane (SMITH ET AL., 1994).

The aim of our work was to determine the effect of rootstock on the appearance of powdery mildew infection on the scion compared to the plants of the same variety grown on their own roots.

MATERIAL AND METHOD

Our research was carried out on the Southern Great Plain, Szentes in the summer of 2011 (from May - to August), and in the autumn of 2012 (from September – to February) in the growing period. The peppers were grown in a 25 m long, 9 m wide plastic-covered growing facility. We used cherry shaped pepper as rootstock that was selected from a plant population growing wild only in Mexico and bred in Szentes (*Capsicum annuum* var. *cerasiforme* L.). The scion was the paprika variety Total. It is bred Szentes. For grafting

the plain matching method was used. Peppers grown on their own roots were planted in a row distance of 40 cm and plant distance of 30 cm. In the growing facility, independently of the growing period, beside 80-90% relative humidity we provided 26-30 °C daytime and 18 °C nighttime. We supported the natural powdery mildew infection by the humidity condensed at night and by the high temperature. Following the symptoms appearing on the substance 30 pieces of Total sweet pepper seedling grafted onto cherry shaped pepper were planted between the infected peppers. The appearing the phases of the development of powdery mildew symptoms on the leaves were surveyed by visual plant diagnosis, and analysed by microscopic examination (*Figure 2*). The photos were taken by Canon DS camera. We did not apply chemical plant protection against the infection. At the end of the growing we examined the root system of 30-30 peppers cultivated on their own roots or concerned from the graft seedlings. At the end of the growing we fixed the roots in 50% ethyl alcohol solution until the beginning of the examinations then purified them again before the painting in 10% KOH solution. We established the mycorrhiza symbiosis on the roots with aniline blue substance (PHILIPS & HAYMAN, 1970). Following the painting we estimated the frequency of the mycorrhiza and its measure by the method of TROUVELOT ET AL. (1986). We carried out the examination of the salicylic acid concentration of the infected leaves and of the ones without symptoms.

The ROS level examinations of the leaves were carried out both on infected plants and on the asymptomatic sweet pepper leaves.

RESULTS

During the examination of the plants it was found that all the root-grown peppers were infected with conidia of powdery mildew in different phases after May 2011 and after October 2012. The appearance of pepper powdery mildew (*Leveillula taurica* Arn.) in the above described forcing conditions was observed in the summer period 2 weeks later after planting in May than it had been experienced during the autumn period. It is likely that in the autumn-winter months, due to the less sunlight, the moisture condensation caused by the difference between day and night temperatures and less ventilation possibility the mildew conidia developed more intensively. The symptom phases set up by visual plant-diagnosis and microscopic examination were ranked by the color and dimension of the spots caused by conidia in both growing periods. Accordingly, on the 5th day, 12th day and 20th day irreversible infection categories were distinguished (*Figures 1 and 2*).

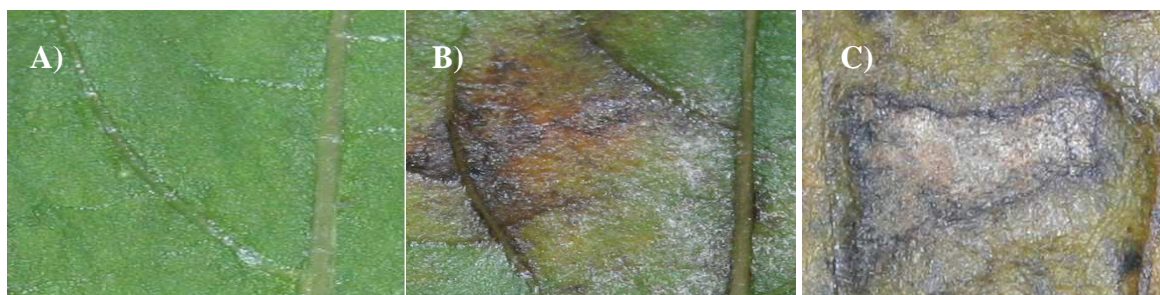


Figure 1. The symptoms of powdery mildew (*Leveillula taurica* Arn.) by via visual plant diagnosis. Symptoms on 5th day A), on 12th day B), on 20th day C)



Figure 2. Advanced state of conidia of *Leveillula taurica*

After studying the infected areas it was concluded that under the described forcing conditions the conidia formed continuous conidia bundles on the back of the leaf within 12 days, which caused the complete destruction of chlorophyll in the leaf tissue structure in 20 days. Consequently, the infected area as a whole necrosed. In the control group, however, where plants were grafted onto cherry shaped pepper no powdery mildew fungus infection was found. During the root mass mycorrhizal symbiosis examination it was found that the peppers grown on their own roots as well as on the roots of those grafted there was nearly equal, although insignificant about 30% of AM-scale type of mycorrhizal relationship discovered (*Figure 3*).

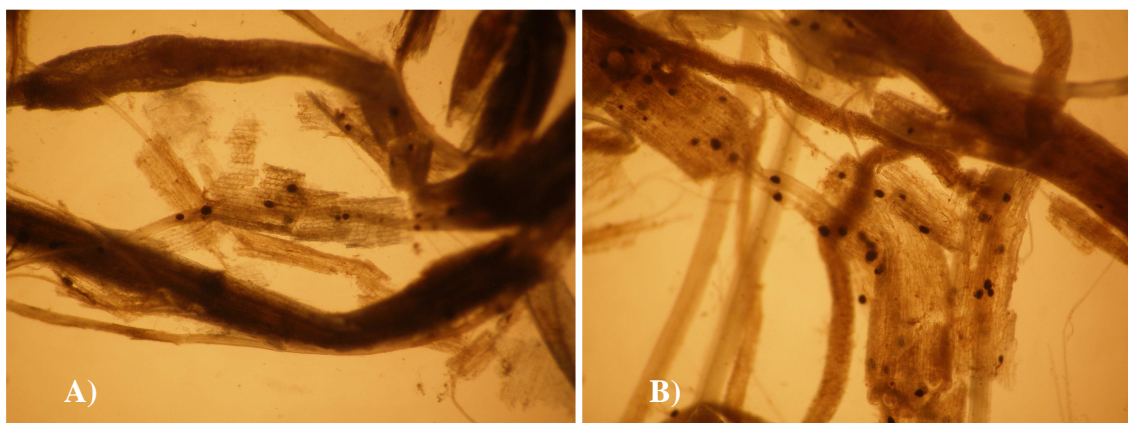


Figure 3. The root mycorrhizal symbiosis of grafted A) and non grafted sweet peppers B)

The grafted, healthy and infected leaves of plants were examined under laboratory conditions at the Hungarian Academy of Sciences Plant Protection Research Institute. During our measurements it was recorded that the reactive oxygen species (ROS), especially hydrogen peroxide (H_2O_2), were extremely concentrated in the leaves of grafted peppers while none of these were found in the infected peppers grown on their own roots (KIRÁLY, personal communication). The large hydrogen peroxide concentration had influenced the inhibition of powdery mildew infection the most. The subjective sensory tests have shown that the cherry shaped pepper stock did not make the peppers lose their characteristic sweet pepper taste or their pleasing shape. The value measuring properties of

non grafted and grafted pepper crop taken from the average of the results of three pickings are shown in *Table 1*.

Table 1. General results of Total sweet pepper in 2011 and 2012

Properties of peppers	Total sweet pepper	
	protected (Amistar), non grafted	grafted
fruit weight (g)	113,5	105,1
thickness of fruitwall (mm)	7	8,56
root mass (g)	18,8	19,9
powdery mildew infection (%)	non protected, non grafted 90	-

CONCLUSIONS

Based on the results of the different forcing periods, it was found that the cherry peppers (*Capsicum annuum* var. *cerasiforme* L.) as a crop and also as a stock plant is highly resistant to powdery mildew infection. This can be explained by the accumulation of hydrogen peroxide conveyed by the roots. Several studies have demonstrated the fact that mycorrhizal relationship of the root induces better nutrient uptake and resistance in the plants. However, the results of our experiments showed that mycorrhizal symbiosis did not play an important role in the inhibition of powdery mildew infection. The results of the tests of peppers grown under Southern Great Plain conditions suggest that the powdery mildew infection can be prevented well by grafting peppers on cherry shaped pepper rootstock. Plant protection against powdery mildew infection in case of plants grafted on cherry shaped pepper of Szentes will no longer be necessary neither in the summer nor in the autumn growing periods. The grafting had no effect on the pleasing shape of the pepper bells.

The further significance of the application of the cherry shaped pepper of Szentes as rootstock is that the grafted peppers can also be used in organic cultivation.

REFERENCES

- GLITS M., FOLK GY. (2000): Kertészeti növénykórtan. Mezőgazda Kiadó, Budapest. 312-313.
- PALTI, J. (1988): The botanical review. The Leveillula Mildews. Agricultural Research Organization Bet Dagan, Israel. Manuscript.
- PHILIPS, J.M., HAYMAN, D.S. (1970): Improved procedures for clearing roots and staining parasitic and vesicular-arbuscular mycorrhizal fungi for rapid assessment of infection. *Transaction of British Mycological Society* 55: 158-160.
- SMITH,, S.E., GIANINAZZI-PEARSON, V.,- KOIDE, R.T., CAIRNEY, J.W.G. (1994): Nutrient transport in mycorrhizas: structure, physiology and consequences for efficiency of the symbiosis. *Plant Soil*. 159: 103-113.
- TROUVELOT, A., KOUGH, J.L., GIANINAZZI-PEARSON, V. (1986): Mesure de taux de micorhization V A d'un système radulaire. Recherche de methodes d'estimation ayant une signification fonctionelle. In: *Micorrhizae: physiology and genetics-Les mycorrhizes*. Proceedings of the 1st ESM/1 er SEM, Dijon 1-5 July 1985.

PLANT-SOIL INTERRELATIONSHIP, FACTOR OF EVOLUTION FOR BACTERIAL POPULATIONS

MARINEL PAȘCA¹, LUMINIȚA COJOCARIU¹, MARINEL HORABLAGA¹, DESPINA-MARIA BORDEAN¹, MĂRIOARA NICOLETA FILIMON², ROXANA POPESCU³, AURUȚA DARLEA¹, AURICA BREICA BOROZAN¹

1 Banat's University of Agricultural Sciences and Veterinary Medicine
300645 Timisoara, 119 Aradului Way

2 West University of Timisoara, 300223 Timisoara, 4 Blvd. V. Parvan, Romania;

3 „Victor Babes” University of Medicine and Pharmacy

300041 Timisoara, 2 Eftimie Murgu Plaza

borozan_a@yahoo.com

ABSTRACT

The rhizosphere is influenced by the region, soil and plant roots. The area that is not influenced by plant roots has been named edaphosphere. Plant roots release a wide range of compounds in the rhizosphere, which create unique micro-environments for the microorganisms present in the soil. By its root exudates, species *Vicia sativa* contributes to an increase in the bacterial density (fact proven by comparison with the control variant), to the improvement of the fertility of the soil (moderately gleyic eutric cambisol) on which it is cultivated and to plant growth. Even there are similarities between the rhizospheric area (culture medium: soil extract), control variants, and respectively edaphosphere (culture medium: soil extract) and rhizospheric bacteria isolated on Topping medium, small differences have been noticed

Keywords: root exudates, *Vicia sativa*, rhizosphere, edaphosphere, Topping nutritive environment, soil extract

INTRODUCTION

It was discovered over a century ago that, through their roots, plants can change their environment, creating the so-called rhizosphere effect.

Although roots can release large quantities of inorganic C, which can affect directly the biogeochemistry of the soil (CHENG ET AL., 1993; HINSINGER ET AL., 2001; HINSINGER ET AL., 2009), they also produce organic carbon, which leads to dramatic changes in the biology of soils but also in the physical and chemical characteristics of soils. In a larger sense, this organic C released is often called rhizodeposit (JONES ET AL., 2004).

Root secretions contain: reductive sugars, amino acids, amides, organic acids and phenolic acids (CURL AND TRUELOVE, 1986; GRAYSTONE ET AL, 1996).

The organic acids identified in the rhizosphere play an important part in the formation of the bacterial population in the soil, therefore they can have a significant impact on plant growth (SHENGJING ET AL., 2011).

The rhizosphere represents a unique biological niche of the soil, being under direct influence of the plant roots, with abundant saprophytic microflora, which decomposes organic matter, lignocelluloses and chitin (LECHEVALIER, 1989B; LYNCH, 1990 A; LYNCH, 1990 B; LYNCH AND WHIPPS, 1991).

The rhizosphere effect is large in the case of the bacterial segment, as compared to the impact on actinomycetes and fungi. Gram negative non-sporogenous species of bacteria dominate the rhizosphere. The number of bacteria in the rhizosphere may vary between 10^8 - 10^9 /g soil. The most frequently met genera are *Arthrobacter*, *Pseudomonas*,

Agrobacterium, *Azotobacter*, *Mycobacterium*, *Alcaligenes*, *Micrococcus*, *Flavobacter*, *Alcaligenes*, *Cellulomonas* and others.

Generally, microbiological activities are positively correlated to the concentration of soluble carbon produced by the root and microbial micromass. The potential of microorganisms to react to plant root secretions suggest a certain degree of co-evolution between the plants and the microorganisms that inhabit the rhizosphere (NANNIPIERI ET AL., 2008).

According to GARBEVA ET AL. (2004), the bacteria influenced by the root plants are selected directly in relation to the dimension and distribution of the particles of a certain soil, the pH, the physical and chemical characteristics, by creating a specific habitat.

The same authors present another way in which the bacteria are selected, namely indirectly, by the exudates of the macroflora represented by plant roots. Plant roots have a strong influence on the availability of C and N through the exudates in the rhizosphere (KORANDA ET AL., 2011).

For the purpose of this paper, the studies have been focused on the bacterial populations in the edaphosphere and rhizosphere, where the direct influence of root exudates of *Vicia sativa* can be seen, but also the impact of the pH, humidity and K in the soil. The research is still in progress, in order for us to observe the benefits that can be obtained from including the legume *Vicia sativa* in rotation.

MATERIAL AND METHOD

The soil under study is moderately gleyic eutric cambisol found in Banat area and cultivated with a vetch species (*Vicia sativa*). The depth for sampling soil was between 0 and 20 cm.

In order to observe the density of the bacterial populations in the rhizosphere we harvested 10 vetch plants, together with the corresponding soil on a distance of 2.5 mm. Later we took 10 soil samples from the edaphosphere, as well as a control variant.

The samples were processed in the laboratory. We isolated the bacteria using the method of suspensions and dilutions, on two culture media: soil extract and Topping. Bacterial cultures were incubated at a temperature of 28 °C for 48 hours (STEFANIC, 2006).

Statistical analysis

The data were statistically analyzed using a statistical package MVSP 3.1.

We are grateful to WEBOMATIK RO SRL for permission to use statistical package MVSP 3.1. and technical assistance.

RESULTS AND DISCUSSIONS

The experimental values obtained after 48 hours of incubation are graphically represented below in *Figure 1*. Significant increases of CFU /g soil, as compared to the control variant, can be noticed especially in the edaphosphere, on both media, followed by the rhizosphere of *Vicia sativa* species (*Figure 1*). An important factor that influences the bacterial population in the rhizosphere is soil type (KOWALCHUK ET AL., 2000). Microbial populations in the rhizosphere benefit from a continuous source of carbon produced by the root of the plant, the result being the increase in the density of the microbial population and a distinct structure of the same population (BOWEN AND ROVIRA, 1991).

The exudates produced by the roots of plants select and influence the development of bacteria and fungi in their vicinity (GRAYSTONE ET AL., 1996; YANG AND CROWLEY, 2000; WHIPPS, 2001).

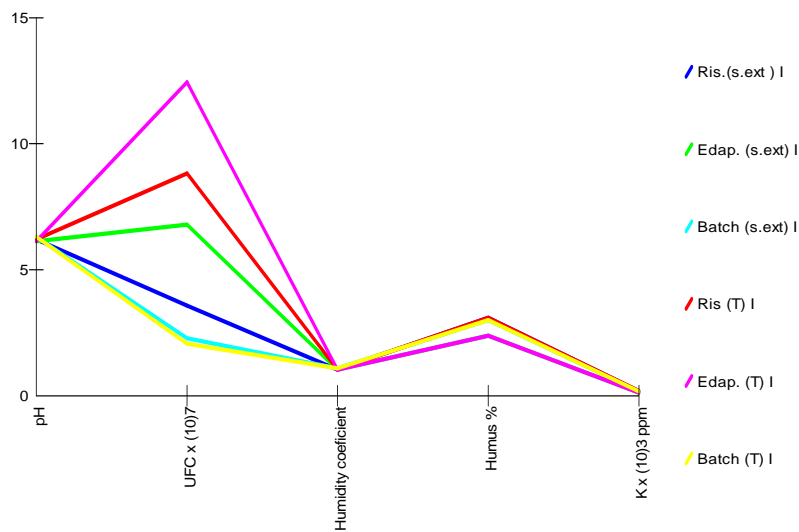


Figure 1. CFU/g soil in relation to some factors present in the biotope

Ris (s.ext) I – rhizosphere (soil extract); Edap (s.ext) I – edaphosphere (soil extract); Batch (s.ext) I – Batch (soil extract); Ris (T) I – rhizosphere (Topping); Edap (T) I – edaphosphere (Topping); Batch (Topping) I – Batch (Topping);

The marking of this increase is realized by a descending plateau in the case of the bacterial segment on soil extract from the rhizosphere (*Figure 2*).

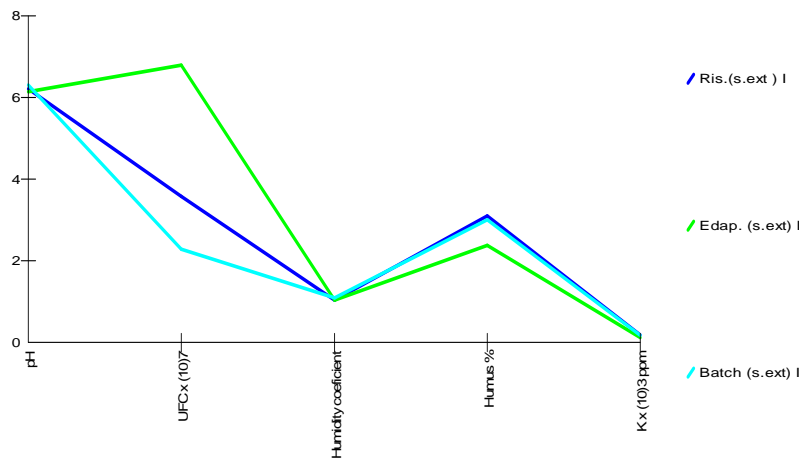


Figure 2. CFU /g soil on soil extract

Of the two culture media used in our research, Topping gave better results. Humus has a limited impact on bacteria in rhizosphere, edaphosphere and the control variant, as shown by our studies, in both types of culture media. Although soil humidity has a direct impact on microbial activity and the degradation capacity of organic matter, it is not clear whether the presence of plants modifies these effects by rhizosphere processes (FEIKE AND WEIXIN, 2007).

The present research has found that the influence of humidity and potassium is insignificant.

By cluster analysis we found that the edaphospheric area (Topping culture medium) differs significantly from the other areas. There is similarity between the rhizospheric area (culture medium: soil extract) and the control variants, and respectively edaphosphere (culture medium: soil extract) and rhizospheric bacteria isolated on Topping medium, although small differences have been noticed even in these situations (*Figure 3*).

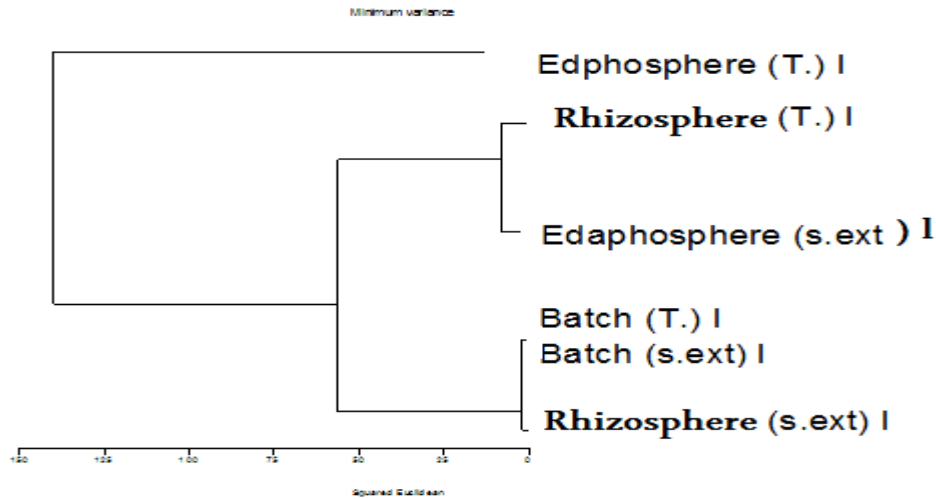


Figure 3. Cluster analysis of bacterial development in the three areas of the soil

By analysing the main components we found an insignificant influence of the humidity coefficient and of the pH, only on the control variants of both experimental media. Humus and potassium have connections only in the rhizosphere (*Figure 4*).

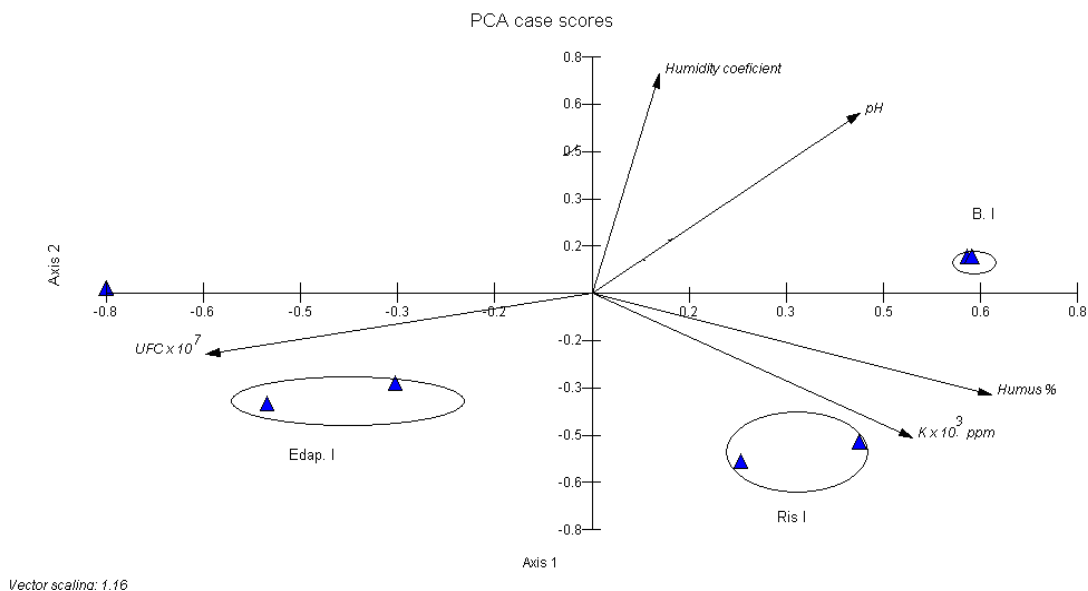


Figure 4. Main component analysis

CONCLUSIONS

Due to the rhizosphere effect of the legume species under research, the bacterial populations have improved in numbers as compared to the control variants.

The humus and the potassium contents have limited impact on CFU/g soil, in the rhizosphere of the above-mentioned forage legume. The humidity coefficient and the pH have an insignificant influence on this component of the soil.

The area where significant increases in the bacterial microflora take place is the edaphosphere.

“In vitro”, the best results were obtained on Topping medium, as compared to soil extract medium.

REFERENCES

- BOWEN GD., ROVIRA AD. (1991): The rhizosphere, the hidden half of the hidden half. In: Waisel Y., Eshel A., Kafkafi U, eds. Plant roots, the hidden half. New York: Marcel Dekker, 641-69.
- CHENG W., COLEMAN D. C., CARROLL C. R. AND HOFFMAN C. A. (1993): In situ measurement of root respiration and soluble carbon concentrations in the rhizosphere. *Soil Biology & Biochemistry* 25, 1189-1196.
- CURL EA., TRULOVE B. (1986): The rhizosphere. Berlin: Springer-Verlag.
- FEIKE A. DIJKSTRA, WEIXIN CHENG (2007): Moisture modulates rhizosphere effects on C decomposition in two different soil types. *Soil Biology and Biochemistry*, 39, 9, 2007, 2264-2274.
- JONES DL, HODGE A., KUZYAKOV Y. (2004): Plant and mycorrhizal regulation of rhizodeposition. *New Phytol* 163:459-480.
- LECHEVALIER M. (1989B): Actinomycetes in agriculture and forestry. In: Goodfellow, M., Williams, S.T. and Williams, M.M. (eds), *Actinomycetes in Biotechnology*. Academic Press, London, UK, pp. 327-358.
- LYNCH, J.M. (1990A): Microbial metabolites. In: Lynch J.M. (ed) *The Rhizosphere*, John Wiley, Chichester, pp177-206.
- LYNCH, J.M. (1990B): Introduction: some consequences of microbial rhizosphere competence for plant and soil. In *The Rhizosphere*. Lynch, J.M. (ed.). Chichester, UK: Wiley and Sons, pp. 1-10.
- LYNCH, J.M., WHIPPS, J.M. (1991): Substrate flow in the rhizosphere. In *The Rhizosphere and Plant Growth*. Kleister, D.L. and Cregan, P.B. (eds). Dordrecht, the Netherlands: Kluwer Academic Publishers, pp. 15-25.
- KORANDA M., SCHNECKER J., KAISER CHRISTINA, FUCHSLUEGER LUCIA, KITZLER BARBARA, STANGE C. F., SESSITSCH ANGELA, ZECHMEISTER-B. SOPHIE, RICHTER A., (2011): Microbial processes and community composition in the rhizosphere of European beech – The influence of plant C exudates. *Soil Biology and Biochemistry*, 43, 3, 551-558.
- GARBEVA, P., VEEN, J.A.V., ELSAS, J.D.V. (2004): Microbial diversity in soil: selection of microbial populations by plant and soil type and implications for disease suppressiveness. *Annual Review of Phytopathology* 42, 243-270.
- GRAYSTONE S.J., VAUGHAN D., JONES D. (1996): Rhizosphere carbon flow in trees in comparison with annual plants: The importance of root exudation and its impact on microbial activity and nutrient availability; *Applied Soil Ecology* 5, 29-56.

- KOWALCHUK, G.A., STIENSTRA, A.W., HIELING, G.H.J., STEPHEN, J.R., WOLDENDORF, J.W. (2000): Changes in the community structure of ammonia-oxidizing bacteria during secondary succession of calcareous grasslands. *Environmental Microbiology* 2, 99–110.
- HINSINGER PHILIPPE , BENGOUGH A. GLYN , VETTERLEIN DORIS, IAIN YOUNG M. (2009): Rhizosphere: biophysics, biogeochemistry and ecological relevance. *Plant and Soil*, 321, 1-2, 117-152.
- HINSINGER P., FERNANDES BARROS ON., BENEDETTI MF. NOACK Y, CALLOT G. (2001): Plant-induced weathering of a basaltic rock: experimental evidence. *Geochim Cosmochim Acta* 65:137–152.
- NANNIPIERI P. , ASCHER J. , CECCHERINI M. T. , LANDI L. , PIETRAMELLARA G. , RENELLA G. AND VALORI (2008): Effects of Root Exudates in Microbial Diversity and Activity in Rhizosphere Soils; Molecular Mechanisms of Plant and Microbe Coexistence. *Soil Biology*, 15, III, 339-365, DOI: 10.1007/978-3-540-75575-3_14.
- SHENGJING SHI, ALAN E. RICHARDSON, MAUREEN O'CALLAGHAN, KRISTEN M. DEANGELIS, EIRIAN E. JONES, ALISON STEWART, MARY K. FIRESTONE, LEO M. CONDRON (2011): Effects of selected root exudate components on soil bacterial communities, *FEMS Microbiology Ecology*, 77, 3, 600–610.
- STEFANIC GH. (2006): Metode de analiza a solului (biologica, enzimatica si chimica). Probleme de agrofitotehnie teoretica si aplicata. Institutul de cercetare-dezvoltare agricola Fundulea, XXVIII, 5-25.
- YANG, C.H., CROWLEY, D.E. (2000): Rhizosphere microbial community structure in relation to root location and plant iron nutritional status. *Applied and Environmental Microbiology* 66, 345–351.
- WHIPPS, J. (2001): Microbial interactions and biocontrol in the rhizosphere. *J. Exper Bot* 52: 487–511.

CHANGES IN THE STRUCTURE OF ACTINOMYCETE POPULATIONS IN THE RHIZOSPHERE OF *VICIA SATIVA* SPECIES

MARINEL PAȘCA¹, LUMINIȚA COJOCARIU¹, HORABLAGA MARINEL¹, DESPINA-MARIA BORDEAN¹, DRAGOS NICA¹, FILIMON MARIOARA NICOLETA², GERGEN IOSIF¹, AURICA BREICA BOROZAN¹

¹ Banat`s University of Agricultural Sciences and Veterinary Medicine
300645 Timisoara, 119 Aradului Way

² West University of Timisoara, 300223 Timisoara, 4 Blvd. V. Parvan, Romania;
borozan_a@yahoo.com

ABSTRACT

It is a known fact that species of legumes improve the soil they are grown on, but at the same time, they produce the so-called rhizosphere effect or rhizodeposit that has a selective effect on the microorganisms which are considered "fertility effectors" for soil. From the three studied area the highest number of actinomycetes was found in edaphosphere and the lowest number in the area influenced by roots. Among the few factors under research for the purpose of this paper, humus and potassium were observed to have the strongest impact on this group. Humidity is a factor that could change the competition between soil microorganisms and plants in the soil for N and it could affect the stability of aggregates.

Keywords: actinomycetes, rhizodeposition, rhizosphere, edaphosphere, Gause medium

INTRODUCTION

Rhizosphere microbial communities are important for plant nutrition and plant health (MARSCHNER ET AL., 2004) . The increased use of cereal/legume crop rotation has been advocated as a strategy to increase cereal yields of subsistence farmers in West Africa, and is believed to promote changes in the rhizosphere that enhance early plant growth (ALVEY ET AL., 2003). Rhizosphere is influenced by the region, soil and the roots of plants with high microbial activity (HILTNER, 1904). Plant roots secrete a large variety of compounds that they release into the rhizosphere, which leads to unique micromedia for microorganisms. Rhizodeposits differ in relation with plant species and plant developmental stage (WHIPPS, 2001; RENGEL, 2002). Interactions and biochemical exchanges that take place between plants and microorganisms in the soil have already been described and analysed (PINTON ET AL., 2007). Competitiveness is fierce among the microorganisms in this area under the influence of plant roots; this makes it possible for intimate associations to be realized between these organisms and plants (HARTMANN ET AL., 2009).

The exudates produced by plant roots select and influence the development of bacterial and fungal populations in their vicinity (GRAYSTONE ET AL., 1996; YANG and CROWLEY, 2000; WHIPPS, 2001). The stimulation of actinomycetes in the rhizosphere has never been studied in detail. There exists a general observation that actinomycetes are less stimulated by the rhizosphere effect than the bacteria, but when the number of antagonistic actinomycetes increases in this area, bacteria are inhibited (LECHEVALIER, M., 1989B).

Of actinomycetes, genera *Nocardia* and *Streptomyces* play an important part in phosphorus solubilisation .Edaphosphere is the area that is not influenced by plant roots. Sporogenic bacteria and actinomycetes are larger in numbers than any other type.

The microbial population in the rhizosphere is influenced by the interaction between the type of soil, plant species and its stage of development (MARSCHNER ET AL., 2001, 2004).

The same authors state that the bacteria in the rhizosphere are also affected by the complex interaction among the type of soil, plant species and the location in relation to the root. In some situations, the effect of the soil type on the microbiota in the rhizosphere can be stronger as compared with that of some plant species (SINGH ET AL., 2007), but there are also cases when plant species have a greater influence on the structure of microbial populations (WIELAND ET AL., 2001, GRAYSTON J. SUSAN AND CAMPBELL D. COLIN, 1996).

Humidity is the factor that could change the competition between soil microorganisms and plants in the soil for N (LIPSON and MONSON, 1998). It could affect the stability of aggregates (LAVEE ET AL., 1996), the intensity of humectation-rehumectation cycles, and in their turn, they could affect root secretions (GORRISEN ET AL., 2004).

The interactions among plants, soils and microorganisms are well known. Nevertheless, few studies have been made in order to understand the microbial diversity, the way soil functions and the influence of the cultivated plant.

MATERIAL AND METHOD

The soil under study is moderately gleyic eutric cambisol found in Banat area and cultivated with a vetch species (*Vicia sativa*). The depth for sampling soil was between 0 and 20 cm. The samples were taken from the rhizosphere of the cultivated plants, from the edaphosphere and a control variant. The samples were processed in laboratory conditions. We isolated the actinomycetes using the method of decimal dilutions and sowing the suspension of culture medium Gause 1. The incubation of the samples was at a temperature of 28 °C for five days (STEFANIC, 2006). The data were statistically analyzed using PAST 2.14 (HAMMER ET AL, 2001).

RESULTS AND DISCUSSIONS

The experimental data obtained after the incubation period were interpreted statistically and they are represented graphically below (Figures 1-6).

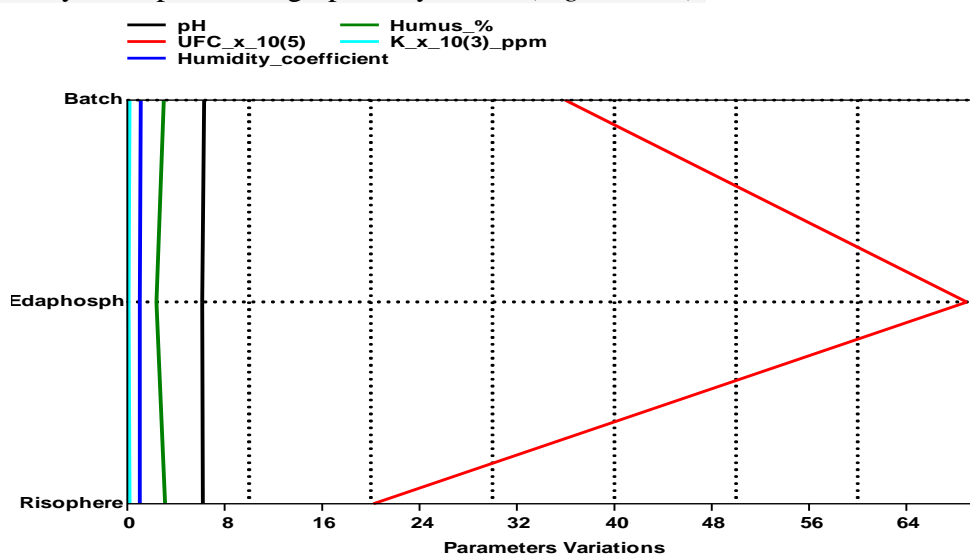


Figure 1. Evolution of studied parameters

Of the three areas under study, edaphosphere (68.96 CFU/g soil) presents the largest number of actinomycetes, followed by the control variant. The smallest number of actinobacteria is to be found in the rhizosphere (20.22 CFU/g soil).

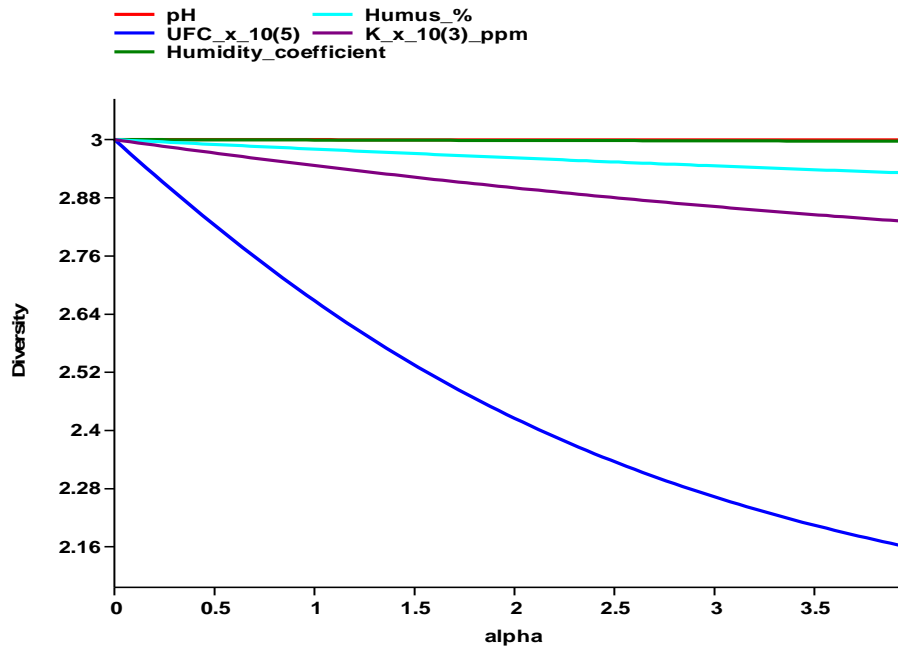


Figure 2. Diversity profiles

The edaphosphere is the area that is not influenced by plant roots. This area is dominated by sporogenic bacteria and by actinomycetes. A large variety of media were used in order to isolate and count the actinomycetes in the rhizosphere, but also to compare cultures and numbers of actinomycetes, eubacteria and fungi found in the soil (BASIL ET AL., 2004).

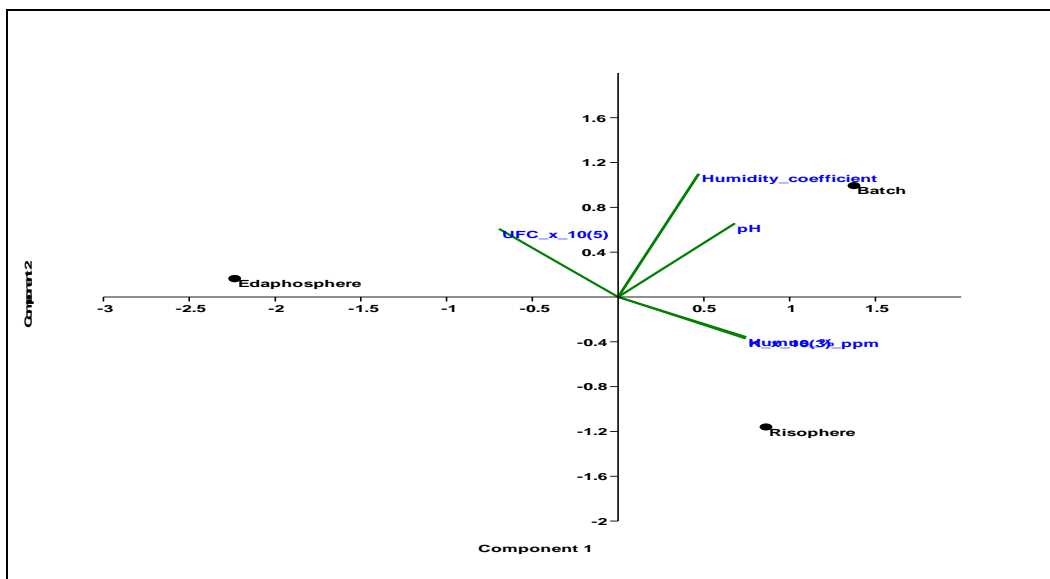


Figure 3. PCA graphical representation of studied parameters

Figure 2 is presenting linear variations for pH, humidity coefficient, humus and potassium content and it is visible that humus and potassium content is influenced by the pH and humidity of soil. UFC is presenting a different profile, but it's visibly influenced by humus and potassium content

PCA analysis is presented in figure 3. Humidity and pH describe the batch, UFC is characteristic to edaphosphere while rhizosphere is characterized more by humus and potassium content (Figure 3). Soil humidity is the key factor that influences the microbial activity in the soil and the processes of decomposition of organic matter (BRADY and WEIL 2002). The variance of the values is 76.344% for the first PC and 23.656 % for the second PC. The PCA loadings for the first axis are presented in Figure 4.

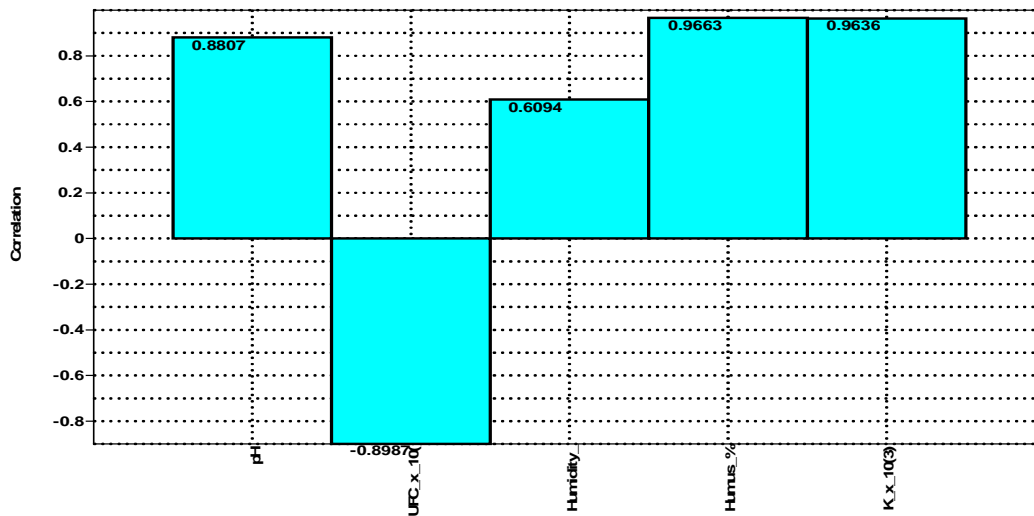


Figure 4. PCA correlations of the first component loadings

The pH, humidity, humus and K contents show positive correlations while UFC presents negative correlation (Figure 4).

The PCA loadings for the second component (Figure 5) present positive correlation for UFC, pH and humidity content while humus and potassium content present negative correlations.

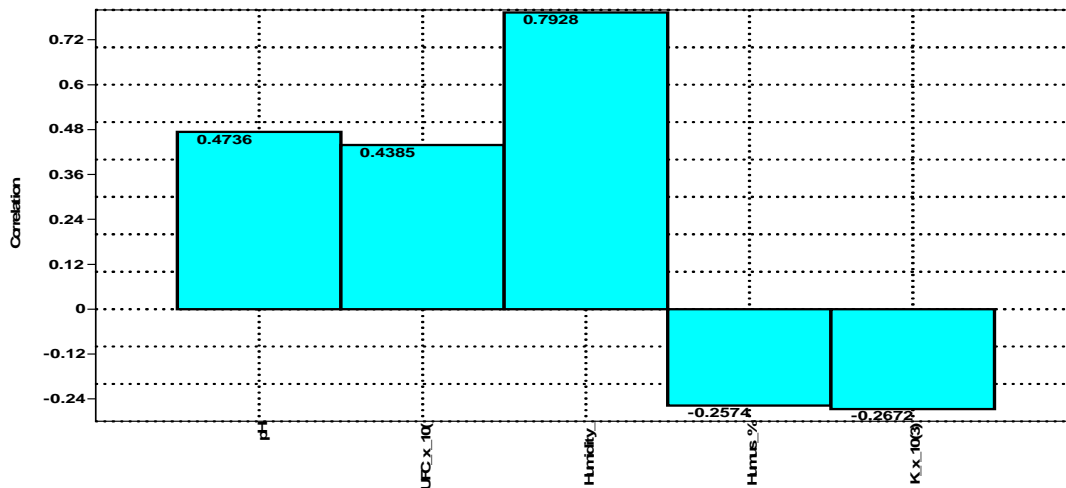


Figure 5. PCA correlations of the second component loadings

This module is used for plotting taxon abundances in descending rank order on a logarithmic (Whittaker plot) scale. This will give a straight descending line in the Whittaker plot. Fitting is by simple linear regression of the logarithmic abundances.

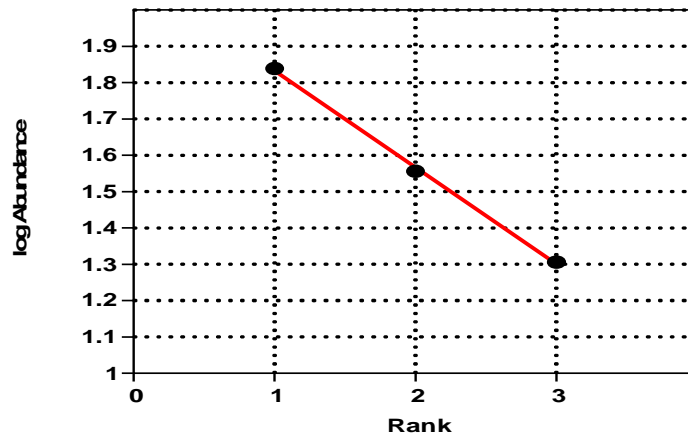


Figure 6. Log Abundance Model of the UFC ($k=0.4585$; $\chi^2= 0.0365$; $p(\text{same}) =0.849$)

CONCLUSIONS

The experimental data obtained are confirmed by the bibliography we studied for the purpose of this paper. The data show that actinomycetes are dominant in the area that is not influenced by legume roots and that their numbers decrease in numbers in the rhizosphere of *Vicia sativa*. The study shows that, of all the factors of influence considered, humus and potassium influence CFU/g soil in a positive way.

As for edaphosphere, the statistical data show a correlation with the pH and the humidity coefficient.

REFERENCES

ALVEY S., YANG C. H., BUERKERT, A., CROWLEY, D. E. (2003): Cereal/legume rotation effects on rhizosphere bacterial community structure in west african soils. *Biol Fertil Soils* (2003) 37:73–82.

BASIL A. J., STRAP J. L., KNOTEK-SMITH H. M. AND CRAWFORD D. L. (2004): Studies on the microbial populations of the rhizosphere of big sagebrush (*Artemisia tridentata*). *Journal of Industrial Microbiology and Biotechnology* 31, 278–288.

BRADY N., WEIL R. R. (2002): *The Nature and Properties of Soils*, 13th ed. Prentice-Hall, Upper Saddle River, NJ, 960 p.

GRAYSTONE S. J., VAUGHAN D., JONES D. (1996): Rhizosphere carbon flow in trees in comparison with annual plants: The importance of root exudation and its impact on microbial activity and nutrient availability. *Applied Soil Ecology* 5, 29-56.

- GRAYSTON J. SUSAN AND CAMPBELL D. COLIN (1996): Functional biodiversity of microbial communities in the rhizospheres of hybrid larch (*Larix eurolepis*) and Sitka spruce (*Picea sitchensis*) *Tree Physiology* 16, 1031–1038.
- GORISSEN A., TIETEMA A., JOOSTEN N.N., ESTIARTE M., PENUELAS J., SOWERBY A., EMMETT B.A., AND BEIER C. (2004): Climate change affects carbon allocation to the soil in shrublands. *Ecosystems* 7, 650–661.
- HAMMER Q., HARPER D.A.T., AND P. D. RYAN (2001): PAST: Paleontological Statistics Software Package for Education and Data Analysis. *Palaeontologia Electronica* 4(1): 9pp.
- HARTMAN A., SCHMID M., VAN TUINEN D. AND BERG G. (2009): Plant-driven selection of microbes. *Plant. soil*, 321, 235-257.
- HILTNER L. (1904): Über neuere erfahrungen und problem auf dem gebiet der bodenbakteriologie und unter besonderer berucksichtigung der grundung und brache. *Arbeiter der Deutsche Landwirtschafts-Gesellschaft*; vol. 98, pp. 59–78.
- LAVEE H., SARAH P., IMESON A.C. (1996): Aggregate stability dynamics as affected by soil temperature and moisture regimes. *Geografiska Annaler Series A—Physical Geography* 78A, 73–82.
- LECHEVALIER M. (1989B): Actinomycetes in agriculture and forestry. In: Goodfellow, M., Williams, S.T. and Williams, M.M. (eds), *Actinomycetes in Biotechnology*. Academic Press, London, UK, pp. 327–358.
- LIPSON D.A., MONSON R.K. (1998): Plant–microbe competition for soil amino acids in the alpine tundra: effects of freeze–thaw and dry–rewet events. *Oecologia* 113, 406–414.
- MARSCHNER P., YANG C.H., LIEBEREI R., CROWLEY D.E. (2001): Soil and plant specific effects on bacterial community composition in the rhizosphere. *Soil Biology & Biochemistry* 33, 1437–1445.
- MARSCHNER PETRAR, CROWLEY DAVID AND CHING HONG YANG (2004): Development of specific rhizosphere bacterial communities in relation to plant species, nutrition and soil type. *Plant and Soil* 261: 199–208.
- PINTON R., VERANINI Z., NANPIERI P. (2007): *The rhizosphere. Biochemistry and organic substances at the soil-plant interface*. New York, USA. Taylor Francis Group, LLC.
- RENGEL Z. (2002): Genetic control of root exudation. *Plant and Soil* 245, 59–70.
- SINGH, B.K., MUNRO, S., POTTS, J.M., MILLARD, P., (2007): Influence of grass species and soil type on rhizosphere microbial community structure in grassland soils; *Applied Soil Ecology* 36, 147–155.
- STEFANIC GH. (2006): Metode de analiza a solului (biologica, enzimatica si chimica). *Probleme de agrofitotehnie teoretica si aplicata*. Institutul de cercetare-dezvoltare agricola Fundulea, XXVIII, 5-25.
- YANG C.H. AND CROWLEY D.E. (2000): Rhizosphere microbial community structure in relation to root location and plant iron nutritional status. *Applied and Environmental Microbiology* 66, 345–351.
- WHIPPS J.M. (2001): Microbial interactions and biocontrol in the rhizosphere. *Journal of Experimental Botany* 52, 487–511.
- WIELAND G., NEUMANN R., BACKHAUS H. (2001): Variation of microbial communities in soil, rhizosphere and rhizoplane in response to crop species, soil type and crop development. *Applied and Environmental Microbiology* 67, 5849–5854.

THE IMPROVEMENT OF A TRACEABILITY PRACTICE AT A HUNGARIAN PRODUCER ORGANISATION

TIBOR MAROSI¹, KATALIN HEGEDŰS²

¹University of Szeged, Faculty of Engineering

6724 Szeged, Mars tér 7.

marosi@mk.u-szeged.hu

²DélKerTész Producer Organisation

6600 Szentes, Szarvasi út 3/b.

hegedusk@delketesz.hu

ABSTRACT

A food traceability system enables to follow the movement of any food product by documentation of each point of food handling. It is important to fully be aware that the traceability system is a special tool for attaining that objective, but the establishment of traceability system itself does not let as an objective. The traceability process enables trading stakeholders to follow products as they move from field to retail store. Each traceability partner must be able to identify the direct source and direct recipient of product. Among the priorities of traceability the most important is to protect the consumer through fast and accurate identification of implicated product. The necessity of the follow up systems are unquestionable, thus the recognition of good practices can ensure the better realizations. The main goal of this paper on the one hand is the shaping how traceability appears in the practice of fresh vegetable and fruit sector, on the other the assay of a traceability system at a selected Hungarian Producer Organization (PO).

Keywords: Traceability, Vegetable, Producer Organisation

INTRODUCTION

Producer Organizations (POs)

In the previous regime the domestic agriculture could be characterized by multiple integration forms of agricultural producers, which were disappeared due to the ownership and organizational changes. Although the accession to the European Union gave new possibilities to the promotion of alliances, but this time cannot produce the spectacular success in practice. Opposing position about integration was not formulated, and the producers agreed in relation to the stronger and more organized market participants (buyers, distributors, processors) that only are able to peer action, if at least the sales are managed together in a coordinated way.

The PO is not an independent company law form but a title can be obtained by a recognition procedure. This title expresses a determining role in the regulation and coordination of producers in the EU fresh fruit and vegetable sector. The base of a PO is a well-functioning economic organization, which is generally cooperative, but can be operated as a limited or joint stock company. For the PO classification strict requirements must be performed. The most important elements are the followings (BARTA ET. AL., 2010):

- Ensuring the adjustment of the production to the demand in relation to the quantity and quality.
- Concentrating the product line, stabilizing the prices of producers.
- Building up domestic and foreign relationships
- Recording crop production activities of their members
- Purchasing materials and equipments for the members.

- Providing the full technical background for the storage, preparation and sale of products
- Providing leaders and workers with the skills necessary to function
- Continuous contact between the members of PO and the external partners which have impact on the operation
- Promoting environmentally friendly production methods and waste management procedures.

In the EU the market of fresh fruits, vegetables and raw materials are less regulated. The market regulation does not establish limits, quotas, but defines strict quality requirements. Thus the resistance of the producer in the market is the base of the competition. Nowadays the market regulation and the support are based on the producer organizations. (ERDÉSZNÉ ET. AL., 2009)

Traceability systems

Traceability systems cover all types of food and related products in the entire food chain and affect food businesses from farm suppliers to retailers. Feedstuffs and other farm supplies needed to produce food, are included, as well as food contact materials such as packaging. A food traceability system enables to follow the movement of any food product by documentation of each point of food handling. It is important to fully be aware that the traceability system is a special tool for attaining that objective, but the establishment of traceability system itself does not let as an objective. Internationally, the definition of food traceability was set at Codex Alimentarius Commission (CAC, 2004). ISO Standard 22005 gives guidance on how an organization would determine which information would enter an organization-specific traceability program design. The framework established by this standard provides for a large degree of flexibility, primarily oriented to business to business transactions and value chains (ISO 22005:2007).

Principles of food identification

Food business operators at each stage of food chain should at least set a rule to identify food (products and raw materials) and its suppliers and buyers, and to interlink in advance. Food (products and raw materials) identification and linkage 5 area are the fundamentals in ensuring traceability. When constructing a traceability system, it is necessary to fulfill the following principles regarding identification and linkage (FMRIC, 2008):

Identification contains the first three principles:

1. Definition of traceable unit (Setting the traceable unit of the products and raw materials at necessary point of each stage)
2. Setting a rule on identification (ID)
3. Segregation management (Setting the method to segregate and manage food products and raw materials for each identified unit/traceable unit)

The responsibility of Food Business Operator (FBO) and the linkage between FBOs can be found in the Fig 1. Principles of linkage (4, 5 and 6) are the followings:

4. Ensuring one step back traceability (Setting the rule on linking the raw material's traceable unit and its supplier and setting the recording form)
5. Ensuring internal traceability (Setting the rule to link a traceable unit of raw materials with that of in-process and finished products and setting the recording forms. If raw materials or products are combined or divided, set the rule on linking

the traceable unit before the combination or division with that after such work, and set the forms to record it.)

6. Ensuring the one step forward traceability (Setting the rule on linking the product's traceable unit and its buyer and setting the recording form)

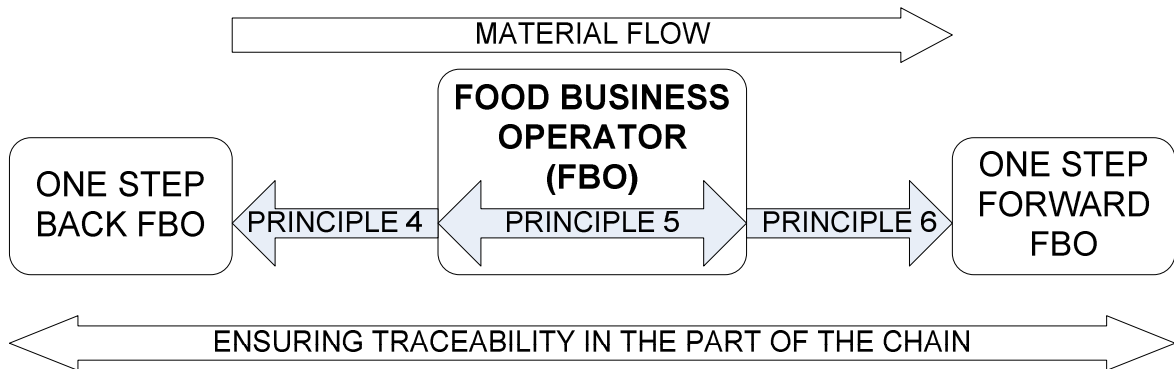


Figure 1. Principle of linkage (4,5,6) that each food business operator fulfills

Source: on the base of (FMRIC, 2008) pp. 27.

Applying principles 4, 5 and 6 for all partners, the traceability in the entire food chain can be ensured. (see Fig 2.)

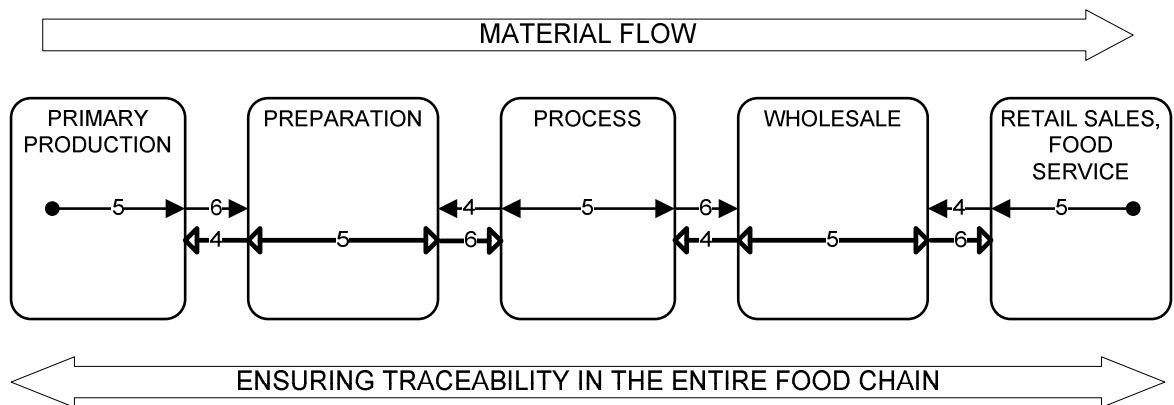


Figure 2. The entire food chain traceability has been ensured if the food business operator at each stage fulfills the requirements of principles 4, 5 and 6

Source: on the base of (FMRIC, 2008) pp. 27.

Next two principles (7 and 8) refer to the media for identification, records, and transmission:

7. Method of attaching ID (Setting the method to attach the ID on the traceable unit (such as stamping, printing, label, electronic tags, etc)
8. Media for information recording and transmitting (Determining the media to record, store and transmit the information which had been read for identification and linking - such as paper documents, electronic database, label, electronic tags)

Establishing a procedure is the last principle

9. Setting the procedure to actualize, following the methods and forms set above

The Hungarian fresh vegetables-fruits sector

The domestic fresh vegetable and fruit sector has undergone a significant transformation since the regime. The most important changes were the presence of POs, the increasing power of the retail chains, and the change of the consumer's buying habits in this sector. Before 1989 the state owned wholesalers gave the connection between the grower and the smaller retailers. From the regime till the connection to EU the private wholesaler and retail chains are gradually evolved. In the last decade beyond the private wholesaler and retail trade, the producer co-operatives have appeared between growers and large-scale retail chains. (LEHOTA ET. AL., 2009). Regarding the producer cooperatives the main issues and conclusions about traceability of this research are the followings:

- They realized the importance of the improvement of the traceability system.
- The main advantages of the traceability systems are the expand of activity in the market, tool to satisfy the purchasers' and consumer demands, and cost reduction originating from less safety hazards.
- Traceability system is typically paper-based, and completed by the use of EAN-code. A minor part of the producers' cooperatives apply product recalling program, hazard handling system for treatment and registration of claims

Traceability Standards

GS1 standards are the common language of business and provide the framework required to support the traceability (business) process. This industry best practice implementation guideline is based on the GS1 Global Traceability Standard (GTS). Developed by industry, the standard defines the globally-accepted method for uniquely identifying:

- Trading parties (your suppliers, your own company, your customers, 3rd party carriers)
- Trading locations (can be any physical location such as a warehouse, packing line, storage facility, receiving dock or store)
- The products your company uses or creates
- The logistics units your company receives or ships
- Inbound and outbound shipments

The GTS also defines the essential pieces of information that have to be collected, recorded and shared to ensure one step up, one step down traceability. The standard is applicable to companies of all size and geography.

While the GTS may be implemented independently from any specific technology, best business practices require adoption of bar coding on cases and/or pallets. Businesses are further encouraged to adopt electronic messaging to exchange essential business information. These technologies will be explored in the sections that follow.

GS1 is a not-for-profit standards organization with member affiliates in every country. Together with local/national produce trade associations they are important resources that are able to help your company understand the most effective way to implement traceability with your trading partners. They can also help your company to connect with technology providers that serve the produce industry. (GS1, 2009)

DélKerTÉSZ Producer Organization

The PO was established at the end of 2002 with 230 members. In 2003 the organization received preliminary, and in 2004 final PO recognition. The main objective of the organization is to ensure safe income and living of the individual producers, family and social entrepreneurs in Szentés and surrounding settlements. In 2010 it had the largest

income between domestic POs, with 530 members. In this year 95% of production was grown in plastic tunnels and greenhouses, the value of sold fresh vegetables was 5 billion Ft. The main customers are the retail chains, with 65% of the products, while 20% has been exported. The export of pepper is directed to Germany, the Czech Republic, Austria and Slovakia. The cabbage sorts to Scandinavian and Baltic countries. The Organization's packing estates all possess the HACCP qualification, while 95% of forced products have GLOBALGAP qualification. The organization regularly participates in exhibitions, and has many awards and prizes. One of the most important recognition is the Hungarian Agriculture Quality Award in 2008.

MATERIAL AND METHOD

This paper in one hand gives an overview about traceability in the fresh fruit and vegetable sector. On the other hand proposes a development for the selected PO's practice. One of the authors is the QM manager of this organization, who has responsibility for the operation of traceability system. With her assistance an inner analysis was done about the efficiency and effectiveness of the applied system. The survey was based on personal discussions with the leaders, representatives of affected areas, moreover with the producers and partly the customers.

RESULTS

Application of the new traceability system

From the start of the co-operation a certain level of traceability was necessary, to ensure identification the product of producer, e.g. in case of complaints. The identification was done on the price label, with the code of producer (e.g. Katalin Hegedűs H001), with the quality (e.g. TV pepper 50/80) and volume (12 kg) of the product, moreover the submission date (28. 10.) was indicated. This check paper had to be done in every box or compartment of producer, this tag accompanied the product to the contact. In case of any objection this card helped the identification of the producer. Since the demand of packed product was low (only 10-15% of the total sale), this system was sufficient. Currently more than 75% of the PO's commodity gets into the partners in packaged form. This necessitated the continuous development of traceability and identification, and as the first step of this result the bar code system was introduced in 2005.

Introduction of traceability at the producer

Due to the changing environment the existing traceability system has to be changed according to the regulatory compliance and the internal expectations of the organization. It has become indispensable that the commodity, the production site and production should be more precisely identified. All suppliers receive a unique number, which may be escorted through the product's life inside and outside of the PO. Independent identification has to be made about producers who involved to the GLOBAGAP registration. The PO's internal audits monitor the compliances according to the requirements of the standard.

Identification after the receipt of goods

One type of identification is, when the incoming good goes to further packing. On the packing unit the producer identification (lot number) can be found.

At the first step the product gets into the freight warehouse (01), with the following identifications: lot number, volume and date of receipt.

From the warehouse (01) the good is transferred to the packaging (10), and get an item number. The item number has 6 characters, the first two is the month, the second two is the day and the third two is a rolling number assigned to the production. (E.g. 060502 means that at 5th of June “TV 500g KK” was transferred) The lot number and the date of receipt are assigned to this item number.

The labels of identifications

Labels used to designate the goods are mostly prepared at the co-operative, partly pre-ordered from the manufacturer. Undated labels can be pre-manufactured, as the orders are changing day by day. The structure of the bar code is the following: the first 7 number is the receiving code of the supplier, the second 7 number characterize the product and its quality, and the third 6 numbers indicate if the product was quality assured or not. Using the lot number the relationship between the purchaser and supplier can be retrieve at any time. Custom-developed software is an integral part of the system. The program on one hand communicates with the barcode reader, on the other prepares the documentation (report) of the movement. The prerequisite of the system operation that the packaging unites, which contain same quality items, have to clearly identify with a barcode. (This unit can be a case, a pallet or a package.)

CONCLUSIONS

The traceability system of the examined PO is suitable to satisfy the regulatory and trading partner requirements. The producers of the co-operation are able to prepare high quality and chemical-free commodities. The gradually increasing demand for packaged products requires further developments and investments. The data entry and data processing efficient, but the human factor is potential for mistakes with increasing movement of goods. Checking the possibilities a barcode scanner port could be incorporated, making possible multiple scanning. In the case of this installation the current producer identification label is no longer suitable to identify the goods, since the barcode does not identify producer only the receiving location, the quality and classification of the good.

Since the current IT system and character support of the printers are suitable to permit the unique identification of producers, the incorporation of producer names (codes) has been proposed into the barcode. This case the barcode reader can identify immediately the producer and his product, and transfer the data to the system. The installation such a barcode system has a high cost (three gates would require), thus the co-operative is not planning this investment now, but they are ready to introduce if the conditions allow.

REFERENCES

- BARTA I., DORGAI L., DUDÁS GY., VARGA E. (2010): Termelői Csoportok és a Zöldség-gyümölcs ágazatban működő TЭСZ-ek Magyarországon, Agrárgazdasági Tanulmányok, AKI, 2010. 6., pp. 1-114.
- ERDÉSNÉ, KANKUNÉ K.GY., KOZAK A., RADÓCNÉ K.T. (2009): A zöldség- és gyümölcságazat helyzete, Agrárgazdasági Tanulmányok, AKI, 2009. 7., pp. 137.
- FMRIC (2008): Handbook for introduction of Food Traceability Systems, Food Marketing Research and Information Center (FMRIC), www.fmric.or.jp/trace/en/, pp. 29-31.

LEHOTA, J., ILLÉS Cs.B., KOMÁROMI N. LEHOTA, Zs., (2009): Development of Traceability in Hungarian fresh vegetable and fruit sector, 4th Aspects and Visions of Applied Economics and Informatics, March 26-27. 2009, Debrecen, Hungary, pp. 446.

Standards and Guidelines

CAC (2004): Codex/ Report of the twentieth session of the Codex Committee on General Principles, Paris, France, 3 – 7 May 2004

GS1 (2009): Traceability for Fresh Fruits and Vegetables - Implementation Guide, Issue 1. Jul-2009, <http://www.gs1.org/docs/gsmpt/traceability/>, pp. 8-9.

ISO 22005 (2007): Traceability in the feed and food chain - General principles and basic requirements for system design and implementation, <http://www.iso.org/iso/>

THE STUDY OF CHEMICAL COMPOSITION ON THE VEGETATION INSTALLED ON TAILINGS

LAVINIA MĂDĂLINA MICU, DORU PETANEC, ISIDORA RADULOV, CRISTINA CORADINI,
MARIUS DICU

Banat's University of Agricultural Sciences and Veterinary Medicine Timișoara
Faculty of Agriculture
street Calea Aradului, no 119, Timișoara, Romania
lavimicu@yahoo.com

ABSTRACT

This paper is a study on identifying the amount of heavy metals extracted from the sterile, by the main species of spontaneous plants, determined as prevailing on the waste dumps from Moldova Noua. Dominance of plant species ponds was determined using the method developed by Braun-Blanquet (1964) and followed for two years. The method of atomic absorption spectrophotometry at different wavelengths each chemical element was determined in part extracted from samples of dried herbs. The results confirmed that species *Salsola kali*, *Festuca arundinacea*, *Medicago falcata* and *Phragmites australis* are the most tolerant plants to heavy metals, long resisted the sterile. Also, *Festuca arundinacea* proved plant hiperacumulatoare the lead, *Medicago falcata* and sterile extract a large number of heavy metals, including manganese, zinc, iron, cadmium, copper and lead in significant amounts.

Keywords: vegetation, tailings, heavy metals

INTRODUCTION

The mining activity from the region of Moldova Noua, in the Caras- Severin county, led to the appearance of profound changes of the relief from this area, transformations of pedological, agrochemical and biological nature. (ROGOBETE and all., 1999). The sterile dumps resulted are an example of the anthropic impact on the area they are located. Their presence in the area determined especially the loss of biodiversity and they simplified the ecosystem structure. At Moldova Noua an area of about 306 hectares is occupied by these ponds/lakes of sterile tailings/dumps, considered to be the largest in Romania. Due to the studies on the composition of the heavy metals of this sterile tailing (coming from the Tausani lake) there were significantly higher results concerning the zinc and nickel content. (MICU, 2011). Following the research on the existence of a spontaneous vegetation on sterile tailings from Moldova Noua, there were identified 41 species of plants arranged uniformly on the surface of three tailing ponds: Tăușani, Boșneag 1 și Boșneag 2. (MICU, 2011). The general appearance of the vegetation on the ponds was that of two groups of individuals more or less monospecific herbaceous plant trees and isolated shrubs.

MATERIAL AND METHOD

Sterile material

Sterile samples were collected from the ponds of Moldova Noua. There were brought into the laboratory and extracted with a mixture of nitric acid with hydrochloric acid and maintained for 16 hours at room temperature, followed by boiling under reflux for 2 hours. The extract was then cleared and brought to volume with nitric acid. The content

of microelements in the extract was determined by the spectrophotometry method of the atomic absorption. (LAȚO, RADULOV, 2007).

Plant material

The stocktacking of plant species on arranged dumps was appointed for two years using the method developed by Braun-Blanquet (1964), cited by Arsene method (2003). The encountered species were determined by the aid of "Flora României" work (1952-1976). For the determination of heavy metals on spontaneous plants from the ponds, there were selected prevalent plant species from these areas, as follows:

- on the ponds Tăușani, which is the largest in size (154 ha), was taken for analysis of all four identified plant species: *Salsola kali* species (Russian thistle), a worthless fodder plant, which occupies 60% of the surface of the pond;

- on the ponds Boșneag 1, *Phragmites australis* species occupies about 80% of the total area of the pond, so this plant has been taken under study concerning the content of heavy metals;

- on the ponds Boșneag 2, of a total identified spontaneous species in a significantly higher percentage were discovered species as: *Medicago falcata* (alfalfa), a plant with good fodder value and *Festuca arundinacea*.

Chemical analysis to determine composition of sample

To determine the content of heavy metals in these plant species, samples were dried and weighed to obtain the extract of which the elements will be determined. It has been weighed 3 g of dried herbs in a 250 ml reaction vessel. It was then moistened with 1 ml of water plus 2 ml of hydrochloric acid while stirring, then 7 ml of nitric acid was added, drop by drop, to avoid foaming. In the absorption vessel were added 15 ml of nitric acid.

The absorption vessel and the refrigerant were attached to the reaction vessel and left 16 hours at room temperature to allow slow oxidation of the organic material of the sterile. After the 16 hours the reaction mixture temperature was raised to reach reflux conditions and maintained for 2 hours, ensuring that the condensation is less than one third of the height of the condenser, then was allowed to cool. Absorption vessel content was added to the reaction vessel, by the refrigerant rinsing the bowl absorption but also the refrigerant in 10 ml of nitric acid. Insoluble residue from the reaction vessel was allowed to settle. Relatively sediment-free supernatant obtained by decantation was carefully passed through a filter paper and the filtrate was collected in 100 ml flask. All the original extract from the reaction vessel was passed through a filter paper, then the insoluble residue on the filter paper was washed with a minimum of nitric acid. Filtrate was then collected with the first.

From the extract thus prepared by the method of atomic absorption spectrophotometry at different wavelengths was determined each item. (LAȚO, RADULOV, 2007).

RESULTS

According to data contained in Table 2, the tailings from Moldova Noua (Caras-Severin) contain a large amount of heavy metals (Cu, Zn, Fe, Pb) in all substrates examined. Values of these elements are very significantly exceeded. Manganese and cadmium content in the tailings, to a depth of up to 40 cm, does not exceed the permissible limit. Copper and zinc had the highest percentage of sterile.

From the literature we found that some plants are known as hyperaccumulator plants which accumulate concentrations over 1000 mg / kg heavy metals for Cu (34 species) for Pb (14 species), Cd (one species). Also known concentrations exceeding 10,000 mg/kg for Zn (11 speci) and Mn (10 species). (GHOSH and SINGH, 2005).

The four species of plants (*Salsola kali*, *Festuca arundinaceea*, *Medicago falcata* and *Phragmites australis*) prevailing on the ponds were found to be tolerant plants to heavy metals, due to the fact that they have resisted every year on these so polluted tailings (table 1).

Salsola kali, compared with other plant species analyzed, accumulated the largest amount of manganese and zinc in the tailings, and cadmium and lead was not extracted.

Copper was extracted mainly by *Phragmites australis* and *Medicago falcata*.

Tabel 1. Chemical content of plants analyzed

Sample	Mn [ppm]	Cu [ppm]	Zn [ppm]	Fe [ppm]	Cd [ppm]	Pb [ppm]
<i>Salsola kali</i> (thistle)	64	8,7	25	14,7	-	-
<i>Festuca arundinaceea</i> (fescue)	50	7,7	15	19	-	2
<i>Medicago falcata</i> (alfalfa)	50	10	9	15,3	0,01	1
<i>Phragmites australis</i> (reed)	55	13,1	12	16	-	-

Source: MICU (2012)

From the information presented in Table 1, *Medicago falcata* was the only plant species that has accumulated through its roots all six studied heavy metals.

Festuca arundinaceea, the only plant with good fodder value, was identified as predominant in the tailings ponds to extract the greatest amount of lead (2 ppm) and lowest copper (7.7 ppm).

Table 2. The synthesis of experimental results and establish the significance of differences limit values of these metals

Sample	Mn			Cu			Zn			Fe			Cd			Pb		
	Conc. [ppm]	The difference	Significance	Conc. [ppm]	The difference	Significance	Conc. [ppm]	The difference	Significance	Conc. [ppm]	The difference	Significance	Conc. [ppm]	The difference	Significance	Conc. [ppm]	The difference	Significance
V₁ (0 cm)	198.56	- 701.44	000	209.20	189.2	**	230.33	130.33	*	12897.67	12897.67	*	0.15	- 0.85	000	18.00	-2	-
V₂ (10 cm)	141.50	- 758.5	000	337.30	317.3	***	270.25	170.25	*	339.67	339.67	-	0.40	- 0.60	00	78.50	58.5	***
V₃ (20 cm)	49.50	-850.5	000	214.30	194.3	**	369.33	269.33	***	27886.17	27886.17	***	0.46	- 0.54	00	40.70	20.70	-
V₄ (40 cm)	111.48	-788.52	000	344.30	304.3	***	37.40	- 62.6	-	20122.70	20122.70	**	0.00	- 1	000	41.70	21.70	-
Valori limită [ppm]	900	witness	-	20	witness	-	100	witness	-	0	witness	-	1	witness	-	20	witness	-
	DL _{5%} = 338.83 DL _{1%} = 456.18 DL _{0.1%} = 606.59			DL _{5%} = 127.13 DL _{1%} = 171.17 DL _{0.1%} = 227.60			DL _{5%} = 128.70 DL _{1%} = 173.28 DL _{0.1%} = 230.42			DL _{5%} = 11823.90 DL _{1%} = 15919.01 DL _{0.1%} = 21167.68			DL _{5%} = 0.36 DL _{1%} = 0.49 DL _{0.1%} = 0.66			DL _{5%} = 23.51 DL _{1%} = 31.66 DL _{0.1%} = 42.10		

Source: MICU (2011)

CONCLUSIONS

Following the studies on heavy metal accumulation by the spontaneous plants on sterile pounds, we found that the best hyperaccumulating heavy metal plant proved to be *Medicago falcata* (alfalfa). Due to its pivoting root, after a few years it reaches depths of 100 cm, exploring a large amount of tailings and also diversified on layers absorbs more elements in larger quantities. Species *Salsola kali*, *Festuca arundinaceea*, *Medicago falcata* and *Phragmites australis* are the most tolerant plants to heavy metals, long resisting on the sterile.

Of the six heavy metals analyzed, manganese was extracted in the largest quantity.

Cadmium and lead cannot be consumed from the sterile by all the plants, only by *Medicago falcata*, and a lead hyperaccumulator proved to be *Festuca arundinaceea*. But these two plants with a good forage value will be searched by wild animals (rabbits etc), and birds (pheasants etc) that can transit the ponds and will get poisoned by lead and cadmium. It is one of the causes of herbivores and bird population reduction in these areas.

Although *Salsola kali* is a worthless fodder plant, being a thistle, should be not get away from the land contaminated with heavy metals, being an excellent plant consuming manganese and zinc.

ACKNOWLEDGEMENTS

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REFERENCES

- ARSENE G.G. (2003): Fitocenologie și vegetația României, Editura Solness, Timișoara;
- GHOSH M., SINGH S. P. (2005): A review of phytoremediation of heavy metals and utilization of its byproducts. Applied Ecology and Environmental Research, 3 (1): 1-18, Budapest, Hungary;
- LAȚO ALINA, RADULOV ISIDORA (2007): Chimia solului - metode de analiză, Editura Eurostampa, Timișoara;
- MICU LAVINIA, MOISUC AL., PETANEC D., LAZAROVICI M., COTUNA OTILIA, RADULOV ISIDORA (2011): Study on chemical characteristic of the tailings dumps from Moldova Noua from Timisoara, Research people and actual tasks on multidisciplinary sciences, Lozenec, Bulgaria;
- MICU LAVINIA MĂDĂLINA, MOISUC AL., PETANEC D., COTUNA OTILIA (2011): The study regarding floristic composition of tailings dumps from Moldova Noua, in order the reconstruction ecological, Lucrări științifice, vol.54, nr.2/ 2011, Iași, ISSN 1454-7414
- ROGOBETE GH., CONSTANTINESCU LAURA, NEMEȘ I. (1999): Manual de Pedologie practică, Editura Mirton Timișoara.

CHANGE IN TIME OF AGROCHEMICAL SOIL PARAMETERS AFTER TOMATO MINERAL FERTILIZATION

MOIGRADEAN DIANA¹, POIANA MARIANA-ATENA¹, ALDA LIANA-MARIA¹, ALDA SIMION², BORDEAN DESPINA-MARIA¹

Banat's University of Agricultural Sciences and Veterinary Medicine,
¹Faculty of Food Processing Technology, ²Faculty of Horticulture,
Calea Aradului 119, Timisoara, RO 300645, Romania
dimodean@yahoo.com

ABSTRACT

The paper presents the results regarding the effect of different NPK fertilization doses on change, during three years of agrochemical soil parameters after tomato mineral fertilization. The following agrochemical indicators were analyzed: pH, humus, total nitrogen, mobile phosphorus and mobile potassium content.

The experience was done in a cambic cernosium soil, with low acidity reaction, very good content in nitrogen, phosphorus and potassium and the high natural fertility potential favorable vegetables cultivation in Romanian Western Plain area. The experimental field is located in temperate climatic area, characterized by Koppen classification in the formula Cfbx. The study was performed on control soil samples (without fertilizers) and soil samples after differentiated NPK fertilization in variable doses: N₃₀P₃₀K₃₀, N₄₅P₄₅K₄₅, N₆₀P₆₀K₆₀ and N₁₂₀P₆₀K₆₀. Tomato fertilization with mineral fertilizer determines, in time, significant modifications of agrochemical soil parameters. To preserve the soil quality must find the optimum dose of NPK fertilizer in tomato crop fertilization.

Keywords: agrochemical soil parameters, mineral fertilization, tomatoes

INTRODUCTION

The fertilization doses and the application methods in tomatoes fertilization were to determine in correlations between agrochemistry factors. Most soils do not naturally possess all the nutrients that are needed to produce top quality yields, crop after crop. Tomato (*Lycopersicon esculentum*) is one of the popular and most consumed vegetable in the world. Tomatoes need moderate to high levels of phosphorus and potassium.

The pH value of soil is one of a number of environmental conditions that affects the quality of plant growth. The soil pH value directly affects nutrient availability. Plants thrive best in different soil pH ranges (www.savvygardener.com). Optimum soil pH for tomatoes cultivations is between 6.0-6.5 (MANESCU, 2003).

The soil humus, or organic colloidal fraction is composed of highly decomposed residues of plant and animal remains (HODGES, 2010), having an important role in its fertility (MILES, 2003). Soil organic matter is distinguished by its high moisture retention, low plasticity, low cohesion, and the dark color it imparts to the soil. The structure of soil organic matter is extremely complex, with many different types of functional groups which can contribute negative charges as well as interact in other more specific ways with cations and organic molecules. Humus does not readily fix exchangeable cations but maintains these ions in an easily exchangeable form. Mineralization of soil humus releases some amounts of nitrogen, phosphorous and sulfur from organic forms, and can dramatically influence the availability of micronutrients. The availability of nutrients to plants is determined by the form and chemical properties of the element, the soil pH, interactions with soil colloids, microbial activity and soil physical conditions such as aeration, compaction, temperature, and moisture (HODGES, 2010).

Nitrogen is a basic component of humus. Concentrations in Romanian soil is between 0.09-0.35% N (LIXANDRU, 1990) up to 0.38% N (GOIAN, 1994). Nitrogen is one of the main nutrients required for plant growth and is therefore applied to crops in large amounts to ensure big yields. Nitrogen fertilizer was often used in excess in the past; as a consequence, soil and water were subject to heavy pollution.

Phosphorus it has low mobility and availability in soils. It is difficult to manage because it reacts so strongly with both solution and solid phases of the soil. As a result, mobility through the soil is extremely limited. While phosphorus occurs in a multitude of inorganic and organic forms in the soil, the plant available forms of phosphorus are limited primarily to solution HPO_4^{2-} and H_2PO_4^- , with the dominant form determined by the soil pH. In soils with pH between 4.3 and 7.0, the H_2PO_4^- form predominates (HODGES, 2010). The total phosphorus content in soil in Romania ranges from 0.05-0.3% P_2O_5 , respectively 0.02-0.12% P (GOIAN, 1994).

Potassium is relatively mobile in the soil, meaning it is readily leached through the soil profile and can be lost from the root zone. Although potassium does move through the soil, if large quantities need to be applied it is best to work it into the soil. Only 1-3% of total soil potassium is potassium exchangeable (GOIAN, 1994).

Complex NPK fertilization maintains a high level of soil-plant balance regarding the consumption of nutritious elements and ensures balanced nutrition for crops (SALA, 2010).

MATERIAL AND METHOD

The experiments were carried out over a period of 3 years: 2006, 2007, 2008. Soil samples were taken 0-25cm depth and were collected in spring 2006, before the establishment of tomato crop and in each year, in June, after tomato crop establishment. The fertilization was applied in spring, with four weeks before tomatoes plantation (DUMAS, 2003). Were use dry/granulated fertilizers NPK 15:15:15 and the nitrogen high dose supply with urea application. pH was determined in aqueous suspension, 1:2.5 soil-solution proportions, using the potentiometric method. The humus was determined by titrimetric method after Walkley-Black (1943). The total nitrogen content was determined by using the Kjeldahl method using UDK 127 Distillation Unit and DK6 model Digester Unit from Velp Scientifica. Mobile phosphorus content was extracted with ammonium lacto-acetate by using the Egner-Riehm-Domingo method (P-AL) using Spectrophotometer UV-VIS SPECORD 205 by Analytik Jena. The concentration of mobile (changeable) potassium was used in the same ammonium lacto-acetate extract (Egner-Riehm-Domingo) (K-AL) by flame photometry (MAIA, 1983). Were used chemicals and reagents from Merck; deionized water.

RESULTS

Timisoara city receives, thanks maritime air masses from the northwest, a higher rainfall with a multiannual average values of 631.0 mm. The climate conditions of the area are characterised by average annual temperature of 10.7 °C. To characterize the area were used meteorological data recorded at the Meteorological Station of Timisoara, in the period 2006-2008 and multiannual average.

In the period when our research was carried out, the temperature values recorded were higher than the multiannual average (*Table 1*).

Table 1. The air temperatures recorded at the Meteorological Station Timisoara

Years	Monthly average temperatures [°C]												Annual average [°C]
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	
2006	-1.7	0.0	5.0	12.4	16.2	19.5	23.6	20.1	17.5	12.0	6.4	2.1	11.10
2007	4.0	6.0	9.0	13.0	18.3	22.5	24.1	23.0	14.9	11.0	4.2	0.1	12.51
2008	1.8	4.8	8.3	12.4	17.8	21.6	21.9	22.6	15.4	12.3	7.1	3.6	12.47
Multiannual average [°C]	-1.2	0.4	6.0	11.3	16.4	19.6	21.6	20.8	16.9	11.3	5.7	1.4	10.85

Source: National Meteorological Administration

Table 2 shows montly precipitation for three experimental years and annual average. The precipitations has irregular nature. In the second experimental year the total rainfall was the maximum annual sum values (662.4 mm) and in the third year the highest monthly values was in June (157 mm).

Table 2. The rainfall recorded at the Meteorological Station Timisoara

Years	Monthly average precipitations [mm]												Annual sum [mm]
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	
2006	30.0	42.0	49.0	78.8	50.2	87.8	50.4	98.0	21.0	17.4	31.3	21.3	577.2
2007	26.0	92.0	57.0	4.4	69.4	65.2	46.4	65.0	62.0	57.0	92.0	26.0	662.4
2008	45.7	22.6	78.4	44.7	49.0	157	45.7	24.8	51.5	17.5	53.1	55.1	645.1
Annual average [mm]	40.9	40.2	41.6	50.0	66.7	81.1	59.8	52.3	47.1	54.8	48.6	47.8	631.0

Source: National Meteorological Administration

Soil agrochemical parameters before experiment were followed: pH=6.34, humus=3.00, N=0.29%, P=163.00 ppm, K=160.00 ppm. The analysis show that soil its favorable for tomatoes cultivation (DAVIDESCU, 1992; MANESCU, 2003). A soil test does not end when the results are determined in the laboratory. Those results must be related to the expected level of plant response and the appropriate rate of fertilizers required eliminating nutrient deficiency (HODGES, 2010).

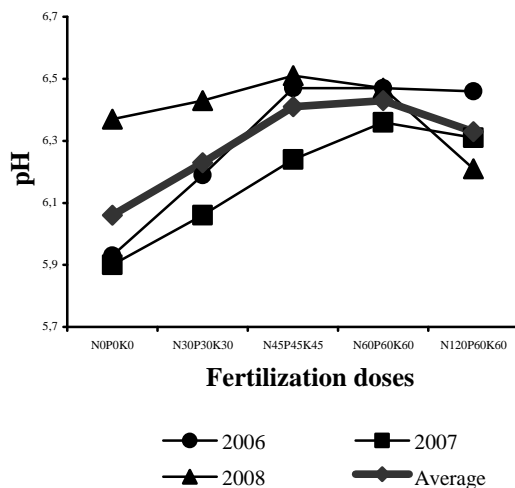


Figure 1. Change of soil pH after tomato mineral fertilization
Source: own research

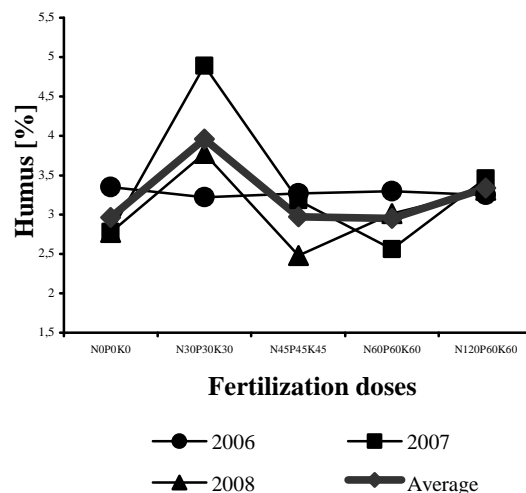


Figure 2. Change of soil humus after tomato mineral fertilization
Source: own research

Over the three experimental years, soil pH change (*Figure 1*). pH increases from one experimental year to another of the unfertilized variant and the variants fertilized with low NPK fertilization doses and decreases at higher fertilization doses. While the fertilization with nitrogen, phosphorus and potassium has a significant influence on soil pH, the application of urea nitrogen form to decrease of soil pH and affect availability of plant which for other nutrients.

Rainfall also affects soil pH. Water passing through the soil leaches basic nutrients such as calcium and magnesium from the soil. They are replaced by acidic elements such as aluminum and iron. For this reason, soils formed under high rainfall conditions are more acidic than those formed under arid conditions (www.savvygardener.com).

In *Figure 2* we observed that the humus has a linear dependence in the first experimental year on all fertilization doses. In the second experimental year the humus values shows a jump from the unfertilized variant (2.78%) to N₃₀P₃₀K₃₀ fertilization doses (4.89%) after falling to normal levels. At the maximum fertilization doses studied (N₁₂₀P₆₀K₆₀) the humus soil content it keeps the same values as the control.

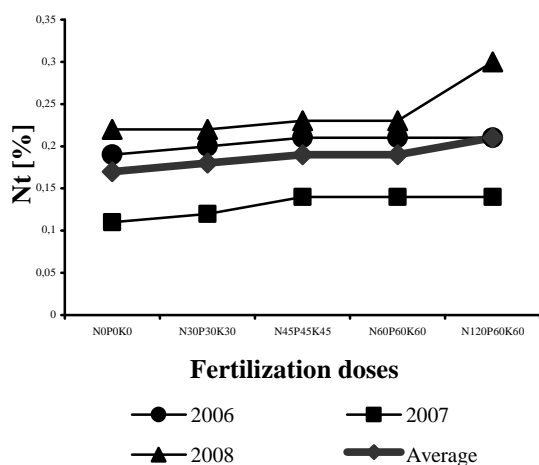


Figure 3. Change of soil nitrogen after tomato mineral fertilization
Source: own research

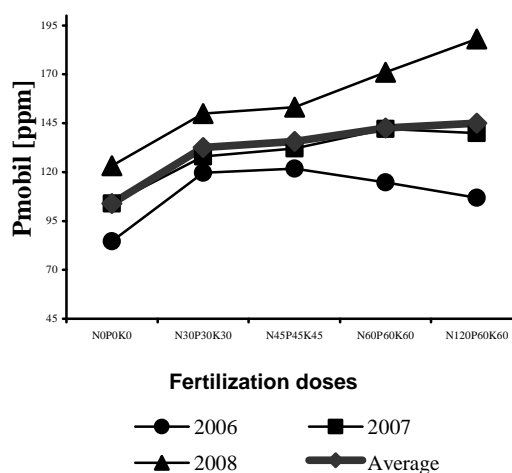


Figure 4. Change of soil phosphorus after tomato mineral fertilization
Source: own research

Total nitrogen content in soil increases, compared with control samples (RADULOV, 2009), in all experimental years, between 0.11-0.30% N (*Figure 3*). In 2007 the percentage of total nitrogen in the soil is below the average experimental years, has a linear dependence of all fertilization doses because when urea is applied to the soil surface, N loss as gaseous ammonia is possible, especially with warm, dry conditions and a soil high pH (HODGES, 2010).

Phosphorus is relatively immobile in soil. Phosphorus moves very slowly in mineral soils and thus tends to build up over time when the amount of phosphorus added in fertilizer and organic matter exceeds the amount removed in the harvested portions of crops (www.soil.ncsu.edu). Due the fixation process of phosphates in the soil, only 15-50% of the phosphorus content of mineral fertilizers comes to be used by the plants, the rest is retained in the soil in the form of inaccessible compounds (GOIAN, 1994).

Mobile phosphorus concentrations increased on all levels of fertilization from one experimental year to another (*Figure 4*).

From previous research it is known that the phosphorus uptake can also be affected by cool soil temperatures, water-logged soil conditions and soil pH (HODGES, 2010).

Potassium is also mobile in soil; the accumulation of potassium also depends upon soil texture (OSMOND, 2008) and movement is primarily through diffusion. It is much less mobile than nitrate nitrogen, but more mobile than phosphorus (HODGES, 2010). Potassium is soluble in water and can be leached out of the soil profile into the groundwater (SAINJU, 2003). Only 1-3% of total potassium in soil is potassium changeable (GOIAN, 1994).

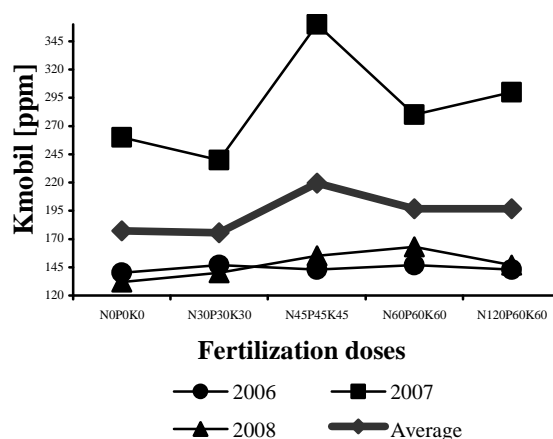


Figure 5. Change of soil potassium after tomato mineral fertilization
Source: own research

Potassium content is within the limits of the control samples values. Potassium remains from the soil in the same range, between 140-147ppm from the experimental year 2006 and 132-163 ppm from 2008 (*Figure 5*). The highest value of potassium soil was observed by $N_{45}P_{45}K_{45}$ fertilization doses (360 ppm). The potassium content of soil in 2007 was more than average experimental years, due to the meteorological conditions: low rainfall and high temperatures.

CONCLUSIONS

The experience was done in a cambic cernosium soil, with low acidity reaction, very good content in nitrogen, phosphorus and potassium and the high natural fertility potential favorable tomatoes cultivation.

The soil acidity increases with mineral fertilizers application from the slightly acid pH to moderately acid pH.

The highest rate of fertilization ($N_{120}P_{60}K_{60}$) not affect the humus content in soil; it's was almost the same value as control sample.

Fertilization with mineral fertilizers in small and average doses determines annual linear increase of nitrogen soil and considerable variations to high doses of fertilizer.

Mobile phosphorus concentrations in soil have increased from one experimental year to another due to residual effect of the phosphorus fertilizers in the soil and the meteorological conditions.

Potassium accumulation in soil depends of soil texture and the meteorological conditions.

To preserve the soil quality must find the optimum dose of NPK fertilizer in tomato crop fertilization.

REFERENCES

- DAVIDESCU, D., DAVIDESCU, V. (1992): Agrochimie Horticola. Editura Academiei Romane. Bucuresti
- DUMAS, Y., DADOMO, M., LUCCA, G., GROLIER P. (2003): Effects of environmental factors and agricultural techniques on antioxidant content of tomatoes. Journal of the Science of Food and Agriculture 83, pp.369–382
- GOIAN, M., BORZA I., RADULESCU, H., SALA F. (1994): Agrochimie. LITO-USAB Timisoara
- HODGES, C.S. (2010): Soil Fertility Basics. NC Certified Crop Advisor Training. North Carolina State University
- LIXANDRU, G. (1990): Agrochimie. Editura Didactica si Pedagogica, Bucuresti
- MANESCU, B., STEFAN, M. (2003): Sisteme horticole comparate. Editura Ceres Bucuresti
- MILES, A., BROWN, M. (2003): Soils chemistry and fertility. Teaching Organic Gardening and Farming Resources for Instructors. Santa Cruz. CA
- OSMOND, L.D., KANG, J. (2008): Nutrient removal by crops in North Carolina published by North Carolina Cooperative Extension Service
- RADULOV, I., SALA, F., BERBECEA, A., CRISTA, F. (2009): Influence of mineral fertilization treatments on soil chemical properties. Research people and actual tasks on multidisciplinary sciences, Lozenec, Bulgaria, pp.321-327
- SAINJU, M.U., DRIS, R., SINGH, B. (2003): Mineral nutrition of tomato. Food. Agriculture & Environment , vol.1 (2), pp.176-183
- SALA, F., RADULOV, I., CRISTA, F., BERBECEA, A. (2010): The modification of some agrochemical soil indices under the influence of mineral fertilization. Research Journal of Agricultural Science, 42 (3), pp.302-305
- ***Agrochemical soil analysis methodology for establish the need amendmets and fertilizers (MAIA), 1983, vol. I (1)
- <http://www.soil.ncsu.edu/publications/Soilfacts/ag-439-16W.pdf>
- http://www.savvygardener.com/Features/soil_ph.html

THE DRY MATTER CONTENT CHANGES OF SPICE PEPPER CULTIVATED UNDER PLASTIC COVER

KITTI NAGY¹, ZOLTÁN TIMÁR², KRISZTIÁNNÉ KIS¹, KATALIN SLEZÁK¹

¹ Corvinus University of Budapest, Faculty of Horticultural Sciences, Department of Vegetable and Mushroom Growing, 1118 Villányi street 29-43., Budapest, Hungary

kitti.nagy@uni-corvinus.hu

² Red Pepper Research-Development Public Benefic Company, 6300 Obermayer tér 9. Kalocsa, Hungary

ABSTRACT

The main objective of our research work consists in determining the particular plant density suitable for spice pepper hybrids and in elaborating the trellis system and the pruning method. In the second year of the series of experiments over several years we examined the effect of plant density, picking frequency and trellis type on yields and fruit quality. In this publication we discuss the change of dry matter content of each picking. Plants were arranged in twin rows (90+40)x38; x34; x30 plant spacing. Four independent replications were used. Plants had two stems and 4 of them were planted on each m². According to our results only the picking frequency influenced on the dry matter content out of three technological elements in our experiment.

Key words: pepper, plastic cover, plant density, picking time, dry matter content

INTRODUCTION

The spice pepper growing area decreased by 25% over the previous year, 2009: 2000ha, 2010:1500ha (FRUITVEB, 2010) in Hungary. The decrease was caused by ecological and economic changes. Due to the climate changes the risk of traditional spice pepper growing (outdoor, sowed or planted) have been increased concerning both the yield and the terms of quality. The growing risk is much higher without proper proportion of the individual living condition (temperature, light) so the quality values are not formed by a high level, as under protected and controlled conditions. Growing under plastic cover proves to be suitable production technology that can result earlier onset of picking, increased number of pickings, better quality (purity, in the first place), better (and cheaper) post harvest maturation and therefore higher quality of the ground product.

The crucial issue of production technology under plastic cover is plant density. 4-4.5-5 plants per square meter could be the optimal plant density. The pruning method and the trellis system are correlated with plant density and have determinant influence on the amount of light that plants receive the micro-climate, plant protection and the number of pickings. In the intensive growing of green pepper under unheated greenhouse conditions it is the two stem pruning that has become widespread (DASGAN – ABAK, 2003; GYÚRÓS – SZŐRINÉ, 2005), in contrast to the less intensive technology where a cordon trellis system is used (ZATYKÓ, 2000, DUROVKA ET AL., 2006).

Since with cultivation under plastic cover higher yield can be achieved more water and nutrients are needed compared to conventional open field (extensive) crop production. Multiple picking requires a continuous plant growth. It can be reached by fertilizing several times a week or even every day with a fertilizer that provides immediately available nutrients for the plants (TERBE, 2009). When fertilizing we need to focus on potash supply, since the formation of pigments are strongly influenced by potassium (IRINYI – KAPITÁNY, 2004).

The increased number of pickings increases total yields as with the removal of ripen fruits

plants are relieved and therefore are permitted to develop and mature other fruits at high quality (DUROVKA ET AL., 2006).

The average dry matter content of fruits is significantly higher in the case of single-pass harvest(single picking) than case of multi picking.

(SOMOGYI, 2010).

Composition parameters are influenced by several production technology factors, starting from fertilizer application to the timing of harvest (BELAKBIR ET AL., 1998; BOSLAND - VOTAVA 2000; ANCHONDO ET AL., 2001; IRINYI – KAPITÁNY, 2004; IRINYI – SLEZÁK, 2006A,B.; GYÖKÖS ET AL., 2009).

The main objective of our research work consists in determining the particular plant density suitable for spice pepper hybrids and in elaborating the trellis system and the pruning method. In the second year of the series of experiments over several years we examined the effect of plant density, picking frequency and trellis type on yields and fruit quality. In this publication we discuss the change of dry matter content of each picking.

MATERIAL AND METHOD

The experiment was set up at the Experimental and Training Farm of the Faculty of Horticulture, Corvinus University of Budapest, using the (indeterminate) variety *Délibáb*. It was cultivated under plastic cover, between unheated conditions.

Main technological parameters of the experiment:

Seedling raising was carried out in KITE trays with 96 cells (400 plants/m²), in seedling soil POT 20, with sowing date 8th March. Planting-out took place on the 22th April.

Treatments:

	Cordon	Plant density (plant/m ²)	Number of picking
1.	Vertical	4	2
2.		4	3
3.		4	4
4.		4.5	2
5.		4.5	3
6.		4.5	4
7.		5	2
8.		5	3
9.		5	4
10.	Horizontal	4	2
11.		4	3
12.		4	4
13.		4.5	2
14.		4.5	3
15.		4.5	4
16.		5	2
17.		5	3
18.		5	4

We used two type of trellis system: vertical and horizontal cordon trellis system.

Plants were arranged in twin rows (90+40)x38 cm; (90+40)x34 cm; (90+40)x30 cm plant spacing. Four independent replications were used.

The plant number per square meter was 4; 4.5; 5.

At vertical trellis system, the stems were trained vertically. After the two stem shaping pruning the main shoots were wound around the string and only branching lateral shoots were broken off above 2-3 internodes.

A preventive plant protection was used in the plastic tunnel against eventual infection by aphids, greenhouse whitefly, cotton bollworm, trips and powdery mildew. (Consequently, no yield loss from pest was observed.)

Picking dates according to the respective treatments are included in *Table 1*.

Table 1. Picking dates (Budapest, 2011).

Date of picking \ Treatments																		
	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.
02.08.			X			X			X			X			X			X
30.08.		X	X		X	X		X	X		X	X		X	X		X	X
28.09.	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
18.10.	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

At the pickings, in order to observe vegetative plant development, the longer main stem of each plant was measured. Pickings were carried out in the state of biological maturity of fruits.

RESULTS AND CONCLUSIONS

Although no statistical difference can be observed between the trellis system, and plant density, but the picking frequency showed a difference. Dry matter content of fruits was the highest (40.82%-70.80%) in case of first picking in the two times harvested parcels (1;4;7;10;13;16). Also the first picking provided the highest dry matter content (24.48%) in three times harvested fruits (2;5;8;11;14;17). However in four times harvested parcels (3;6;9;12;15;18) measured the lowest dry matter content (13.58%) in case of first picking . The three other pickings gave about the same average value. (*Figure 1-2*).

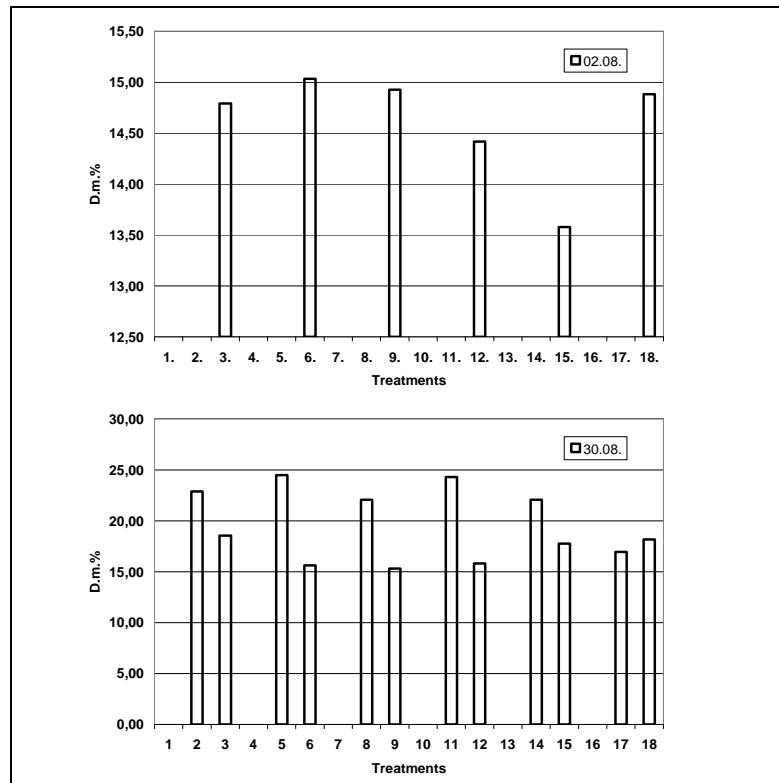


Figure 1. Effect of first and second pickings on dry matter content

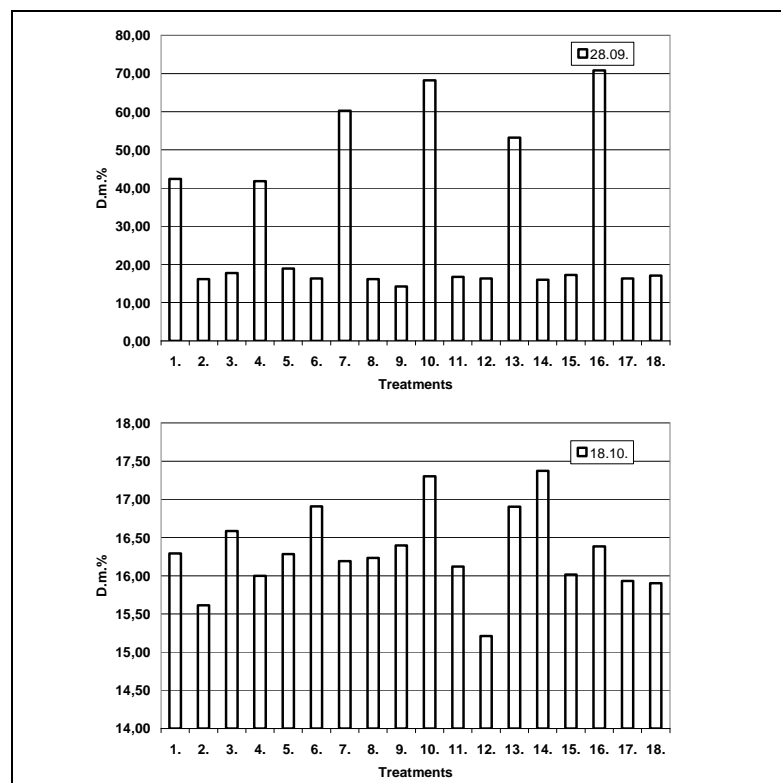


Figure 2. Effect of third and fourth pickings on dry matter content

Figure 3. shows trend of harvested fruitweights weighted annual average dry matter content.

Also the picking frequency showed statistically demonstrated difference. The average annual dry matter content in the two times harvested parcels is 48.38%. However most frequently picked parcels dry matter content is low 15.95%. It is true that, there is no statistically significant difference between the trellis systems, but average values showing horizontal cordon result in higher dry matter content (30.23%), than the vertical cordon.

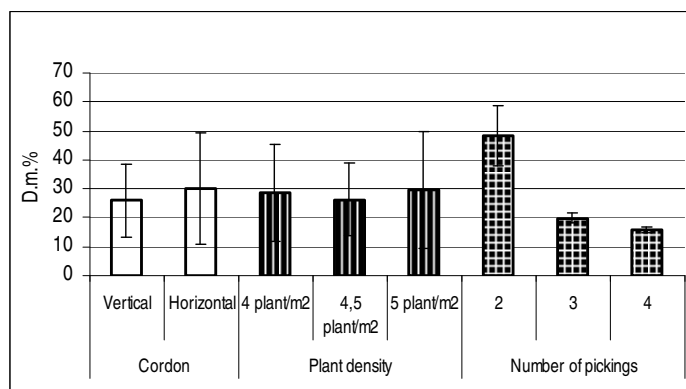


Figure 3. Trend of fruitweights weighted annual average dry matter content

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REFERENCES

- ANCHONDO, J.A.; WALL, M.M.; GUTSCHICK, V.P.; SMITH, D.W. (2001): Pigment accumulation and micronutrient concentration of iron-deficient chilli peppers in hydroponics. *HortScience*.36(7):1206-1210.
- BELAKBIR, A., RUIZ, J.M., ROMERO, L. (1998): Yield and fruit quality of pepper (*Capsicum annuum* L.) in response to bioregulators. *HortScience*. 33(1): 85-87.
- BOSLAND, PW, VOTAVA, EJ. (2000) Peppers: Vegetable and Spice Capsicums. CABI Publishing, Oxon New York. ISBN 0 85199 335 4. p. 204
- DASGAN, H.Y., ABAK, K. (2003): Effect of plant density and number of shoot on yield and fruit characteristics of peppers grown in glasshouses. *Turkish Journal of Agriculture and Forestry*. 27 (1): 29-35.
- DUROVKA, M., LAZIĆ, B., BAJKIN, A., POTKONJAK, A. MARKOVIĆ, V., ILIN, Ž., TODOROVIĆ, V. (2006): Proizvodnja povrća I cveća u zaštićenom prostoru. Grafomark, Laktaši, Bosnia. ISBN 86-7520-087-0 p. 510.
- FRUITVEB (2010): A zöldség és gyümölcs ágazat helyzete Magyarországon. Magyar Kertészeti Tanács, Budapest.
- GYÖKÖS, E., DUDÁS, L., HODOSSI, S., KAPITÁNY, J. (2009): A betakarításkori érettség és az utóérlelés hatása a fűszerpaprika festéktartalmára. *Agrofórum*, 20(9): 56-59.
- GYÚRÓS, J., SZŐRINÉ, Z. A. (2005): Paprika. In: In: Terbe I. , Hodossi S., Kovács A. (szerk): Zöldségtermesztés természetöberendezésekben. Mezőgazda Kiadó, Budapest. ISBN 963 286 204 X. p.133-152.
- IRINYI, B., KAPITÁNY, J. (2004): A káliumtrágyázás szerepe a fűszerpaprika terméshozamának és minőségének növelésében. *Kertgazdaság*, 36(1):14-19.

- IRINYI, B., SLEZÁK, K. (2006a): Lombtrágyázás hatása a fűszerpaprika termésmennyiségére és minőségére. *Zöldségtermesztés*, 37(3):24-28.
- IRINYI, B., SLEZÁK, K. (2006b): Lombtrágyázás hatása a fűszerpaprika fontosabb beltartalmi tulajdonságaira. *Magyar Táplálkozástudományi Társaság XXXI. Vándorgyűlése*. Keszthely, 2006. október 5-7. Proc. 35.
- SOMOGYI, N. (2010): Hibrid fűszerpaprika nemesítés és hajtatásos termesztéstechnológia doktori értekezés. Keszthely. Pannon Egyetem Georgikon Kar, Növénytermesztési és Kertészeti Tudományok Doktori Iskola. Kézirat.
- TERBE, I. (2009): A hajtatott fűszerpaprika igény szerinti víz- és tápanyag-ellátása. *Zöldségtermesztés*. 40(1): 5-6.
- ZATYKÓ, L. (2000): Paprika. In: Balázs S. (szerk.): *A zöldség-hajtás kézikönyve*. Mezőgazda Kiadó, Budapest. ISBN 963 9358 03 7. p. 195-243.

THE AGRICULTURAL SYSTEM IN BELINT, TIMIS COUNTY

OKROS ADALBERT¹, NITA LUCIAN DUMITRU¹, MIHUT CASIANA¹, TRASCA ILEANA²

¹USAMVB Department of Soil Science and Plant Nutrition, Timisoara, Romania

²City Hall, Recas, Romania

adalbertokros@yahoo.com

ABSTRACT

The significant potential of Romanian agriculture, as well as the rise in prices for agricultural products worldwide could maintain the high interest displayed by foreign investors in this sector. This is one of the conclusions drawn by economic analysts regarding the field of agriculture. They claim that Romania presents the highest level of use of unemployed familial workers in agriculture among all EU countries. Another point they make is that the low investment rates have increased the vulnerability of Romanian agriculture to meteorological conditions and induced a volatile behaviour into this sector.

The highly fragmented structure of the agricultural area represents an obstacle for attracting new investments, and at the same time it affects work productivity. The rural area is characterized by the existence of a considerable number of people who are economically and socially vulnerable, and who face difficulties in complying with the new set of complex EU requirements in the field of agriculture. The ever-rising prices represent an opportunity for the countries which benefit from strong agricultural sectors. România enjoys a privileged position from the point of view of the agricultural resources.

The arable land represents 39.5% of the total surface: there are only five other countries in the world with a more comfortable position from this point of view. The domestic agricultural sector is frequently seen as the main beneficiary of the fact that Romania has become a part of the European Union. The opportunities arise from the important European funds that can be accessed in the frame of the Common Agricultural Policy - around 7.5 billion euro in the period between 2007 and 2013.

Keywords: agriculture, potential, arable land, animal husbandry, agricultural area

INTRODUCTION

Being situated to the east from the relative centre of Timis County, on the national road DN 6, the settlement named Belint, which is the capital of the commune that bears the same name, is located at a 45.5 km distance from Timisoara. The closest town is Lugoj, 14.5 km away.

The municipality of Belint covers an area of 6320 ha, of which 5670 ha is arable land. The administrative composition of the municipality engulfs villages Belinț, Babșa, Chizătău and Gruni.

There are three elements making up the relief in the area. One third of the relief belonging to these settlements is made up of hills. Part of Lipova Hills, 150-180 m high, they are located north of the Bega River and East-Southeast from Gruni, with a general inclination from North-North-east towards South-South-west. Another part of the relief represented in this area is the plain, part of Timis Plain, present to the south of the area belonging to Belint, in the shape of alluvial-proluvial dam situated between Lipova Hills and the right bank of the Timis river. The altitudes range from 105m to 110 m near Chizatau village and 111m to 140m in the Gruni-Babsa area. The third element is represented by the valleys, namely the valleys of rivers Timis and Bega. The main water courses are the Timis river and the Bega river, while rivulets Miniș, Hisiaș, Glavița, as well as the Timis-Bega canal complete the hydrographic network. It is worth noting that the Bega, the Miniș and the Hisiaș also collect the waters from the gullies and ravines in the hill area, the common trait of gullies and ravines being the great flow fluctuations, with maximum flows during springtime and at the beginning of summer, when the

precipitations are higher. The current aspect of the hydrographic system is the result of large improvement works started in 1728. Two of the most important results to this date are the canalization of the Bega and the damming of the Timis riverbed.

MATERIAL AND METHOD

The weight of agriculture in Romanian economy has gone down after 1990. Nevertheless, the contribution of agriculture to the gross domestic product remains substantial (12.8% in 2001).

After the 1990s, agricultural yield has manifested very diverse specific dynamics, both in what the sector is concerned (vegetal and animal), and from a regional point of view, in relation to the diversity of the agri-climatic conditions and to the degree of use of the production factors. The vegetal production has grown at a higher pace, because it requires smaller financial efforts, which is a very important factor if we take into consideration the lack of a capital market in our country.

The number of animals raised in the area has decreased considerably in the last decade, which, under the current situation, can jeopardize the genetic fund for animal husbandry.

For the purpose of this paper, we used data obtained by direct observation, as well as information from The Statistic Annuary of Romania, Ministry of Agriculture and Rural Development, The National Institute of Statistics and Economic Studies and Belint town hall.

RESULTS

The situation of the land fund

Table 1 presents the situation of the land fund of Belint commune in the years 2009 and 2010. As the table shows, the arable land surface increased from 4388 ha in 2009 to 4496 ha in 2010. The surplus of arable land resulted from the transformation of a part of the forest for agricultural purposes. In the same period, the surface covered with meadows and orchards stayed the same.

Table 1. The situation of the land fund of Belint commune in 2009

Use	2009	2010
	Surface (ha)	Surface (ha)
Arable	4388	4496
Meadows	1104	1004
Hay lands	45	45
Vineyards	--	--
Orchards	44	44
Agricultural total:	5581	5689
Forests, bushes	59	59
Waters, ponds	142	142
Non-productive	6	6
Roads, railroads	185	185
Buildings	217	217
Non-agricultural:	609	609

General total:	6320	6320
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As for the classification into quality classes (fertility), for the "arable" category of use, things stand as follows:

- ✓ second class 1482 ha (26.1%)
- ✓ third class 2224 ha (39.3%)
- ✓ fourth class 1270 ha (22.4%)
- ✓ fifth class 694 ha (12.2%).

Structure of crops

As one can notice in Table 2, the structure of crops is very varied, covering a large range of crops. Thus, 2458 ha were cultivated with cereals in 2009. The main crop was maize: it was grown on 1600 ha. In 2010, the same crop was the most used one, covering 1710 ha, 110 ha more than in the previous year.

The second place was taken by wheat, with 510 ha in 2009, while in 2010 the lands sown with it decreased by 280 ha. Barley covers a similar surface in the two years of reference. In what the legumes are concerned, in the two years taken into consideration people grew peas, beans and soybeans; of these, beans covered the largest surface: 10 ha.

An important area (70 hectares) is covered by technical crops, more precisely sunflower. Potatoes are extremely important in the agriculture of Belint: 290 ha are destined for autumn consumption and 120 ha for early consumption.

Vegetables play an important part, since they are the main source of income for the inhabitants in the area: 395 hectares are destined for growing vegetables, either in open air or in greenhouses.

Animal husbandry sector

The inhabitants of Belint raise a large variety of animal species, hence the animal husbandry sector is well represented in the area.

Here is the situation of cattle:

- ✓ Dairy cows: 182 head;
- ✓ Heifers 59 head;
- ✓ Young bulls 41 head.

The total of bovines is 282 head, with a tendency towards increasing the number in the following years, due to the large areas cultivated with fodder plants and meadows.

The current situation of swine in Belint area is as follows:

- ✓ Calving sows 80 head;
- ✓ Young sows for calving 20 head;
- ✓ Boars 8 head;
- ✓ Fattened pigs over 50 kg 936 head;
- ✓ Fattened pigs under 50 kg 842 head.
- ✓ Total swine 1886 head.

The data presented above show good livestock potential. The problem regarding swine in the area is not raising them, but slaughtering them: this should be performed in certain, properly equipped enclosed spaces and according to certain rules, in order to comply with the EU rules.

Table 2. The structure of crops in 2009 and 2010 (data provided by the Chamber for Agriculture of Belint Town Hall)

Structure of crops(ha)	2009	2010	Difference
Cereals, of which:			
Wheat	510	230	- 280
Rye	20	0	- 20
Triticale	--	5	+ 5
Barley	40	20	- 20
Spring two-row barley	--	3	+ 3
Oats	280	280	--
Maize	1600	1710	+ 110
Total cereals	2458	2248	- 210
Legumes, of which:			
Peas	5	5	--
Beans	10	10	--
Soybeans	8	--	- 8
Total legumes	23	15	- 8
Technical crops, of which:			
Sunflower	70	70	--
Early and semi-early potatoes	120	120	--
Autumn potatoes	290	290	--
Total technical crops	480	480	--
Vegetables on the field and in greenhouses Of which:			
Autumn tomatoes	30	30	--
Onions	57	57	--
Garlic	25	25	--
Early and autumn cabbage	43	43	--
Peppers	50	50	--
Cucumbers	50	50	--
Root crops	60	60	--
Pods of pea	5	5	--
Pods of beans	5	5	--
Aubergines	30	30	--
Cauliflower	30	30	--
Other vegetables	50	50	--
Total vegetables (field and greenhouses)	395	395	--
Watermelons and cantaloupes	4	4	--
Total fodder plants	365	365	--
Non-sown fields	364	562	+ 198
Crop fields	300	320	+ 20

The numbers of sheep are the following:

- ✓ Ewes 5600 head;
- ✓ Rams for breeding 105;
- ✓ Young sheep 670 head;

Raising sheep here proves the fact that the villagers know how to effectively use the hills in Belint, since that area cannot be used for crops.

The situation of the poultry is as follows:

- ✓ Chickens - 24.060;
- ✓ Turkeys - 420;
- ✓ Geese - 320;
- ✓ Ducks - 260;
- ✓ Broilers - 4.200;
- ✓ Other species - 140.

The large number of poultry in the commune is raised privately and is enough to ensure the food supplies for villagers. Other animals raised in the area:

- ✓ Traction horses 85 head;
- ✓ Calving mares 66 head;
- ✓ Rabbits 430 head;
- ✓ Bees 160 hives.

Table 3 Animal husbandry sector (data provided by the Chamber of agriculture in Belint Town Hall)

Animals	No.
Cattle Of which:	
Dairy cows	182
Heifers	59
Young bulls	41
Total bovines	282
Total Swine	1886
Sheep Of which:	
Ewes	5600
Rams	105
Young sheep	670
Total sheep	6375
Goats of which:	
Goats	4
Kids	10
Total goats	14
Total poultry	28.745
Horses Of which:	
Mares	66
Traction horses	85
Total horses	134
Rabbits	430
Beehives	160

Equipment and machineries

As shown in Table 4, the equipments and machineries in Belint commune cover all requirements for obtaining good crops (both from a quantitative and a qualitative point of view). The large number of machines of all sorts allows people to make all works at the optimal moment, thus yielding good crops.

Thus, the following machineries can be found in Belint:

- ✓ Tractors from 45 to 65 HP - 140 pieces;
- ✓ Tractors over 65 HP - 3 pieces;
- ✓ Ploughs - 92;
- ✓ Sowers - 49 pieces;
- ✓ Harrows - 197 pieces,
- ✓ Row crops - 80 pieces;
- ✓ Seedling planters - 4 pieces;
- ✓ Herbicide machines - 17 pieces;
- ✓ Self-propelled combines and hoes for cereals - 20 pieces;
- ✓ Trailers 68 pieces;

CONCLUSIONS

Located to the east from the relative centre of Timis County, on the national road DN 6, the settlement named Belint is situated 45.5 km away from Timisoara. The closest town is Lugoj, which is to be found 14.5 km away. The commune of Belint covers an area of 6320 ha, of which 5670 ha is arable land. The administrative composition of the municipality engulfs villages Belinț, Babșa, Chizătău and Gruni.

The people in the commune make good use of the soil resources, obtaining good crops, both from a qualitative and a quantitative point of view.

The great majority of the active population works in agriculture, especially in growing vegetables, thus obtaining decent living but at high cost, reflected in their long work hours. For the past two years, the situation has been a little more difficult than in the previous years, since the economic crisis that the world faces has affected the inhabitants of Belint, too. Thus, they have not sold as much as in the years before, and also they have had to lower the prices in order to be able to sell their products.

Still, the determination of these villagers, the agricultural potential that their lands have and the support given by the ministry of agriculture are the premises of good development of the commune for the good of the people living in it.

REFERENCES

- IANOȘ G., 1997 - *Condițiile naturale din județul Timiș*, A XVII-A Conferință a SNRSS, Ghidul excursiilor, Timișoara;
- IANOȘ G., PUȘCĂ I., GOIAN M., 1997 - *Solurile Banatului II – Condiții naturale și fertilitate*, Ed. Mirton, Timișoara;
- MÂNDRUȚ O., 1993 - *Geografia României*, Ed. Coresi, București;
- MIHĂILESCU V., 1966 - *Dealurile și câmpiile României*, Ed. Științifică, București;
- BORCEAN L, PÎRȘAN P., BORCEAN A., - *Fitotehnie, Partea I Cereale și leguminoasele cultivate pentru boabe*. Curs.USAMVB Timișoara
- xxx. Data supplied by Belinț Town Hall;
- xxx. Data supplied by Timișoara meteorological station;
- xxx. Anuarul statistic al României;
- <http://ro.wikipedia.org>.
- <http://www.apmtm.ro/timis.htm>;
- http://www.timisoreni.ro/info/date_geografice/Timisoara_Clima.html;
- <http://www.madr.ro/pages/raport/agricultura-romaniei-feb2010.pdf>

AGRICULTURE IN THE TOWN OF RECAS, TIMIS COUNTY

OKROS ADALBERT¹, NITA LUCIAN DUMITRU¹, MIHUT CASIANA¹, TRASCA ILEANA²

¹USAMVB Department of Soil Science and Plant Nutrition, Timisoara, Romania

²City Hall, Recas, Romania

adalbertokros@yahoo.com

ABSTRACT

The solution to the food crisis that affects the entire world nowadays depends directly and decisively on increasing the agricultural yield, through rational use of the productive resources and technical and social modernization of agriculture, since agriculture is the main branch of world food economy. That is why the effort of all countries must be focused on increasing the availability of food worldwide.

Agriculture has been the main - maybe still the only - food source for mankind; the number of people has been continually increasing and this poses a problem especially now, with the population explosion taking place in poor countries. These two major events make it not only necessary but also urgent for all nations to combine their efforts towards finding ways to accelerate the development of agriculture, in order to regulate the great discrepancies in food consumption and to ensure fair living conditions for all inhabitants of the earth.

These risks can be reduced or even eliminated only by putting technologies into practice correctly, with the help and under the supervision of agronomists, animal husbandry specialists, veterinarians, chemists and biologists.

We, Romanians, are still strongly tied by our origins, culture and mentalities to rural civilization, which may seem to be an impediment in our way to progress and modernization. Nevertheless, we will not solve the problems of modernization by cutting ourselves off from the village, but instead by integrating the villagers in this process which is by no means easy, but certainly long-lasting.

Keywords: Rural Development Strategy, planning, agriculture, strategy

INTRODUCTION

Modern and competitive agriculture cannot be practised without specialists, without a strong research-development sector, without technologies, without chemical and biological products in compliance with health safety requirements. Let us not get the wrong idea: there are just as many risk factors in ecological agriculture as there are in industrial agriculture.

These risks can be reduced or eliminated only by putting technologies into practice correctly, with the help of and under the supervision of agronomists, animal husbandry specialists, veterinarians, chemists and biologists.

These are the facts that require the evolution from villager and subsistence farming to farmer and efficient farming. This transformation is neither simple nor easy to accomplish. The educational system must play a very important part in this process. For this purpose, the system of continuous formation must be introduced among farmers and specialists; at the same time, they should be granted access to information and expertise.

Young people living in villages must be convinced and helped to make a career in the field of agriculture, where they can lead a decent life, with all the attributes of modernity. We must not repeat past mistakes or the mistakes made by other countries. Forced urbanization does not necessarily mean progress.

An increase in the level of civilization in villages by introducing public utilities, like schools, hospitals, kindergartens, common transport system, sewage system, gases, etc, can lead to the necessary balance between rural and urban areas.

MATERIAL AND METHOD

The data used for writing the present paper were obtained from MADR, INSSE and the Chamber of Agriculture in Recas.

The weight of agriculture in Romanian economy has constantly decreased after 1990 (the pace was slower during the first years of the transition and faster after 1997). Nevertheless, the contribution of agriculture to GDP (gross domestic product) is substantial (12.8% in 2001), as compared to the EU average (1.7%).

The regional distribution of agricultural lands according to their use is differentiated in relation to the relief, soil and climatic conditions, and suitability for certain crops. Overall, only 25% of all agricultural lands have superior quality, with good and very good productive potential.

Agricultural yield has manifested very diverse specific dynamics, both per sector (vegetal and animal) and region, in accordance with the diversity of soil and climatic conditions and also with the degree of use of the production factors.

The vegetal production has had a faster growth rhythm, since it implies smaller material and financial efforts, during times when the capital market and favourable credits are practically non-existent.

In the last decade, the numbers of animals have decreased significantly. Their decrease under the current level, which represents the technological minimum, may lead to disparagement of the genetic fund in animal husbandry.

RESULTS

Recas fits into the typology of localities with mixed activities, while localities Izvin, Bazoş, Petrovaselo, Herneacova, Stanciova and Nadas are rural settlements with mainly agricultural activities. The fact that these settlements are all situated along national road DN6 (European E70) makes their development potential to be higher than that of others.

The primary sector is represented by agriculture (growing crops, raising animals) and forestry, the secondary sector is represented by processing (food industry), constructions, light industry, storage. The tertiary sector is mainly public administration, education, health, culture, sports, commerce, financial and banking activities, post and telecommunications. Being placed on a hill, Recas is the most famous vinery area in the west of Romania

Other economic branches (industry and services) are in development, since the geographic conditions and the local conditions of the town attract investments with Romanian and foreign capital. Agriculture is the main activity in Recas, providing roughly 30 % of the jobs (employees). Crops represent the main agricultural activity, namely maize, wheat, barley, two-row barley, oats, vegetables, sunflower, sugar beet.

Agriculture

Agriculture is the main occupation of the inhabitants of Recas: more than half of the active population work in this sector. In 2009, the land fund and categories of use were as follows:

**Table 1. The situation of Recas land fund in 2009
(according to the agricultural chamber of Recas town hall)**

Use	Surface (ha)	%
Arable	14.331	73
Meadows	2355	12.08
Hay lands	969	4.97
Vineyards	1589	8.15
Orchards	230	1.80
Agricultural total	19479	100
Forests, bushes	1810	54.86
Waters, ponds	403	12.21
Non-productive	177	5.36
Roads, railroads	510	15.45
Constructions	399	12.12
Non-agricultural total:	3299	100
General total	22773	100

The structure of crops, orchards and their yields in 2010 are presented in *Table 2*.

Table 2. The structure of crops, orchards and their yields in Recas in 2010

Crop	Area (ha)	Yield (t)	t/ha on average
Wheat	1616	4848	3
Barley	500	1400	2.8
Winter two-row barley	410	1025	2.5
Spring two-row barley	105	210	2
Spring barley	305	610	2
Maize ears	2610	9135	3.5
Legumes	30	64	2.13
Sunflower	715	1573	2.2
Rape	290	522	1.8
Potatoes	140	3780	27
Total legumes	269	4233	15.73
Total fodder plants	1310	41260	31.50
Total fruit	230	1106	4.80

The structure of the areas cultivated with various crops vacillated in time in direct relation to the price of products. The average yields obtained are modest in comparison with the production potential of the area. One cause for this is the weak fertilization of the plots in the area. Table 3 shows the average quantity of chemical fertilizers applied per hectare. Still, these numbers are not accurate in reflecting the reality in the field.

Some traders in the agricultural field practise competitive agriculture, in that they apply the proper quantities of chemical fertilizers. Other producers do not apply any chemical fertilizers or use them, but not in satisfying quantities, due to the high prices of chemical fertilizers, which for some have become "luxury products". Nevertheless, during the agricultural census the natural persons did not report accurate numbers. This makes it possible for one to notice, after making direct observations on the state of crops that these quantities are larger than those presented in *Table 3*.

**Table 3. Chemical fertilizer application per surface unit in 2010
(data obtained from the Chamber of Agriculture of Recas Town Hall)**

Indicator denomination	Area (ha)	Quantity (t)	Average kg/ha
Nitrogen chemical fertilizers	5861	51,8	8
Phosphate chemical fertilizers	3495	13,6	3,90
Potassium chemical fertilizers	3495	13,6	3,90
Manure	--	--	--
Liming	--	--	--

Animal husbandry

When the census in January 4 1971 was performed, there were 7661 cattle, 9586 pigs, 11078 sheep, 431 goats, 1354 horses, 38200 poultry, 881 beehives.

After 1989, the number of animals have reduced drastically after the old agricultural cooperatives were dissolved; in the individual sector this has happened because of the uncertain status of the land and because the products have not been purchased from the population.

At present, the situation of livestock is the one presented in *Table 4*.

Table 4. The numbers of animals in Recas county (data obtained from the Chamber of Agriculture, Recas Town Hall)

Animals	No.
Cattle of which:	
Dairy cows	272
Heifers	143
Total Cattle	415
Total Pigs	1782
Sheep of which:	
Ewes	11955
Rams for breeding and young sheep	2756
Total Sheep	14711
Goats of which:	
She-goats	361
He-goats	29
Total Goats	390
Total Poultry	19.000
Total Horses	513

Agro-industrial firms

There are 36 agricultural firms in Recas. The most representative of these are presented in *Table 5*, as follows:

Table 5 Agro-industrial firms in Recas (data obtained from the Chamber of Agriculture of Recas Town Hall)

No.	Company	Arable land (ha)
1	SC HORTII EXPRESS	121.26
2	SC VULTURUL DE AUR	350
3	SC NORD SRL	251.41
4	SC BAZOŞ SRL	558
5	SC ENOTRIA SRL	117.28
6	SC VIGNA SRL	124.26
7	SC MC BUSSINES	272
8	SC CLAUMAR SRL	332
9	SC AGROPRELIPSEM	502
10	RNP ROMSILVA	359
11	SC ROMANAGRI SRL	1405
12	SC UNICA CBF	166
13	SC BANAT BEET SRL	288
14	RECATIM SA	33.5

In Recas there is a small factory at present that processes milk, "LACTITALIA". It pasteurizes and packages milk and also produces dairy products.

S.C. Recosemtract S.A. currently has a slaughterhouse equipped in conformity with EU standards through a SAPARD project; it presents increased processing capacity and it also has a chain of shops in the county.

There is also a stud farm activating in Recas; "Herghelia Izvin" is a branch of the Romanian Horse Breeders Association. It is a stud farm and provider of stallions for breeding.

The rest of the agricultural lands are capitalized by private entrepreneurs or by their owners, according to the level of mechanization of each.

CONCLUSIONS

The yields obtained differ from one year to another in relation to the weather conditions, the fluctuation of the prices for cereals and to the equipment and money that the producers have access to. As agriculture focuses on man getting the control over food production, it constitutes a fundamental social activity that satisfies the vital requirements of mankind.

In Recas area, the arable land is favourable to crops and it can sustain a large range

of crop plants. Nevertheless, insufficient knowledge, difficulties in capitalizing agricultural products on the market and especially the reduced purchasing power of the villagers have had as a result the fact that the main crops are wheat, maize, sunflower. On smaller areas people grow potatoes, vegetables and sugar beet. As a matter of fact, people have stopped growing sugar beet because it was hard to capitalize it.

In time, the local operating conditions, associated with other problems of the transition period that have had massive impact on this domain, have led to a reorientation of the locals regarding agriculture. Many of them have given up tilling the land. Part of the locals have sold their land or rented it to the associations that have formed over time.

The local people also raise animals. Various species of animals, cattle, sheep, pigs and poultry, raised in various numbers in individual households, give the complete image of the livestock in Recas.

The main problem regarding the capitalization of agricultural products is the lack of organized distribution channels. There are no organized networks for the distribution of the main agricultural products. Nor can one talk about vertical integration in networks. In what the supply of seeds, chemical fertilizers, pesticides is concerned, it is easily noticeable that there is no organized market for this purpose. There are some individuals that sell this kind of supplies through the trading firms that they own.

Agri-tourism is not to be overlooked in Recas. It could be further developed especially because of the vineyards in the area. At the same time, the hills and forests in the area have high potential that has not yet been used fully.

The Ministry of Agriculture is involved in helping the agriculturists by various programs such as payments per hectare and crops through the Agency of Payments and Interventions in Agriculture (APIA), which allots around 130 Euro/ha every year. There are also various measures, such as Measure 112, Installation of young farmers, that offers 25.000 Euro non-refundable to young people under 40 who take on for the first time the farm manager position in an agricultural exploitation.

However, due to difficult conditions for submitting projects, financing in this sector is still not at best levels.

The only real ways in which agriculture in this area can be developed is to obtain a good price when selling cereals and to reinvest the profit in modern technologies that can ensure high productivity at low costs.

REFERENCES

- BORCEAN I., TABĂRĂ V., DAVID G., BORCEAN EUGENIA, ȚĂRĂU D., BORCEAN A., 1996 - *Zonarea, cultivarea și protecția plantelor de câmp în Banat*, Ed. Mirton, Timișoara;
- COSTE I., *Ecologie agricolă*, curs IAT (LITO), Timișoara, 1986.
- IANOȘ G., 1997 - *Condițiile naturale din județul Timiș*, A XVII-A Conferință a SNRSS, Ghidul excursiilor, Timișoara;
- BORCEAN L, PÎRȘAN P., BORCEAN A., - *Fitotehnie, Partea I Cereale și leguminoasele cultivate pentru boabe*. Curs.USAMVB Timișoara
- xxx OGR nr. 34/17.04.2000 privind produsele agro-alimentare ecologice în România.
- xxx. Data supplied by Recaș Town Hall;
- xxx. Data supplied by Timișoara Meteorological Station;
- xxx. Anuarul statistic al României;

HAIR DETERMINATION AND IDENTIFICATION FROM BIRD NESTS

LÁSZLÓ PATKÓ, NIKOLETT UJHEGYI, MIKLÓS HELTAI

Szent István University of Gödöllő
Institute for Wildlife Conservation
Gödöllő 2100 Páter Károly St. 1.
faceofsmile@gmail.com

ABSTRACT

The aim of our study was to test a new noninvasive method, the bird-nest analysis in urban environment. The study area (Merzse-swamp) is located in the south south-west of Budapest. The area is bordered by the M0 motorway (from East), the Ferihegy Airport (from South) and the suburb of the 17th district (from East). We have collected 13 nests and we have found mammalian hairs in 9 nests (69,23%). From one nest an average of 5,31 (SE=5,31) hairs were found, from this 3,77 (SE=4,17) were able to be prepared and 2,85 (SE=2,91) were categorized. We have created 13 categories from the data. 5 of these were species categories (*Talpa europea*, *Mustela nivalis*, *Homo sapiens*, *Lutra lutra* and *Myoxus glis*), 3 of them were twin-species (*Rattus rattus*-*Rattus norvegicus*, *Muscardinus avellanarius*-*Dryomys nitedula* and *Oryctolagus cuniculus*-*Lepus europaeus*). These species cannot be exactly identified just by hair morphology (supplementary data is needed, e.g.: area of distribution). 3 genera were identified (*Canidae* spp., *Chiroptera* spp. and *Apodemus/Microtus* sp.). Finally, there are 2 categories for unidentifiable hairs („not hair”: revealed during the microscope study, „unidentifiable”: data deficient). The most common species were *Homo sapiens* and *Mustela nivalis*. In the case of one species (*Lutra lutra*) we think it would be necessary to confirm the presence with other observations (visual observation, footprints and remains of preys). According to our study it has been demonstrated that the nest-analysis can be a useful technique to researchers and urban wildlife management experts. References from hairs and practice are necessary to get familiar with the method.

Keywords: hair identification, urban environment, non-invasive method, Merzse-swamp, bird nest

INTRODUCTION

It has always been a problem to examine animals with reclusive lifestyle, due to this and the rarity of some species the uses of non-invasive techniques are growing increasingly (MACKAY et al., 2008; CASTRO-ARELLANO et al., 2008 http1).

The essence of these indirect methods is that the observers and the examined animals will avoid direct contact. Because of this, researchers' presence will not bias the result and the animals can avoid stressful situations. The usage of non-invasive techniques probably dates back to the origin of humans (MACKAY et al., 2008), the knowledge about traces and scats can be considered noninvasive methods, but we can gather useful information from mammalian hairs too.

Numerous mammalian species can be indentified from their hairs. Basically, there are two types of identification, one is based on the morphological characters of the hair (qualitative and/or quantitative features) (TÓTH, 2002, 2008; TEERINK, 1991; SEILER, 2010; MARINIS & ASPREA, 2006; DEMARINIS & AGNELLI, 1993), and another based on the mtDNA collected from hair shafts (DOMINGO-ROURA et al., 2006; AMENDOLA-PIMENTA et al., 2010; BALESTRIERI et al., 2010).

Basically, there are two groups of methods are in use for collecting hair samples. Hair-traps can be baited or unbaited (passive) (KENDALL & MCKELVEY, 2008). The former ones are usually artificial hair-traps (KENDALL & MCKELVEY, 2008; CASTRO-ARELLANO et al.,

2008), the latter are natural hair-traps like fox earth, surrounding of a trace, scratching surfaces and also bird nests (TÓTH et al., 2010A).

Bird-nest analysis (TÓTH, 2008) is a new, internationally accepted method. Certain bird species use mammal hairs for lining or structural strengthening of their nest. After the fledging of chicks these nest can be gathered and analyzed to receive faunistical data from the area. Since the growing process of urbanization (PATTERSON et al., 2003) and the urban dwelling animals with reclusive lifestyle (e.g.: *Martes foina*) (TÓTH et al., 2007; TÓTH et al., 2010B; SZÓCS & HELTAI, 2010) this method can give a new surveying technique to wildlife researchers and urban wildlife management experts.

The aims of our study were to (1) find out if there are enough nests to an appropriate assessment, (2) find out what lining materials do birds use in a semi-urban environment and to collect hair samples if there is any, (3) find out what species can be detected.

MATERIAL AND METHOD

Merzse-swamp (located in the 17th district of Budapest) and its surroundings were the study area. The swamp is surrounded by agricultural areas, shelterbelts and planted forests. The area is bordered by the M0 motorway (from East), the Ferihegy Airport (from South) and the suburb of the 17th district (from East).

The field survey was done in 17 February 2011 which occasion we have found 13 bird nests. All nests have been photographed, coded (M1, M2... Mn) and GPS coordinates have been recorded. After a few days drying, the nests were placed under an UV disinfection equipment to avoid potential zoonoses. Then the nests were took into pieces on a white paper. Mammal hairs were placed into labeled reclosable polyethylene bags.

It was necessary to record the macroscopic features of the hairs (color, shape, length). Before the preparation to microscopic analysis, the hairs were soaked into 70-80% alcohol for a few hours and then placed into ethyl-ether for a few seconds to remove all grease and contamination (TÓTH, 2008).

For the microscopic analysis we used the guidance of TEERINK (1991), TÓTH (2008) and LANSZKI (personal comm.). The cuticula impressions were made in 5-10% gelatin solution with a few thymol crystals. After the solution cooled a bit hairs were put into the solution, with special attention not to be covered by gelatin. After the gelatin solidified the hair can be dig out with an insect pin (minimal damage is unavoidable) and scale pattern will be seen in the gelatin. Then the hair was put on another microscope slide and fixed with transparent nail polish, after this a scalpel was used to cut the hair and lastly, paraffin oil was applied to replace the air in the medulla (structure will be revealed). According to our guides and personal experiences five features can be important at the identification, (1) the cuticula scale pattern at the shaft and (2) at the thickest part of the shield, the medulla structure at the thickest part of the shield without oil penetration (3) and with oil penetration (4) and macroscopic features (5). The microscopic features (1-4) were recorded with a digital microscope camera, thus as far as the preparation was optimal 4 pictures were taken from one hair. 178 pictures were taken from 13 bird nest.

Since this technique requires a lot of practice we have created a reference material from 22 species. The references were gathered both from live animals and from prepared ones. We have used 3 hairs from one species, altogether 269 pictures were taken (in some cases more than 4 pictures were taken from a hair). To help the identification reference books, papers, websites (TEERINK, 1991; TÓTH, 2002, MARINIS & ASPREA, 2006; TÓTH, 2008, [http2](#), [http3](#), [http4](#)) and our personal reference materials were used.

RESULTS

Nests' lining materials

We have found mammal hairs in 9 nests (out of 13) (69,23%). Artificial nesting materials were found in 3 cases (M5, M7 and M13) (25%). The artificial materials' quantitative features were not examined in this study, due to their irrelevance (*Table 1.*).

In 4 cases we thought we found hairs but during the microscopic analysis it turned out that the found objects were artificial materials. From one nest an average of 5,31 (SE=5,31) hairs were found, from this 3,77 (SE=4,17) were able to be prepared and 2,85 (SE=2,91) were categorized (*Table 1.*).

Table 1. Hairs and artificial lining materials found in bird nests.

Nest code	Hairs found (db)	Hairs prepared (db)	Hairs categorized (db)	Artificial nesting material
M1	11	11	9	-
M2	5	5	5	-
M3	3	3	3	-
M4	18	12	7	-
M5	0	0	0	fishing line, synthetic liner
M6	0	0	0	-
M7	10	8	5	fishing line
M8	7	4	2	-
M9	6	1	1	-
M10	0	0	0	-
M11	5	2	2	-
M12	0	0	0	-
M13	4	3	3	thread
x	5,31	3,77	2,85	-
SE	5,31	4,17	2,91	-

Identified hairs

We have created 13 categories from the data (*Figure 1.*). 5 of these were species categories (*Talpa europea*, *Mustela nivalis*, *Homo sapiens*, *Lutra lutra* and *Myoxus glis*), 3 of them were twin-species (*Rattus rattus-Rattus norvegicus*, *Muscardinus avellanarius-Dryomys nitedula* and *Oryctolagus cuniculus-Lepus europaeus*). These species cannot be exactly identified just by hair morphology (supplementary data is needed, e.g.: area of distribution). 3 genera were identified (*Canidae* spp., *Chiroptera* spp. and *Apodemus/Microtus* sp.). Finally, there 2 categories for unidentifiable hairs („not hair”: revealed during the microscope study, „unidentifiable”: data deficient).

The most common species were humans (*Homo sapiens*) (7) and *Mustela nivalis* (7). 5 *Mustela nivalis* hairs were found in one nest (M4). 16 hairs were unidentifiable (43,27%) (“not hair” or “unidentifiable”) from the total of 37. 2 rarer species were found during the identification, *Lutra lutra* (2) from M3 and *Myoxus glis* (1) from M7.

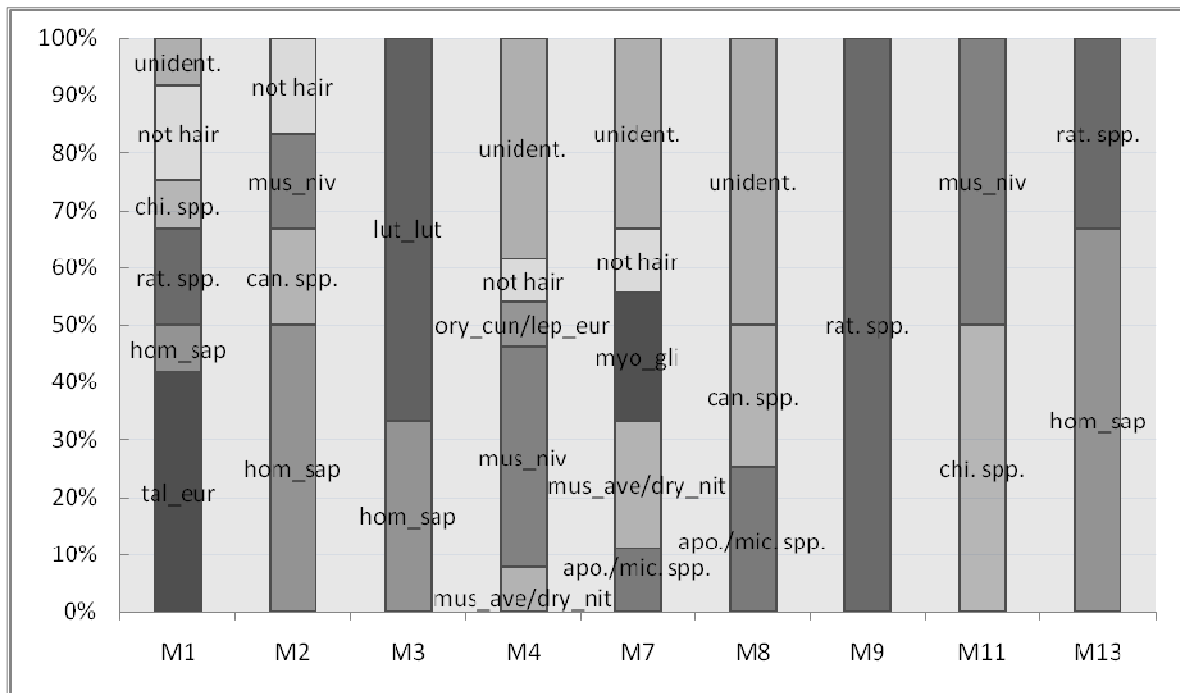


Figure 1. Species and species groups found in bird nests. (Legend: unident.=unidentifiable, chi. spp.=*Chiroptera* spp., rat spp.=*Rattus* spp., hom_sap=*Homo sapiens*, tal_eur=*Talpa europea*, mus_niv=*Mustela nivalis*, can. spp.=*Canidae* spp., lut_lut=*Lutra lutra*, ory_cun/lep_eur=*Oryctolagus cuniculus/Lepus europaeus*, mus_ave/dry_nit=*Muscardnius avellanarius/Dryomys nitedula*, apo./mic. spp.=*Apodemus/Microtus* sp.)

CONCLUSION

The aim of our study was to test a new noninvasive method, the bird-nest analysis (TÓTH, 2008) in urban environment. We have found 13 nest in the study area (Merzse swamp) and in its surroundings. Hairs were found in the 69,23% of nests (9 out of 13). From one nest an average of 5,31 (SE=5,31) hairs were found, from this 3,77 (SE=4,17) were able to be prepared (hairs were damaged during the preparation) and 2,85 (SE=2,91) were categorized. An average of 2,85 hairs were categorized, in our opinion this number can increases with practice. We think that the number of the found nests and the number of hairs in a nest can be a proof of the usage of this technique in a semi-urban environment. *Table 1.* also shows us that it is relatively few artificial lining materials were used in the nests, although all nests were find in a semi-urban environment.

Humans were one of the most common species. We have found 7 hairs in 4 nests. This is not an exceptional result because Merzse-swamp is used by several people for recreation and relaxation, and also these hairs are bigger and easier to find for birds. We have also found 7 hairs of *Mustela nivalis*, although 5 of these were found in a nest on the ground (M4). This nest could be a victim of a nest predation (HELTAI & LANSZKI, 2007) and this might explain the relatively large amount of *Mustela nivalis* hairs in it.

The above mentioned species can be problematic during the identification. *Mustela nivalis* and *Mustela erminea* are so called twin-species, thus differentiation from their hairs' qualitative features cannot be done. In this case supplementary data is needed for example area of distribution or additional surveys (or quantitative features). *Mustela erminea* is probably one of the least spread mustelid in Hungary which also avoid anthropogenic effects (LANSZKI & HELTAI, 2007), that is why we excluded this species. In this way we

can exclude *Qryctolagus cuniculus* (the twin pair of *Lepus europaeus*). In our field studies we saw *Lepus europeus* at several times, while from *Qryctolagus cuniculus* it is known that RHD, myxomatosis and a few extreme cold winters suppressed its distribution area (KATONA & ALTBÄCKER, 2007). It is also just a few places in Hungary where *Rattus rattus* can be found (HORVÁTH, 2007), thus it is more likely that *Rattus* sp. hairs are belong to *Rattus norvegicus*. Distribution maps can help really lot to separate twin pairs, but some of these species can also be differentiated from hairs' quantitative features.

In the case of exact identification there are more problems that we have to mention. In a study at Northern Australia experienced trainees' identifications were examined, they indentified 23 taxon categories and from these 19 were species. In 18 cases identification involved at least some level of error. Several factors influenced the accuracy of identifications in the study, principally the need to identify samples to species level, rather than not making identification. The lack of samples locality was also a problem (they did not know the area of distribution) (LOBERT et al., 2001). SPAULDING et al. (2000) received the same result when examining *Canis lupus* scats. However, the authors agree on that practice and reference materials are make identification more accurate. Thus, we think reference materials are needed for practice and for make identification more accurate. This is why we have created the reference from 22 species (269 pictures), and also this is why the unidentifiable categories' percentage can be considered relatively high (43,27%).

In the case of one species (*Lutra lutra*) we think it would be necessary to confirm the presence with other observations (visual observation, footprints and remains of preys). In the study area *Lutra lutra* presence has not been demonstrated so far. However, according to literature *Lutra lutra* population in Hungary is considered stabile and widespread in the country (LANSZKI et al., 2007; LANSZKI, 2008), thus it can be that this species will appear sooner or later at Merzse-swamp. Despite that, *Lutra lutra* is a strictly protected species in Hungary, it is a possibility that the hairs can came from a fur.

Finally, in our opinion bird-nest analysis is a good technique in urban or semi-urban environment, but references from hairs and practice are necessary to get familiar with the method. Our future goal is to test this method at a city park (Gödöllő) to find out if there is any usage of the technique there.

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REFERENCES

AMENDOLA-PIMENTA, M., GARCIA-FERIA, L., SERIO-SILVA, J., C. and RICO-GRAY, V. (2010): Noninvasive Collection of Fresh Hairs From Free-Ranging Howler Monkeys for DNA Extraction, *American Journal of Primatology*, 71(4): 359-363.

- BALESTRIERI, A., REMONTI, L., FRANTZ, A., C., CAPELLI, E., ZENATO, M., DETTORTI E., E., GUIDALI, F. and PRIGIONI, C. (2010): Efficacy of passive hair-traps for genetic sampling of a low-density badger population, *Hystrix-Italian Journal of Mammalogy*, 21(2): 137-141.
- CASTRO-ARELLANO, I., MADRID-LUNA, C., LACHER JR., T. E. and LEÓN-PANIAGUA, L. (2008): Hair-trap Efficacy for Detecting Mammalian Carnivores in the Tropics, *Journal of Wildlife Management* 72(6): 1405-0412
- DEMARINIS, A., M. & AGNELLI, P. (1993): Guide to the Microscope Analysis of Italian Mammals Hairs – Insectivora, Rodentia and Lagomorpha, *Bollettino Di Zoologia*, 60(2): 225-232.
- DOMINGO-ROURA, X., MARMI, J., FERRANDO, A., LÓPEZ-GIRÁLDEZ, F., MACDONALD, D., W. and JANSMAN, H., A., H. (2006): Badger hair in shaving brushes comes from the protected Eurasian badger, *Biological Conservation* 128: 425-430.
- HELTAI, M. and LANSZKI, J. (2007): Eurázsiai menyét, In: BIHARI, Z., CSORBA, G. and HELTAI, M.: Magyarország emlőseinek atlasza, Kossuth kiadó, Budapest pp. 232-233
- HORVÁTH, GY. (2007): Házi patkány, In: BIHARI Z., CSORBA G. and HELTAI M.: Magyarország emlőseinek atlasza, Kossuth kiadó, Budapest pp. 199-200
- KATONA, K. and ALTBÄCKER, V. (2007): Üregi nyúl, In: BIHARI Z., CSORBA G. and HELTAI M.: Magyarország emlőseinek atlasza, Kossuth kiadó, Budapest pp. 132-134
- KENDALL, K., C. and MCKELVEY, K., S. (2008): Hair Collection In: LONG, A., R., MACKAY, P., ZIELINSKY, J., W. and RAY, C., J. (ed.): *Noninvasive Survey Methods for Carnivores*, Island Press, Washington DC, pp. 141-182.
- LANSZKI, J. (2008): A vidra elterjedése és az előfordulását befolyásoló tényezők vizsgálata a Kapos-folyó vízgyűjtőjén, Budapest, *Természetvédelmi Közlemények* 14: 61-75
- LANSZKI, J. and HELTAI, M. (2007): Hermelin, In: BIHARI Z., CSORBA G. and HELTAI M.: Magyarország emlőseinek atlasza, Kossuth kiadó, Budapest pp. 228-229
- LANSZKI, J., GERA, P. and NAGY, D. (2007): Közönséges vidra, In: BIHARI Z., CSORBA G. and HELTAI M.: Magyarország emlőseinek atlasza, Kossuth kiadó, Budapest pp. 245-248
- LOBERT, B., LUMSDEN, L., BRUNNER, H. and TRIGGS, B. (2001): An assesment of accuracy reliability of hair identification of South-East Australian mammals, *Wildlife Research* 28(6): 637-641.
- MACKAY, P., ZIELINSKI, J. W., LONG, A. R. and RAY, C. J. (2008): Noninvasive Research and Carnivore Conservation In: LONG, R. A., MACKAY, P., ZIELINSKI, J. W. and RAY, J. C. (ed.): *Noninvasive Survey Methods for Carnivores* Island Press, Washington DC, pp. 75-109.
- MARINIS, A.M. & ASPREA, A. (2006): Hair identification key of wild and domestic ungulates from southern Europe, *Wildlife Biol.* 12: 305-320.
- PATTERSON, M. E., MONTAG, J. E. and WILLIAMS, D. E. (2003): The urbanization of wildlife management: social science, conflict and decision making, *Urban Forestry & Urban Greening* 1: 171-183
- SEILER, N. (2010): SEM-Atlas of hair structures of South-African mammals, *Mammalia*, 74(3): pp. 281-290
- SPAULDING, R., KRAUSMAN, P., R. and BALLARD W., B. (2000): Observer bias and analysis of gray wolf diets from scats, *Wildlife Society Bulletin*, 28(4): 947-950.
- SZÓCS, E. and HELTAI, M. (2010): Nyestek a városban, In: CSÁNYI, S. and HELTAI, M.: *Vadbiológiai olvasókönyv*, Mezőgazda kiadó, Budapest, pp. 163-170
- TEERINK, B., J. (1991): *Hair of West-European Mammals*, Cambridge University Press, Cambridge, pp. 224
- TÓTH, M., HELTAI, M. and LANSZKI, J. (2007): Nyest, In: BIHARI, Z., CSORBA, G. and HELTAI, M.: Magyarország emlőseinek atlasza, Kossuth kiadó, Budapest pp. 236-238

TÓTH, M. (2002): Identifiacion of Hungariaon Mustelidae and other Small Carnivores Using Guard Hair Analisys, *Acta Zoologica Academiae Scientiarum Hungaricae*, 48(3): 237-250.

TÓTH, M. (2008): A new noninvasive method for detecting mammals from birds nests, *Journal of Wildlife Management* 72(5): 1234-1240.

TÓTH, M., LANSZKI, J. and Heltai, M. (2010B): Mit csinál a nyest az emberek között? In: HELTAI M. (ed.): *Emlős ragadozók Magyarországon*, Mezőgazda Kiadó, Budapest, pp. 163-178

TÓTH, M., LANSZKI, J., HELTAI, M., SZEMETHY, L. and SZABÓ, L. (2010A): Hogyan csináltuk? Rövid módszertani áttekintés, In: HELTAI, M. (ed.): *Emlős ragadozók Magyarországon*, Mezőgazda Kiadó, Budapest, pp. 123-134

http1: <http://www.brighthub.com/science/genetics/articles/40541.aspx>

http2: http://www.iamaweb.com/Animal_Hair/animal_hair_images.html

http3: [http://www.bioone.org/doi/abs/10.2981/09096396\(2006\)12%5B305:HIKOWA%5D2.O.CO%3B2?prevSearch=&cookieSet=1](http://www.bioone.org/doi/abs/10.2981/09096396(2006)12%5B305:HIKOWA%5D2.O.CO%3B2?prevSearch=&cookieSet=1)

http4: http://www.fbi.gov/aboutus/lab/forensicsciencecommunications/fsc/july2004/research/2004_03_research02.htm

THE EFFECT OF BIOGEL CONTENT ON THE SOME VISCOELASTIC PROPERTIES OF A SNAIL PATE

VIORICA MIRELA POPA, DANA CAROLINA CRISAN, DIANA NICOLETA RABA,
CONSTANTIN MATEESCU

1“Lucian Blaga” University of Sibiu, Faculty of Agricultural Sciences, Food Industry and Environmental Protection, Bd-ul. Victoriei, Nr.10, Sibiu, 550024, România
2Banat’s University of Agricultural Sciences and Veterinary Medicine from Timisoara, Dept. Food Processing Technology, 119 Calea Aradului, 300645 Timisoara, Romania,
c.mateescu@usab-tm.ro

ABSTRACT

Four sorts of snail pâté with different contents (0, 1, 2, 3%) of a vegetal protein (biogel) were prepared. The influence of the content of biogel on the viscoelastic characteristics of snail pâté were studied in this paper. These characteristics of snail pâté were derived from stress relaxation tests. The relaxation times and the elastic moduli, as viscoelastic characteristics, were calculated from the relaxation curves by non-linear regression. The best correspondence between experimental data and calculated curves was obtained for a mechanical model with three Maxwell elements in parallel with a lone ideal spring element. Every measurement was made in triplicate. From above viscoelastic parameters, the viscosities were calculated. Correlation between experimental relaxation curves and calculated curves were emphasized by absolute average deviation (AAD), the minimum AAD value being 0.15% and the maximum one 0.82%. The stiffest snail pâté contains 2% biogel, and the snail pâté with 3% biogel is more viscous.

Keywords: snail pâté, rheology, viscoelastic properties, stress relaxation, temperature influence

INTRODUCTION

Snail meat is a delicacy in Japanese and Chinese. In French, North of America and Australia it is consumed also as main meal. In South Africa, land snail is also a traditional food. Snail recipes vary from cuisine to cuisine. Studies on the nutritional value of snail have reported that snail is high in protein but low in fat contents. It is estimated that snail is 15% protein, 2.4% fat and about 80% water. This makes snail healthy alternative food for people with high protein low fat diet requirements. Besides, snail is high in health benefiting essential fatty acids such as linoleic acids and linolenic acids (SU, 2004), Having a low content of lipids and high content of proteins, meat snail is similarly with fish meat. Nowadays, there is an increasing demand for foodstuffs with lower fat content. However, the reduction of fat in meat products or its replacement with a more unsaturated fat might affect their technological or sensory characteristics (MARTIN, 2008), mainly in products in which fat is one of the major components of the formulae, such as frankfurters, sausages, beef patties or liver pâtés (PINHO, 2000) The rheology of pâté is less studied. There are same references on rheology of ham pâté (VIANA, 2005), and of pork liver pâté by textural profile analysis and penetration tests (D’ARRIGO, 2004). In addition, the consistency at 23°C of the refrigerated pâtés was calculated from compression tests (MARTIN, 2008). There are not signaled yet the study of viscoelastic characteristics of different pâté formulae. The similar studies on snail pâté are not signaled. The stress relaxation test (or step strain test) is one of the most important evaluation tools used for determining viscoelastic properties of materials (CAMPUS, 2010, BELLIDO, 2009, OLIVERA, 2009, RODRIGUEZ-SANDOVA, 2009, BHATTACHARYA, 2006, HERRERO, 2005). In this paper, we try to characterize by stress relaxation tests the viscoelasticity of some variants of snail pâté with different content of vegetal protein.

MATERIAL AND METHOD

Theoretical background

Many food products simultaneously exhibit obvious fluid-like (viscous) and solid-like (elastic) behavior. Manifestations of this behavior, due to a high elastic component, can be very strong and create difficult problems in process engineering (STEFFE, 1996). In the book of Steffe, one of the best books for American food engineers, the subject of viscoelasticity has very well present in chapter 5. One of the most used transient tests for viscoelasticity is stress relaxation (step strain). In stress-relaxation experiments, the test specimen is compressed to a predetermined level of strain that is kept constant, during which time the viscoelastic material shows a declining trend of force/stress as a function of time (YADAV, 2006). Viscoelastic materials are relaxed gradually, the end point depending on the molecular structure of the material being tested. (STEFFE, 1996, TABILO-MUNIZAGA, 2005). Mechanical models or analogues have been developed to predict different patterns of viscoelasticity. The Maxwell model has frequently been used to interpret stress-relaxation data of a viscoelastic material (RODRIGUEZ-SANDOVA, 2009). A Maxwell element consists of a spring and a dashpot arranged in a series (figure 1a). The model involves a parallel coupling of a Hooke's body and n Maxwell's bodies (LACHOWICZ, 2003) as shown in figure 1b.

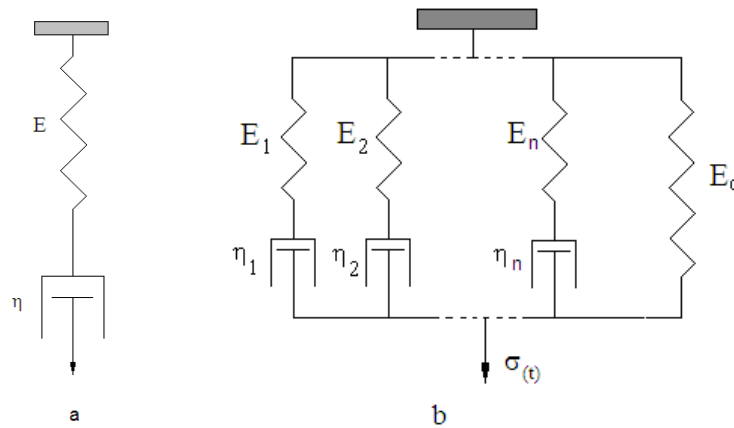


Figure 1. Mechanical models used to solve the experimental data from relaxation tests (a –Maxwell element; b – a mechanical model with n Maxwell elements and an ideal spring in parallel)

The stress relaxation equation described by this mechanical model is given by equation 1.

$$\sigma(t) = \varepsilon \cdot \left(E_o + \sum_{i=1}^n E_i \exp\left(-\frac{t}{\lambda_i}\right) \right) \quad (1)$$

In this equation, $\sigma(t)$ is the stress at any time during the relaxation test, ε is the initial constant strain. Because testing was conducted in uniaxial compression, E_i is equilibrium modulus (Young's modulus) of the n springs from the n Maxwell elements, and E_o is the equilibrium modulus for the lone ideal spring element. In addition, λ_i represents the relaxation times, which is defined in terms of the ratio between viscosity of the fluid from the n dashpots and the elastic modulus (equation 2):

$$\lambda_i = \frac{\eta_i}{E_i} \quad (2)$$

Equation 1 could be written as:

$$\frac{\sigma(t)}{\varepsilon} = E(t) = E_o + \sum_{i=1}^n E_i \exp\left(-\frac{t}{\lambda_i}\right) \quad (3)$$

where $E(t)$ is the equilibrium module of the sample from snail pâté. It exponentially decreases with the time of relaxation process.

At the initial moment, when $t = 0$,

$$E_{\text{initial}} = E_o + \sum_{i=1}^n E_i \quad (4)$$

Finally, when $t \rightarrow \infty$, $E_{\text{final}} = E_o$

Experimental measurements

The ingredients for preparing three variants of pâté with different content of biogel (0; 1; 2; and respectively 3%), are presented in a previous paper (CRISAN, 2011). Cans with snail pâté were storage at 4-6°C in refrigerator. To equilibrate at room temperature cans were maintained 2 hours before measurements. Using a cork borer, cylindrical specimens of snail pâté were prepared. The specimens had a diameter of 20 mm and their height was adjusted at 10-15 mm. The exactly height of the sample had been measured with a digital caliper Black & Decker. To determinate the viscoelastic characteristics, by stress relaxation tests, a compression apparatus JTL Janz was used. Stress relaxation characteristics of the lubricated (using paraffin oil) cylindrical sample were determined by uniaxial compressing the sample up to a Cauchy strain of 0.10 at a compression rate of 6 mm · min⁻¹. When the compression was achieved at the desired level, the upper plate (a square with a surface of 9 cm²) was stopped, and the pâté sample was allowed to relax for 300-400 s. The force at different relaxation times was continuously monitored. Every measurement was made in triplicate. The TableCurve program has been used for non-linear regressions and Origin program to plot experimental data and to draw the calculated stress-relaxation curves.

Statistical analysis

The overall predictive capability of the mechanical model used could be commonly explained by the coefficient of determination (R^2), but R^2 is not a measure of the model's accuracy. Absolute average deviation (AAD) analysis is a direct method for verifying the model's suitability. The AAD is calculated by equation 5:

$$AAD = \left(\left(\sum_{i=1}^n \left(\frac{|y_{i,\text{exp}} - y_{i,\text{cal}}|}{y_{i,\text{exp}}} \right) \right) \cdot \frac{1}{n} \right) \cdot 100 \quad (5)$$

where $y_{i,\text{exp}}$ and $y_{i,\text{cal}}$ are the experimental and calculated responses, respectively, and n is the number of the experimental runs. Evaluation of AAD and R^2 values together should check better the accuracy of the mechanical model (BOYACI, 2004).

RESULTS

A typical stress-relaxation curve for snail pâté with 2% biogel is shown in figure 2. The stress-relaxation curves for all variety of snail pâté at the three studied temperatures are similar with the curves from figure 2. The same picture of these stress-relaxation curves for muscle tissues from Gilthead Sea Bream (CAMPUS, 2010), Asian noodles (BELLIDO, 2009), frozen cooked organic pasta (OLIVERA, 2009), cassava dough (RODRIGUEZ-SANDOVA, 2009), ice-stored cod (HERRERO, 2004) and acid milk gel (HOUBE, 2005) had been obtained.

By previous statistical tests, the best correspondence between experimental data and calculated curve (eq. 1) was obtained for a model with three Maxwell elements similar

with the mechanical model from figure 1b.

The mechanical answer against an imposed deformation is described by equation 6, derived from equation 1:

$$\sigma(t) = \varepsilon \left(E_o + E_1 \exp\left(-\frac{t}{\lambda_1}\right) + E_2 \exp\left(-\frac{t}{\lambda_2}\right) + E_3 \exp\left(-\frac{t}{\lambda_3}\right) \right) \quad (6)$$

The same model was used to analyze stress relaxation curves for muscle tissues from Gilthead Sea Bream (*Sparus aurata* L.) (CAMPUS, 2010), frozen cooked organic pasta (OLIVERA, 2009), and frozen stored Cape hake (*M. capensis* and *M. paradoxus*) (HERRERO, 2005).

In the stress-relaxation curves presented in figure 2, stress depends on time, with three zones: The initial portion shows a high slope, the third zone has the lowest slope and appears to approach a residual or an equilibrium value, whereas the second zone is intermediate between these two zones (YADAV, 2006). In the stress-relaxation curve of samples with 2% biogel, these three zones are showed clearly in figure 2. As an example, from the curve with AAD = 0.59% the first zone was in the range of 550–750 Pa, the second zone ranged from 550 and 450 Pa, and the third zone was between 450 to 400 Pa.

The parameters obtained by non-linear regression from the above mentioned model, E_1 , E_2 , E_3 , E_o , λ_1 , λ_2 , and λ_3 are detailed in Table 1. From these values $E_{initial}$, $\frac{E_o}{E_{initial}}$, and the

viscosities η_1 , η_2 , and η_3 , were calculated and presented in the same table. It can be observed all values are influenced by the content of biogel in snail pâté. At the same content of biogel the values of the relaxation times increase in order $\lambda_1 < \lambda_2 < \lambda_3$. The first relaxation process occurs in the first portion of relaxation curve (figure 2) for $\lambda_1 < 0.5$ seconds, portion where is a marked reduction of the relaxation stress. The third relaxation process happens in the final portion of the relaxation curve where a small reduction of the stress occurs.

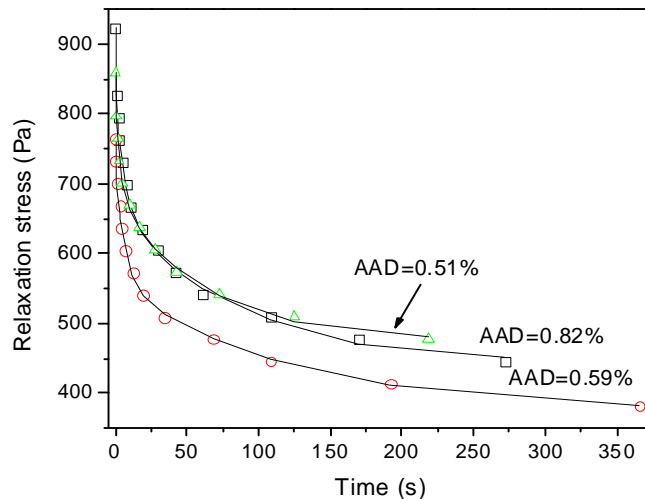


Figure 2. A typical experimental data and stress-relaxation curve for samples of snail pâté with 2% biogel, fitted by the Maxwell model. Experimental data (\square, \circ, Δ), fitted curve (continuous line)

The elastic moduli E_1 , E_2 and E_3 were affected significantly by the content of added biogel. The magnitude of σ_o , calculated as product of imposed deformation of the sample and the equilibrium modulus for the lone ideal spring element ($\sigma_o = E_o \cdot \varepsilon$), can be taken as a

measure of the stiffness of the material (CAMPUS, 2010). Because for all samples the deformation was the same ($\square = 0.1$) the samples with the highest elastic modulus values are the stiffest materials. Appears from the table 2 the stiffest material is the snail pâté with 2% biogel. The absence of biogel corresponds to a less stiffness material.

For all varieties of snail pâté, the calculated viscosities increase in the order $\tau_1 < \tau_2 < \tau_3$. The highest values of viscosities have the samples without biogel and the samples with 3% biogel. The lower values for viscosities were found in the samples with 2% biogel. The ratio of the equilibrium modulus (E_o) to $E_{initial}$ (equation 4) could give an information of viscoelastic characteristics of snail pâté. A less values of this ratio, means a more pregnant viscous nature of the sample. A greater value of the ratio, signify a greater elastic nature of the material (STEFFE, 1996). Therefore, the snail pâté with 3% biogel is more viscous and snail pâté with 1% biogel is less viscous.

CONCLUSIONS

A mechanic model with three Maxwell elements and an ideal spring in parallel is the best solution to analyze the relaxation curves. By nonlinear regression with a mathematical model corresponding to mechanical model was determined the values of the relaxation times and of the elastic moduli. From these viscoelastic characteristics was calculated the values of the viscosities. From the equilibrium modulus for the lone ideal spring element appears as the stiffest material is the snail pâté with 2% biogel. The snail pâté with 3% biogel is material that is more viscous.

REFERENCES

- BELLIDO, G.G., HATCHER, D.W. (2009): Asian noodles: Revisiting Peleg's analysis for presenting stress relaxation data in soft solid foods, *Journal of Food Engineering*, Volume 92, pp.29–36
- BHATTACHARYA, S., NARASIMHA, H.V., BHATTACHARYA, S., (2006): Rheology of corn dough with gum arabic: Stress relaxation and two-cycle compression testing and their relationship with sensory attributes, *Journal of Food Engineering*, Volume 74, pp.89–95
- BOYACI, I.H., WILLIAMS, P.C., KOEKSEL, H. (2004): A rapid method for the estimation of damaged starch in wheat flours, *Journal of Cereal Science*, Volume 39, pp.139–145
- CAMPUS, M., ADDIS, M.F., CAPPUCCINELLI, R., PORCU, M.C., PRETTI, L., TEDDE, V., SECCHI, N., STARA, G., ROGGIO, T. (2010): Stress relaxation behaviour and structural changes of muscle tissues from Gilthead Sea Bream (*Sparus aurata* L.) following high pressure treatment, *Journal of Food Engineering*, Volume 96, pp.192–198
- CRISAN, D.C., DANCIU, I., MATEESCU, C. (2011): Rheological characterization of snail pâté. I. Uniaxial compression, *Journal of Agroalimentary Processes and Technologies*, Volume 17, Number 1, pp.25-29
- D'ARRIGO, M., HOZ, L., CAMBERO, I., LOPEZ-BOTE, C.J., PIN, C.; ORDÓÑEZ, J.A. (2004): Production of n-3 fatty acid enriched pork liver pâté, *LWT - Food Science and Technology*, Volume 37, Number 6, pp.585-591
- HERRERO, A.M., CARECHE, M. (2005): Stress-relaxation test to evaluate textural quality of frozen stored Cape hake (*M. capensis* and *M. paradoxus*), *Food Research International*, Volume 38, pp.69–76

- HERRERO, A.M., HEIA, K., CARECHE, M. (2004): Stress Relaxation Test for Monitoring Post Mortem Textural Changes of Ice-stored Cod (*Gadus morhua* L.), *Journal of Food Science*, Volume 69, Number 4, pp.178-182
- HOUZE, G., CASES, E., COLAS, B., CAYOT, P. (2005): Viscoelastic properties of acid milk gel as affected by fat nature at low level, *International Dairy Journal*, Volume 15, pp.1006–1016
- LACHOWICZ, K., SOBCZAK, M., GAJOWIECKI, L., ZYCH, A. (2003): Effects of massaging time on texture, rheological properties, and structure of three pork ham muscles, *Meat Science*, Volume 63, pp.225–233
- MARTIN, D., RUIZ, J., KIVIKARI, R., PUOLANNE, E. (2008): Partial replacement of pork fat by conjugated linoleic acid and/or olive oil in liver pâtés: Effect on physicochemical characteristics and oxidative stability, *Meat Science*, Volume 80, pp.496–504
- OLIVERA, F.D., SALVADORI, O.V. (2009): Effect of freezing rate in textural and rheological characteristics of frozen cooked organic pasta, *Journal of Food Engineering*, Volume 90, pp.271–276
- PINHO, O., FERREIRA, I. M. P. L. V. O., OLIVEIRA, M. B. P. P., FERREIRA, M. A. (2000): Quantification of synthetic phenolic antioxidants in liver pâtés, *Food Chemistry*, Volume 68, Number 3, pp.353-357
- RODRIGUEZ-SANDOVA, E., FERNANDEZ-QUINTERO, A., CUVELIER, G. (2009): Stress relaxation of reconstituted cassava dough, *LWT - Food Science and Technology*, Volume 42, pp.202–206
- STEFFE, J. F. (1996): *Rheological Methods in Food Processing Engineering*. 2nd ed., Freeman Press, East Lansing, MI 48823, USA,
- SU, X.Q., ANTONAS, K.N., LI, D. (2004): Comparison of n-3 polyunsaturated fatty acid contents of wild and cultured Australian abalone, *International Journal of Food Sciences and Nutrition*, Volume 55, pp.149 – 154
- TABILO-MUNIZAGA, G., BARBOSA-CANOVAS, G.V. (2005): Rheology for the food industry, *Journal of Food Engineering*, Volume 67, pp.147–156
- VIANA, F.R., SILVA, V.D.M., DELVIVO, F.M., BIZZOTTO, C.S.; SILVESTRE, M.P.C. (2005): Quality of ham pâté containing bovine globin and plasma as fat replacers, *Meat Science*, Volume 70, pp.153–160
- YADAV, N., ROOPA, B. S., BHATTACHARYA, S. (2006): Viscoelasticity of a simulated polymer and comparison with chickpea flour doughs, *Journal of Food Process Engineering*, Volume 29, pp.234–252

EVALUATION MICROELEMENTS AND VITAMIN C CONTENT OF SOME SPICES

VIORICA MIRELA POPA, DESPINA BORDEAN, ALDA SIMION, DIANA NICOLETA RABA, CAMELIA MOLDOVAN, DELIA GABRIELA DUMBRAVA, LIANA ALDA

Banat's University of Agricultural Sciences and Veterinary Medicine from Timisoara, Dept. Food Processing Technology, 119 Calea Aradului, 300645 Timisoara, Romania, mirevio_gh@yahoo.com

ABSTRACT

In this paper were studied by comparison microelements (Cu, Zn, Ni, Mn, Pb, Co, Cr) and vitamin C content of some commercial spices: ground black pepper (*Piper nigrum*), sweet paprika, cayenne pepper (*Capsicum annuum*) and powder cinnamon (*Cinnamomum zeylanicum*). For this purpose, the mineral elements mentioned were quantified by Atomic Absorption Spectrophotometry (AAS), for their determination was used the atomic absorption spectrophotometer's contr AA 300, Analytik Jena and the vitamin C content was analyzed by 2,6-diclorindofenol method using as standard ascorbic acid solution, 0.5 mg / ml. This work attempts to contribute to knowledge of the nutritional properties of these plants. These results may be useful for the evaluation of dietary information. Principal component analysis (PCA) was carried out for quantitative mineral concentration and vitamin C content. Among microelements, Cu, Zn and Mn were found in the highest concentration in whole investigated vegetable material.

Keywords: mineral elements, spices, vitamin C,

INTRODUCTION

Capsicum peppers used for paprika are unusually rich in vitamin C, a fact discovered in 1932 by Hungary's 1937 Nobel prize-winner Albert Szent-Györgyi. Much of the vitamin C content is retained in paprika, which contains more vitamin C by weight than does lemon juice. Paprika is also high in other antioxidants, containing about 10% of the level found in açai berries. Prevalence of nutrients, however, must be balanced against quantities ingested, which are generally negligible for spices.

Spices are common food adjuncts that impart flavour, aroma and colour to foods. Several common spices are now understood to exert many beneficial physiological effects (SRINIVASAN, 2005A). Among these, their hypolipidemic and antioxidant properties have far-reaching health implications. Work in our laboratory on the physiological effects of spices has focused on their influence on lipid metabolism, their action as a digestive stimulant, the beneficial influence of hypocholesterolemic spices on cholesterol gallstone disease and diabetic nephropathy, and the beneficial influence of antioxidant spice principles on inflammatory disease (SRINIVASAN, 2005B).

Peppers are an important source of nutrients in the human diet, and an excellent source of vitamins A and C as well as neutral and acidic phenolic compounds, which are important antioxidants for a variety of plant defense responses. Levels of these compounds can vary by genotype and maturity and are influenced by growing conditions and losses after processing (HOWARD, 2000).

After pepper was brought to Spain following the discovery of America, growers have selected many pepper cultivars for the properties and characteristics that were most popular or most profitable agriculturally. The result is a great number of very different cultivars showing a wide range of morphological and organoleptic characteristics, including color, which determine their use. In the last 30 years, an important increase of vegetable production has taken place in Almería (Spain), due to the generalized use of greenhouses,

providing a better control on nutrient availability by plants. Thus, new pepper varieties are cultured, but the nutritional composition of the same is unreported until now. (GUIL & GUERRERO, 2006).

Cinnamomum verum belongs to the family Lauraceae. Cinnamaldehyde, one of the components of *C. verum* has been found to possess significant antiallergic, antiulcerogenic, antipyretic, anaesthetic and antimutagenic activities. (SULTANA, 2010).

Functioning of living organisms can be done optimally, only in the presence of adequate amounts of macro and microelements. Their presence in insufficient quantities or exceeding certain limits permitted because the body can affect nutrition-disease.

Some modern cultures still consume wild plants as a normal spice and herb source, obtaining fairly good amounts of several nutrients, and it is widely accepted that herbs are significant nutritional sources of minerals. Furthermore, other nutrients, such as carotenoids and phenols, are found in larger quantities in these plants (GUIL, 1997; ÖZCAN, 2004). The nutritional and medicinal properties of these plants may be interlinked through phytochemicals, both nutrient and non-nutrient.

Vitamin C is the most abundant antioxidant in plants, but its functions are entirely unknown. Ascorbic acid is well known for its antioxidant activity, acting as a reducing agent to reverse oxidation in liquids. When there are more free radicals (reactive oxygen species, ROS) in the human body than antioxidants, the condition is called oxidative stress (MC GREGOR., 2006).

Chemometric techniques may reveal useful information from analytical data, including characterization of natural goods. However, caution must be taken to ensure that these techniques are used in an appropriate manner (DEFERNEZ, M., 1997).

Multivariate analysis techniques were applied in collected data and principal component analysis (PCA) was carried out for quantitative mineral concentration, and the total of variation explained was calculated as the sum of extracted Eigen-values. The PCA techniques can be used to determine the variables containing the maximum possible variance and to reduce the information of a multidimensional data set in that it can be displayed in a scatter plot with only three axes. (BOZOKALFA, 2011).

MATERIAL AND METHOD

Material

Dried spices, including: black pepper, hot and sweet pepper and cinnamon powder, were collected from local markets. Chemicals and reagents were purchased from Sigma-Aldrich.

Method

Determination of microelements content

Dried samples were prepared in duplicate, were then calcined at 650°C for 4 hours. Samples calcined white were treated with 5 ml 0.5 N HNO₃ and brought to dryness on a sand bath. After cooling mineral residues were dissolved in 25 ml 0.5 N HNO₃, filtered and brought to the mark with distilled water. For determination of micro elements were used diluted 1:100 working solution in distilled water for dilute solutions of potassium and calcium and sodium and magnesium if 1:10. The standard solution of 0.1 mg element / mL. Pipette 1-5 mL, 5-25 mL respectively in 100 ml flasks. Add 10 ml of phosphate acidity. Monopotassium to ensure roughly equal samples for analysis. Make the mark with distilled water and mix. Standard solutions stored in sealed bottles. Mn, Co, Ni, Cu, Zn, Cr, Pb, by atomic absorption spectroscopy using an atomic absorption spectrometer contrr AA 300. Standard working conditions flame type: C₂H₂/aerw; flame height: 6 mm; air flow: 568l/h;

acetylene flow: 80l/h for determination of As, 70l/h for Mg, 60l/h for Fe, 50l/h for other minerals.

Titrimetric determination of ascorbic acid (vitamin C) with the redox indicator 2,6-dichloroindophenol

Redox indicator 2,6-dichloroindophenol is a weak oxidizer with mild oxidizing action of ascorbic acid. The method is based on titration of ascorbic acid from plant extracts with redox indicator 2,6-dichloroindophenol until a persistent pink colour for 5 seconds. Were used: 250 mL Erlenmeyer flask, 400 mL Berzelius glasses, 10 mL pipettes, biurette and reagents required have been following: 0.25 M oxalic acid solution, 0.5 mg/mL ascorbic acid solution, indophenol standard solution: dissolve 250 mg of 2,6-dichloroindophenol sodium salt, add 250 mL of distilled water and 210 mg NaHCO₃, shake vigorously, and after the dissolution of the indicator, dilute to 1 L with distilled water.

RESULTS

The mineral compositions of condiments are shown in *Table 1*. The results of the analyses were established to give nutrient values per 100 g of used portion of dried weight. Mineral elements were found to vary widely depending on the different spices.

Table 1. Microelements and vitamin C content of some spices (mg/kg)

Crt. No.	Samples	Cu	Zn	Mn	Co	Pb	Ni	Cr	Ascorbic acid mg/100g dry sample
		(mg/kg)							
1	Sweet Pepper	5.01	9.37	9.43	0.10	0.14	8.71	0.30	0.89
2	Hot Pepper	6.99	10.71	9.25	0.11	0.19	0.68	3.89	0.72
3	Black pepper	0.04	0.07	0.32	0.00	0.00	0.01	0.00	0.88
4	Cinnamon	0.00	0.22	0.88	0.01	0.01	0.03	0.00	1.48

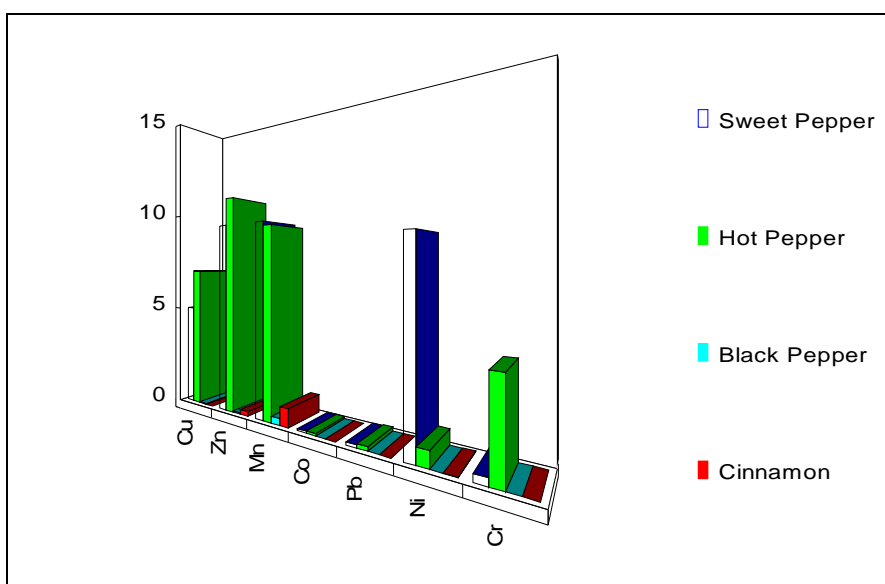


Figure 1. Graphical representation of microelements content

Principal Component Analysis (PCA) used transposed standardized data

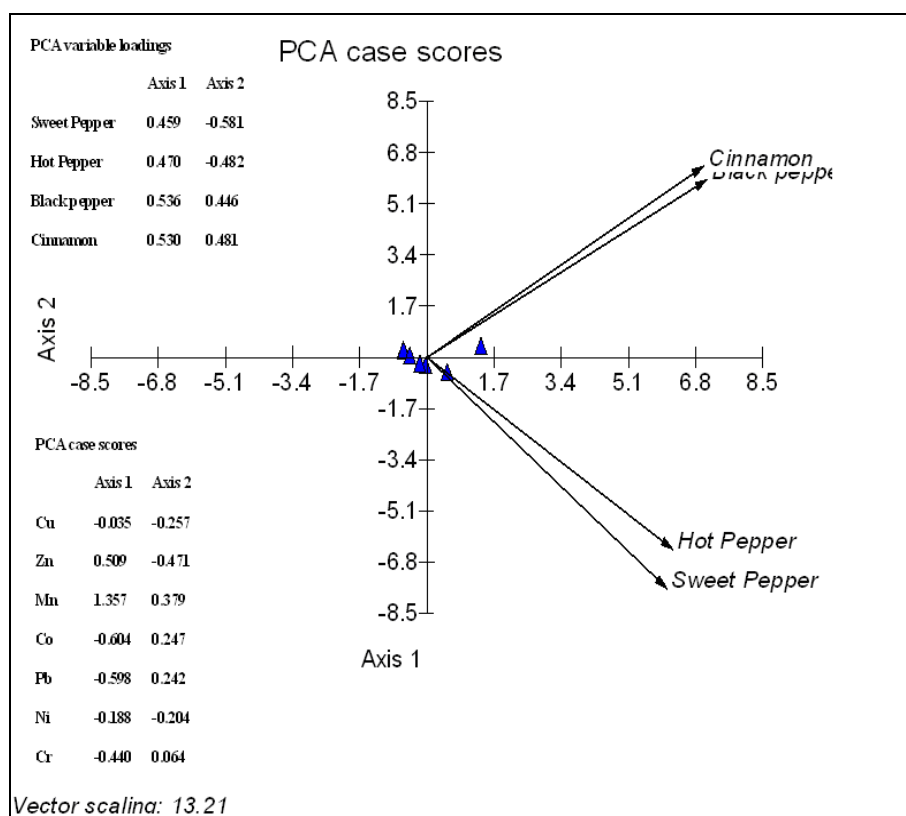


Figure 2. PCA case score representation of microelements content

PCA analysis is showing the representation of the vectors corresponding to the studied samples (black pepper powder, hot and sweet pepper powder and cinnamon powder). In the first quarter we can see the vectors corresponding to Cinnamon and Black Pepper, while in the fourth quarter hot and sweet pepper. This is revealing the fact that the first two samples have similar microelements content, probably also same country of origin. The pepper powder hot and sweet have as country of origin Romania, so it explains the similarity of graphic PCA distribution.

The highest content of vitamin C was found in the cinnamon powder sample (1.48 mg/100g dry sample). Similar values were for sweet pepper powder samples (0.89 mg/100g) and black pepper powder (0.88 mg/100g). Lowest content of vitamin C was the hot pepper powder sample (0.72 mg/100g).

It finds that most were concentrated microelements Zn, Mn and Cu in samples of sweet and hot pepper powder and black pepper and cinnamon powder samples, trace content is Manganese is well represented in the sweet and hot pepper powder samples (9.25-9.43 mg/kg) and the other samples analyzed, manganese was determined in the range 0.32-0.88 mg/kg.

Chromium content was undetectable when samples of black pepper and cinnamon powder, sweet and hot pepper powder (0.30 mg / kg.) And relative content for hot pepper powder sample.

Nickel is present in very small amounts (0.01-0.68 mg / kg) in all samples analyzed, the highest amount of Ni can be found in sweet pepper powder sample (8.71 mg / kg.).

In the cobalt, it is not in the sample of black pepper and has very low values in other samples subjected to analysis. spectrophotometry.

The values obtained for copper in the range 0.04-6.99 mk / kg, and for zinc in the range of 0.22-10.71 mk / kg.

Lead is considered toxic heavy metal, which is why for Pb maximum limit is 0.5 ppm, and values ranged between 0.01-0.19 mk / kg, was undetectable for the sample of black pepper.

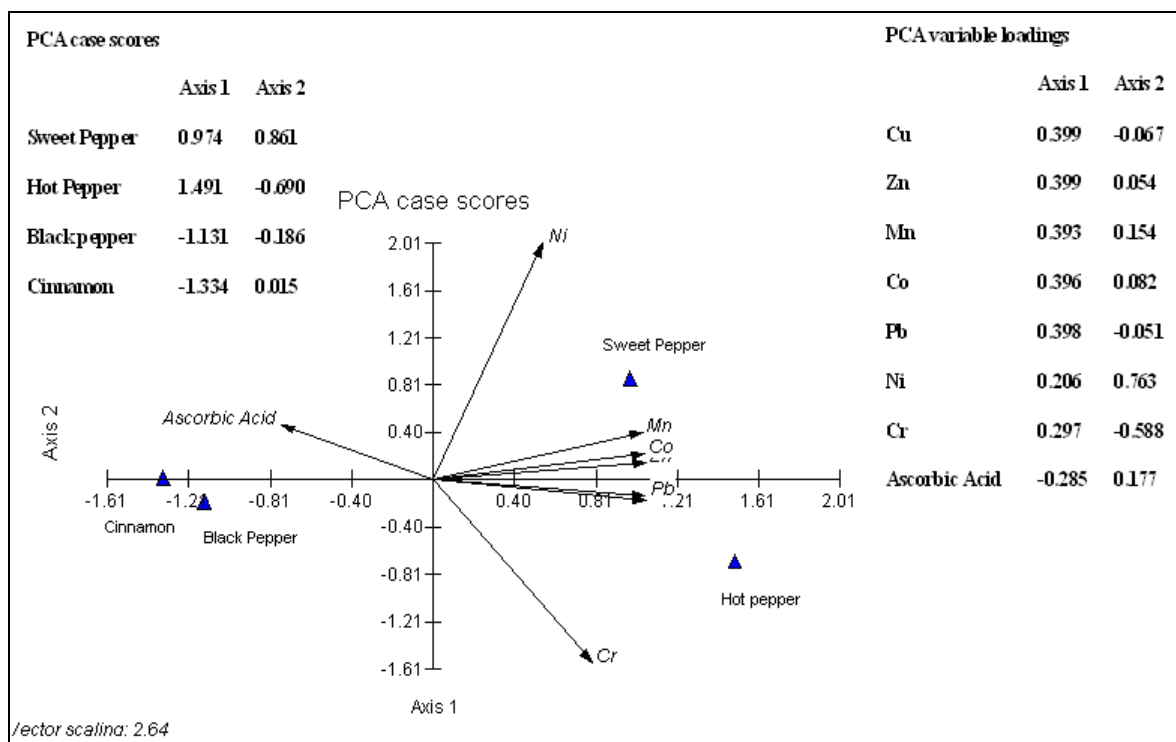


Figure 3. PCA representation of ascorbic acid content associated with microelement content

Figure 3 is presenting the distribution of microelements and ascorbic acid content. Similar to Figure 2, we can observe the distribution of cinnamon and black pepper, very close to each other, and that is confirming the origin of products even by taking in consideration ascorbic acid content. The distribution of sweet pepper in quarter 1 and hot pepper in quarter 4 is specifying that the ascorbic acids values are different in the 2 Capsicum powders (one sweet and the second hot), but its not infirming the country of origin for both (Romania).

CONCLUSIONS

The highest microelement contents were Cu, Zn and Mn. This work attempts to contribute to knowledge of the nutritional properties of these plants. In addition, knowledge of the mineral contents, as spices is of great interest.

The values obtained for vitamin C content are lower than the literature data, determinations were made on samples dried and stored, not fresh evidence.

REFERENCES

- BOZOKALFA, M. K., ESIYOK, D., YAGMUR, B. (2011): Use of multivariate analysis in mineral accumulation of rocket (*Eruca sativa*) accessions, *Genetika*, Volume 43, number 3, pp. 437-448
- DEFERNEZ, M., AND KEMLSEY, E.K. (1997): The Use and Misuse of Chemometrics for Treating Classification Problems, *Trends Anal. Chem.*, Volume 16, pp. 216–221
- GUIL, J. L., MARTINEZ, J. J. G., ISASA, M.E. (1998): Mineral nutrient composition of edible wild plants. *J. Food Composition and Analysis*, Volume 11, pp. 322–328.
- GUIL-GUERRERO, J. L., MARTINEZ-GUIRADO, C., MA DEL MAR REBOLLOSO-FUENTES, CARRIQUEZ-PÉREZ, A, (2006): Nutrient composition and antioxidant activity of 10 pepper (*Capsicum annuum*) varieties, *European Food Res. Technol.*, Volume 224, pp. 1-9
- HOWARD, LR, TALCOTT, ST, BRENES, CH, VILLALON, B. (2000): *J Agric Food Chem.*, Volume 48, pp.1713–1720
- MCGREGOR, G.P., BIESALSKI, H.K. (2006): Rationale and impact of vitamin C in clinical nutrition, *Current opinion in clinical nutrition and metabolic care*, Volume 9, number 6, pp. 697–703.
- ÖZCAN, M. (2004): Mineral contents of some plants used as condiments in Turkey, *Food Chemistry*, Volume 84, pp.437-440
- SRINIVASAN, K. (2005a): Role of spices beyond food flavouring: Nutraceuticals with multiple health effects. *Food Reviews International*, Volume 21, pp. 167–188.
- SRINIVASAN, K., (2005b): Spices as influencers of body metabolism: an overview of three decades of research. *Food Research International*, Volume 38, pp.77-86
- SULTANA,S., RIPA, F.A., HAMID, K. (2010): Comparative antioxidant activity study of some commonly used spices in Bangladesh, *Pakistan Journal of Biological Sciences*, Volume 13, Number 7, pp. 340-343
- SURESH, D, MANJUHATNA, H., SRINIVASAN, K. (2007): Effect of heat processing of spices on the concentrations of their bioactive principles: Turmeric (*Curcuma longa*), red pepper (*Capsicum annuum*) and black pepper (*Piper nigrum*), *Journal of Food Composition and Analysis*, Volume 20, pp. 346-351

COMPARATIVE CHARACTERIZATION OF SOME FUNGAL LACCASES

E. SAJBEN-NAGY (1), L. MANCZINGER (1), B. ŠKRBIĆ (2), N. ĐURIŠIĆ-MLADENOVIĆ (2),
Cs. VÁGVÖLGYI (1)

(1) University of Szeged, Faculty of Science and Informatics
Department of Microbiology
Közép fasor 52, H-6726 Szeged, Hungary

(2) University of Novi Sad, Faculty of Technology
Bulevar cara Lazara 1, 21000 Novi Sad, Serbia
sajben@gmail.com

ABSTRACT

Laccase producing fungi were isolated from environmental samples. They were identified on the basis of ITS (Internal Transcribed Spacer) sequence analysis. The laccase production of the isolates were investigated and compared with those of other strains deriving from the Szeged Microbiological Collection and from mushroom producer's spawn. The enzyme production were examined in various (e.g. basic, mineral and inducer containing) liquid media. The pH optimum determinations for laccase activities were carried out in cell free ferment broths, at pH 3.5, 4, 4.5, 5, 5.5, 6, 6.5, 7 and 8, applying 25 mM succinate buffer. The investigations were based on ABTS [2,2'-azinobis-(3-ethylbenzthiazoline-6-sulphonate)] substrate measurement method. The results showed that under these conditions, among the ascomycetes strains investigated the best laccase producer was a *Rhizoctonia solani* isolate (the SzMC 6252J strain). Among the basidiomycetes tested, the best laccase producer was a *Ganoderma* isolate (HM3).

Keywords: bioremediation, laccase, pH optimum determination

INTRODUCTION

Laccases (benzenediol: oxygen oxidoreductases, EC 1.10.3.2) are produced in many fungal species belonging to ascomycetes and basidiomycetes groups, accordingly, the enzyme has already been purified from various fungal species. Laccases are typical for the wood-rotting basidiomycetes and a related group of litter-decomposing saprotrophic fungi. They have received much attention from researchers during the past decades because of their capability to oxidize wide range of toxic and environmentally harmful substrates including chlorinated phenolics. Presence of these substances even at very low concentrations in waters and agricultural soils creates substantial danger: they and their degradation products could be mutagenic, carcinogenic and teratogenic. In certain cases, the degradation products may pose greater risks than parent compounds (WEI et al., 2011). Laccases utilize board range of substrates, so they could oxidize various xenobiotics and their degradation products. Moreover, they could react with different redox mediators such as ABTS, methionine, phenol and syringaldehyde. These are low molecular weight compounds which could act as redox mediators after oxidization and could oxidize other molecules expanding the spectrum of laccases (CAMARERO et al., 2004). Up to now, more than 100 laccases have been purified and more or less characterized from fungi. The molecular weight of a typical fungal laccase is about 60-70 kDa, and they have around pH 4.0 isoelectric point. Several laccase isoenzymes have been detected in many fungal species (BALDRIAN, 2005), for example *Pleurotus ostreatus* have at least 10 of them (TÉLLEZ-TÉLLEZ et al., 2005). Like most fungal extracellular enzymes, laccases are glycoproteins. The glycosylation ranges are between 10% and 25%. (SHLEEV et al., 2004). Fungal

laccases have pH optimum in the lower pH range. In the case of ABTS substrate the pH optimum is generally lower than 4.0 (BALDRIAN, 2005).

In this study, we isolated new laccase producer Ascomycota and Basidiomycota fungi from environmental samples and we compared their enzyme producing ability under different culture conditions with other known laccase positive strains.

MATERIAL AND METHOD

Strains and conditions

Fungal strains

DP1 (*Ganoderma sp.*), DP2 (*Ganoderma sp.*), DP3 (*Ganoderma sp.*), HM3 (*Ganoderma sp.*) and Lac22, were isolated from environmental samples; HK35 (*Pleurotus ostreatus*), deriving from a mushroom producer; SzMC 6244J (*Botrytis cinerea*) and SzMC 6252J (*Rhizoctonia solani*) from the Szeged Microbiological Collection. The strains were maintained on malt extract agar (MEA), one liter containing 20 g malt extract, 20 g glucose, 1 g peptone and 20 g agar.

Isolation and identification of laccase producers from environmental samples

For the isolation of laccase producer white-rot fungi one liter of basal medium (BM) contained: 0.5 g KH_2PO_4 , 0.2 g $\text{MgSO}_4 \cdot 7\text{H}_2\text{O}$, 0.1 g NH_4NO_3 , 0.1 g KCl , 0.02 g FeSO_4 , 0.05 g $\text{Ca}(\text{NO}_3)_2 \cdot 4\text{H}_2\text{O}$, 2 g malt extract, 15 g agar. After sterilization 0.4 ml guaiacol was added for indicating the laccase activity. For the isolation of laccase producers from air the isolation medium (LI) was the following for 1 liter: 10 ml glicerol, 1 g arginine, 1 g KH_2PO_4 , 1 g K_2HPO_4 , 1 g $\text{MgSO}_4 \cdot 7\text{H}_2\text{O}$, 0.002 g FeSO_4 , 0.002 ZnSO_4 and 0.002 CuSO_4 . The identification was carried out by sequence analysis of ITS (Internal Transcribed Spacer) region, using ITS4 (5'-TCCTCCGCTTATTGATATGC-3') and ITS5 (5'-GGAAGTAAAAGTCGTAACAAGG-3') universal primers (WHITE et al., 1990). We searched for homologies using NCBI BLAST program (<http://www.ncbi.nlm.nih.gov/BLAST>, ALTSCHUL et al., 1990).

The production of laccases

The production of laccases was investigated in different liquid media. ME contained 20 g malt extract, 20 g glucose, 1 g peptone per liter. MEM liquid media: one liter of ME base media supplemented with 80 μl of minerals (1.0 g $\text{CaCl}_2 \cdot 2\text{H}_2\text{O}$, 1.0 g $\text{FeSO}_4 \cdot 7\text{H}_2\text{O}$, 0.1 g $\text{ZnSO}_4 \cdot 7\text{H}_2\text{O}$, 0.16 g $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$, and 1.0 g Na_2EDTA per liter). MEMX media contained in addition to MEM, 1% xylan as indicator. Fifty milliliters of liquid media were inoculated with agar pieces cut from well-grown mycelium. After 6 days of incubation at 28 °C (180 rpm), the samples were centrifuged at 8000g for 10 minutes. The tenfold dilution of the cell free ferment broths served as a basis for the activity assays.

The optimum pH values

The optimum pH values of the secreted laccases were measured at pH 3.5, 4, 4.5, 5, 5.5, 6, 6.5, 7 and 8, applying 25mM succinate buffer from cell free tenfold diluted supernatants. In the experiments we used 5mM ABTS [2,2'-azinobis-(3-ethylbenzthiazoline-6-sulphonate)] as substrate, and we measured the OD at 436 nm wavelength after 5 minutes of incubation (KIISKINEN ET AL., 2002 and 2004).

RESULTS

Isolation and identification of laccase producers

We isolated 4 promising laccase positive Basidiomycota strains, DP1, DP2, DP3 and HM3 on BM media, all of them were identified as *Ganoderma sp.* on the basis of their ITS sequence analysis. On LI media only one applicable laccase producer, Lac22 Ascomycota fungus was isolated. Both strains could grow under laboratory conditions, at 25 °C.

Effect of liquid media to the laccase production

Both fungi could grow in liquid media, ME, MEM and MEMX. The ME basic media was the best for laccase production in the most cases at pH 4.5. DP3 (*Ganoderma sp.*), HK35 (*P. ostreatus*), SzMC 6252J (*R. solani*) and SzMC 6244J (*B. cinerea*) showed the highest activity under this condition. The MEM, (ME supplemented with minerals) inhibited the production in several times, except at DP1 (*Ganoderma sp.*), HM3 (*Ganoderma sp.*) and Lac22, when increased activities were shown. The addition of xylan as inducer increased the activity in only one case, only at DP2 (*Ganoderma sp.*). Outstandingly promising producers were DP1, HM3 and HK35 among the basidiomycetes and SzMC 6252J from the ascomycetes (*Figure 1*).

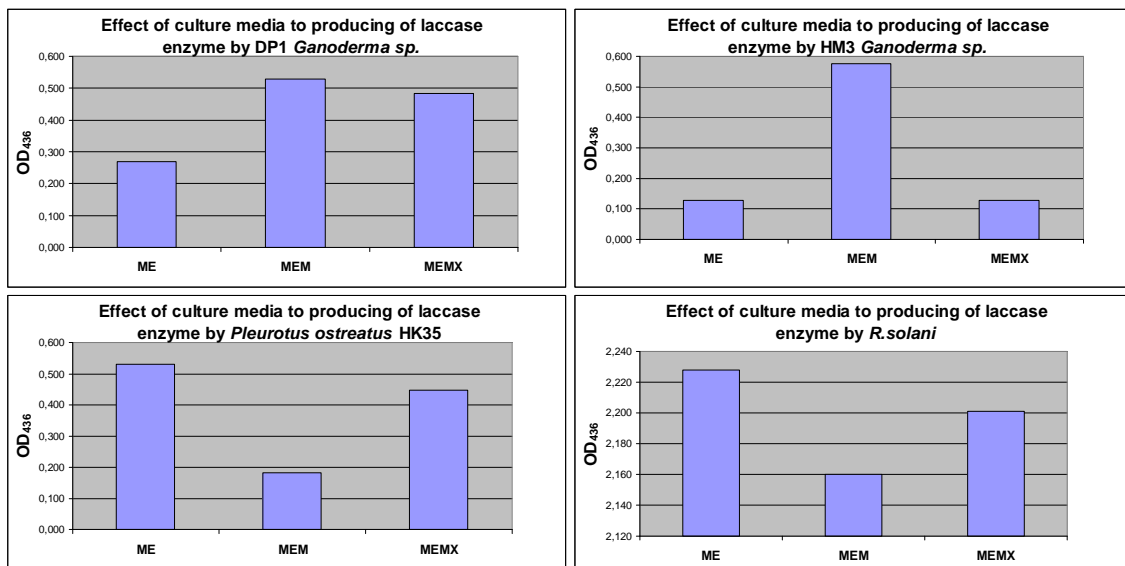


Figure 1: Enzyme activities of the best laccase producer fungi using different liquid media.

Comparison of the pH optimums: On the basis of the experiments carried out with 5 mM ABTS in 25 mM succinate buffer we could conclude that the optimal pH for all of the produced laccases is under pH 4.0. We measured high activities at pH 3.5. The activities dramatically decreased if we increased the pH. Over pH 6.0 much reduced activities occurred, except SzMC 6252J which is a *R. solani* strain, where we could measure activity at pH 7.0 also. It should be mentioned that this strain cannot be really compared to the others, because of its outstandingly high laccase activity (*Figure 2*).

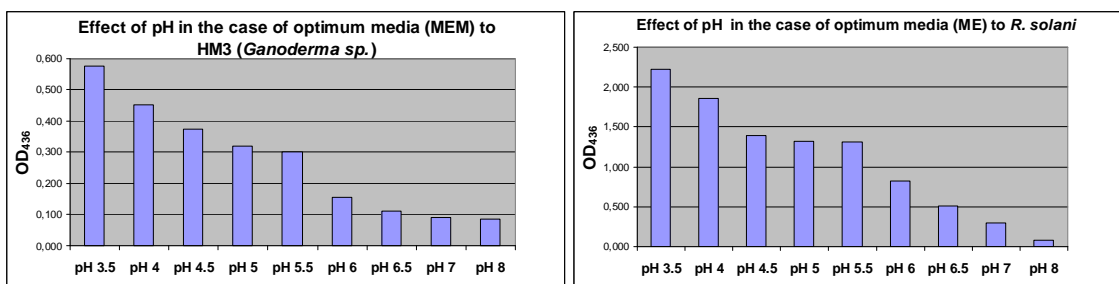


Figure 2: pH dependence of the laccase activities in the ferment broths of HM3 *Ganoderma sp.* and SzMC 6252J *Rhizoctonia solani* strains.

CONCLUSIONS

The results of the investigations on culture media dependence of laccase production showed that the applied inducers mostly decreased the laccase production, but there are some exceptions. For example the addition of minerals increased the activity in case of DP1, HM3 and Lac 22 isolates. The xylan reduced the productivity in all cases. The comparison of the pH dependence curves showed in all cases that the increasing pH decreased the activity, as was expected on the basis of the former work of BALDRIAN, 2006. On the basis of our results we could conclude that the best laccase producer among the investigated strains was the *R. solani* SzMC 6252J. The genus is already known about the good laccase producing ability (BOLLAG et al. 1988; CROWE and OLSSON, 2001). For bioremediation aims, this seems to be the best laccase, because it retains significant activity at higher pH values, which is essential for *in situ* soil treatments.

ACKNOWLEDGEMENTS

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REFERENCES

- ALTSCHUL S.F., GISH W., MILLER W., MYERS E.W., LIPMAN D.J. (1990): Basic local alignment search tool. *Journal of Molecular Biology* **215**, 403-10.
- BALDRIAN P. (2006): Fungal laccases – occurrence and properties. *FEMS Microbiological Review* **30**, 215-242.
- BOLLAG J.-M., SHUTTLEWORTH K. L., ANDERSON D. H. (1988): Laccase-mediated detoxification of phenolic compound. *Applied and Environmental Microbiology* 3086-3091.
- CAMARERO S., IBARRA D., MARTÍNEZ M.J., MARTÍNEZ A.T. (2005): Lignin-derived compounds as efficient laccase mediators for decolorization of different types of recalcitrant dyes. *Applied and Environmental Microbiology* 1775-1784.
- CROWE J.D, OLSSON S. (2001): Induction of laccase activity in *Rhizoctonia solani* by antagonistic *Pseudomonas fluorescens* strains and a range of chemical treatments. *Applied and Environmental Microbiology* 2088-2094
- KIISKINEN L.-L., RÄTTÖ M., KRUIUS K. (2004): Screening for novel laccase-producing microbes. *Journal of Applied Microbiology* **97**, 640–646.

- KIISKINEN L.-L., VIKARI L., KRUS K. (2002): Purification and characterisation of a novel laccase from the ascomycete *Melanocarpus albomyces*. *Applied Microbiology and Biotechnology* **59**, 198-204.
- SHLEEV S.V., MOROZOVA O., NIKITINA O., GORSHINA E.S., RUSINOVA T., SEREZHENKOV V.A., BURBAEV D.S., GAZARYAN I.G., YAROLOV A.I. (2004): Comparison of physico-chemical characteristics of four laccases from different basidiomycetes. *Biochimie* **86**, 693-703.
- TÉLLEZ-TÉLLEZ M., SÁNCHEZ C., LOERA O., DÍAZ-GODÍNEZ G. (2005): Differential patterns of constitutive intracellular laccases of the vegetative phase of *Pleurotus* species. *Biotechnology Letters* **27**, 1391-1394.
- WEI H-R, RHOADES M.G., SHEA P.J. (2011): Formation, adsorption, and stability of N-Nitrosoatrazine in water and soil. American Chemical Society. In: It's all in the water: studies of materials and conditions in fresh and salt water bodies; BENVENUTO M., et al.; ACS Symposium Series; American Chemical Society: Washington, DC, 2011.
- WHITE T.M., BRUNS T., LEE S., TAYLOR J. (1990): Amplification and direct sequencing of fungal ribosomal RNA for phylogenetics. In: INNIS M.A., GELFAND D.H., SNINSKY J.J., WHITE T.J. (Eds.). PCR protocols: a guide to methods and applications. Academic Press, San Diego, CA, pp. 315-321.

BIOGAS EXPERIMENTS WITH PIG SLURRY AND WHEAT PROCESSING RESIDUES

LASZLÓ SALLAI

University of Szeged
Department: Plant Scientific and Environmental Protection
Hódmezővásárhely 6800 Andrásy St. 15.
sallai@mgk.u-szeged.hu

ABSTRACT

An energetic aim of the utilisation of the manure meaning serious environmental load with other wastes between the economic structural relations of a certain micro-region increases the profit-making ability of reverse investments to this aim significantly together with byproducts. The economical operation of the pork breeding claims the increase of the firm size especially, which may entail the considerable increase of the environment-damaging effects. The many times beneficial application of the biogas production (energy production + environmental protection investment + bio-manure production + the treatment of hazardous waste and its utilisation) expounds his effect then only, if the possible coferment's power generating ability is modelled similar to operating circumstances between conditions on an experimental road beforehand. I outlined the possible techniques of application being attached to the different methane content of the biogas in my work. I pretended with the loads changing, the changing of substrate combinations and the changing of manure production in the course of the experiments. The intensity of the methane production of the direct measure of the activity of the methanogen bacteria, and than like that, the most sensitive, typical indicator of the digester's yield. The combination of the produced gas and its yield features that may be useful to estimate the stability of the anaerobic system. Consequently the results of the examinations bring practical profit on the sizing, investment and firm operational area indispensable.

Keywords: renewable energy sources, laboratory with half firm methods, fermentation process, agricultural main and by-products

INTRODUCTION

The biogas production based on the pork liquid dung, and the other waste of agricultural main product of processing known, and accepted technological procedure in the EU's member states, as the result of which biogas and fermented manure is produced. The quantity and the quality of the raw materials and additives, and the biogas forming in the function of the parameters of the applied technology are strongly variable (KALMAR ET AL.2003, ARTHURSON 2009). The target of my experiments aimed the increase of the proportion of the renewable energy sources of application is to increase the methane quantity originating from the various organic matters, to increase of the intensity of the formation, to produce stable gascontent. Making the organic matters polluting the environment harmless is the indirect result of the application of the technology. The biogas increasing a greenhouse effect with big methane content means concentrated environmental load and source of danger and on the other hand unutilized energy source on a farming area where the use of the exterior power sources is considerable anyway (GOTTSCHALK 1979, GERARDI 2003). While the economy size is his principle from below, the relatively little energy content of the biomass in the view of the transportation expense from above limits the firm concentration. Because of this it is expedient to examine the energetic utilisation of all possible organic waste at least with laboratory or half firm methods.

MATERIAL AND METHOD

At the Engineering and Agricultural Faculty of Szolnok College there is an appropriate, available, semi-automatic experimental system, representing the operating circumstances, providing similar conditions suitable the formation process of the biogas, regulating change of influencing factors and all of necessary measurements of typical data. The liquid pig manure was used during my biogas production experiments as basic substance. I used the bran as additive. The application of appropriate bacteria strain may decrease the time of fermentation and the measure of the demolition may improve and the methane content of the forming biogas may be growing.

The supreme features of industrial byproducts and wastes suitable for biogas production:

- dry matter
- organic matter
- nitrogen content
- C:N proportion
- specific gas yield

The technology of fermentation experiments, the process of the experiment series:

- a) Loading of laboratory digesters, setting of the treatment combinations
- b) Sampling.
- c) Measurements, examine of parameters

We may split the process of the fermentation into sections according to the table 1..

We can dose ~ 50 dm³ of liquid dung mixture pro treatment to take the factors in connection with the capacity of the fermentors into account. It is possible the simultaneous examination the effect of 9 treatment combinations with in a heatable room placed, mobile by manual power, hermetically closed fermentors. We applied the continuous (filling up) system, wich is most widespread in the practice, it can be reproduced the process sections, as the launching, load change, receipt change, according to certain expert opinions each single daily measurement combination for a separate experiment can be qualified.

Table 1.

The parameters measured during the experiment series, measuring devices, methods, frequency

Serial number	Measured parameter	Device	Method	Comment
1.	Fermentor temperature (oC)	digital thermometer		once a day, at the same time
2.	Gasyield (dm ³)	gasmeter		
3.	Gascontent %	GA45 gas analyser		
4.	Conductivity (mS/cm)	Hydrolab	electrometria	once a day, at the same time
5.	Soluted oxigen (mg/l)			
6.	pH			
7.	Salination (PSS)			
8.	Redoxpotential (mV)			
9.	BOD5 (mg/l)	Oxi Top 110	pressure dropping	from samples selected based on professional viewpoints
10.	COD (mg/l)	NANOCOLOR	photometria	
11.	Dry matter content	drying cupboard		once a day, at the same time

I measured the most important parameters to follow the degradation process (*Table 1*). The *Table 2* contains the different treatments in the different process periods.

Table 2.

Experiment series and treatments

No.	Process period	Duration time	Treatments and fermentors				Comment
			1.	2.	3.	4.	
1.	Stabilization		Composition: 50% fresh liquid manure; 25% manure from the store; 25% sludge from the store			100 % water	Same circumstances
2.	Refilling period with fresh substance	7 days	6,6 vol.% refilling with fresh substance daily			6,6 tf % water refilling	
3.	refilling with fresh substance daily (running up period)	15 days	6,6 tf % refilling with fresh substance daily				32 – 37 °C different process
			Bact. treatment 4 V/V % (once) Bran additive 60g/day (45g DM)	Bran additive 60g/day (45g DM)	control	Bact. treatment 4 V/V % (once) Bran additive 60g/day (45g DM)	
4.	comparative experiments, refilling period Fresh material	15 days	Compaund: 6,6 tf % refilling with fresh substance daily (1,2,3 – liquid pig manure; 4 – water)				
			Bran additive 60g/day (45g DM.)	Bran additive 60g/day (45g DM.)	control	Bran additive 60g/day (45g DM)	
5.	comparative experiments, refilling period Recirculated material	15 days	6,6 vol % recirculated material daily				
			Bran additive 60g/day (45g DM)		control	Bran additive 60g/day (45g DM)	

RESULTS

The water-based, pure bran starting treatment for biogas production is only a fraction of bacteria was able to power. The relative effectiveness of recirculation technology here refers to the slowdown degradation. The liquid pig manure based on 6.6 V / V% loading, dry matter content 45 g / day of wheat bran dosing the gas production more than doubled, the methane content to 5%, the influence of the bacterial treatment increased by 7.5%. Generally the by-products examined by me the methane content reduced by the bacterial treatment, the gasproduction was increasing, but in the case of wheat bran I didn't notice that. The bacterial treatment didn't increase the performance of the bran additive, but the methan content was growing, which has been unique among the experiments (*Table 3*). The substrat load was not too high, because the daily gasproduction generally increased in case the different treatment (*Figure 2*), but in the recirculation technology the organic matter content was decreasing from the substrate, that's why the yield was decreasing (*Table 3*). The changing of the methane content is generally paralell with the production. It shows the condition of the decomposition process (*Table 4*). The situation isn't similare in

the case of recirculation, water based treatment, mainly the slow speed of the decomposition. The recirculated didn't reconstructed substrat increased the production (Figure 3.).

Table 3. The average gas production of the fermentors in the course of the comparative experiments with wheat bran additive

		Average gasyield (dm ³ /day) in the fermentors				Specific fermentor volume referred gasyield(dm ³ /dm ³ day)			
		1.	2.	3.	4.	1.	2.	3.	4.
biogas	Fresh substrat load	55,1	62,7	24,2	17	1,102	1,254	0,484	0,34
	Recirculation technology	40,9	42	10,1	22,9	0,818	0,84	0,202	0,458
methane	Fresh substrat load	32,3	35,9	13,2	6,6	0,646	0,718	0,264	0,132
	Recirculation technology	23,6	24,2	6,3	10,6	0,472	0,484	0,126	0,212

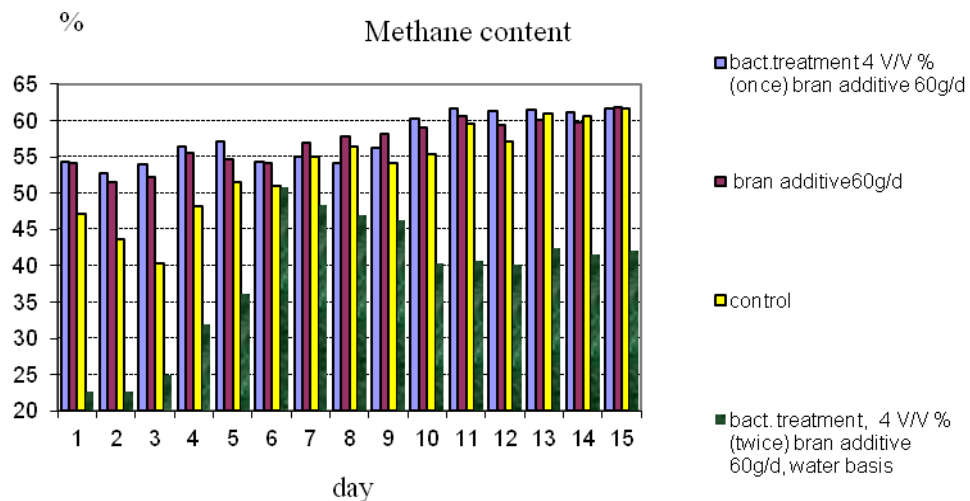


Figure 1. Methane content, refilling technology, fresh material (15 days: from 37th day to 51st day)

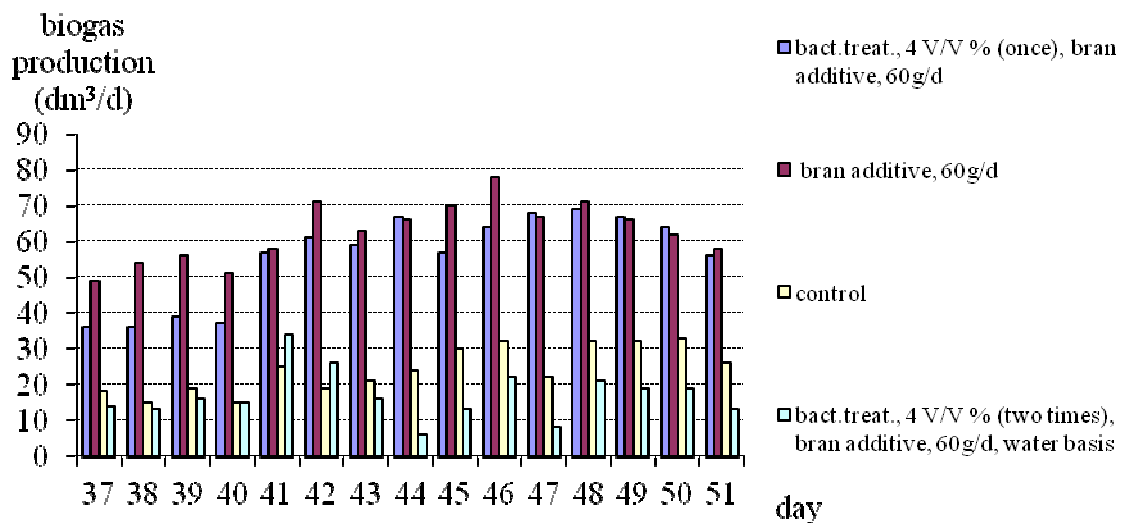


Figure 2. Biogas production, refilling technology, fresh material (15 days: from 37th day to 51st day)

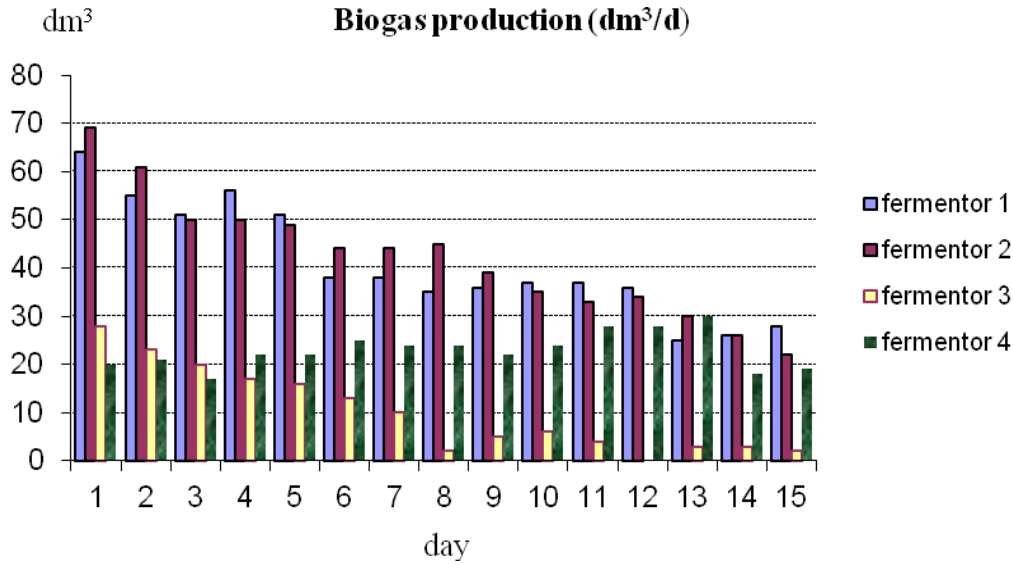


Figure 3. Gasproduction in recirculation, refilling technology

1. FERMENTOR: BACTERIA TREATMENT: 4 V/V % (ONCE), BRAN ADDITIVE 60G/D; 2. FERMENTOR: BRAN ADDITIVE 60G/D; 3. FERMENTOR: CONTROL; 4. FERMENTOR: BACTERIATREATMENT, WATER BASIS 4 V/V % (TWICE), BRAN ADDITIVE, 60G/D

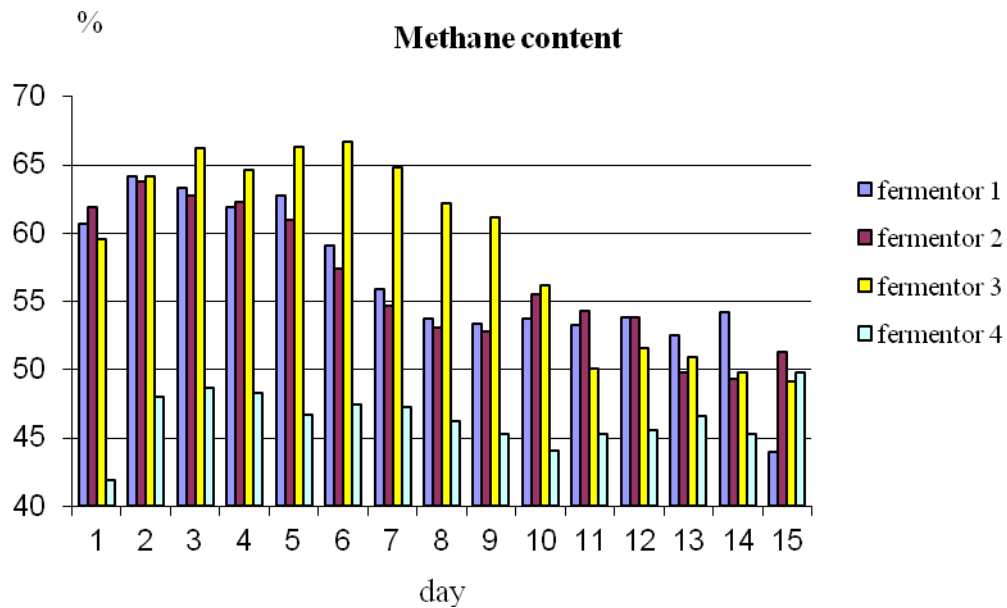


Figure 4. Methane content in recirculation, refilling technology

1. FERMENTOR: BACTERIA TREATMENT: 4 V/V % (ONCE), BRAN ADDITIVE 60G/D; 2. FERMENTOR: BRAN ADDITIVE 60G/D; 3. FERMENTOR: CONTROL; 4. FERMENTOR: BACTERIATREATMENT, WATER BASIS 4 V/V % (TWICE), BRAN ADDITIVE, 60G/D

CONCLUSIONS

By the liquid dung basis control the examined 3,4-4,6 % average dry-matter content province was growing the average quantity of the developing gas (16,98 dm³/days -23,04 dm³/days). That is the 35 %-os average dry-matter content increase nearly 35 %-os average a quantity of gas caused an increase. The gas forming increase is bigger quantity compared to the control, with similar dry-matter content, than the methane content decrease. The result fall into the applicable category yet though.

I resourced the yield increasing effect of the wheat bran among the by-products of the milling industry. Above it as a control method I compared the specific yield of bran additive to the production of the control. The bran was running with 60g drymatter/day/fermentor load 0,72 dm³ methane/ dm³ /day production, what was made worse a little bit the bacterial treatment (0,65 dm³ methane/ dm³ /day). In case of twice bacterial treatment on water basis the recirculation technology let more time to the bacterias for the decomposition (0,21-0,13 dm³ methane/ dm³ /day).

REFERENCES

- ARTHURSON, V. (2009) Closing the Global Energy and Nutrient Cycles through Application of Biogas Residue to Agricultural Land – Potential Benefits and Drawbacks. *Energies* 2, 226-242.
- GERARDI, M. H. (2003) *The Microbiology of Anaerobic Digesters*. USA: Wiley-Interscience, 286.
- GOTTSCHALK, G.(1979). *Bacterial Metabolism*. New York: Springer-Verlag, 154.
- KALMÁR, I., KOVÁCS, K. L., BAGI, Z.(2003) Sertés hígrágyára alapozott biogáz referencia üzem. MTA AMB Kutatási és Fejlesztési Tanácskozása. Gödöllő, 2. 82-86

RURAL DEVELOPMENT IN THE BANAT AREA

STAN ANDREEA, PETROMAN I., PETROMAN CORNELIA, MARIN DIANA, STATIE C., ȘUCAN
MOISINA, BELA ANGELA

Banat's University of Agricultural Sciences and Veterinary Medicine Timisoara
Faculty of Farm Management
Calea Aradului, nr. 119, Timisoara
standeia@yahoo.com

ABSTRACT

In the context of huge problems engendered by the European agricultural policy and related to rural area development, the rural area on the whole needs new perspectives to ensure a positive evolution of the human communities. Romania, a member of the European Union for over 5 years now, needs to valorise all its natural, human, and cultural resources of the rural area to be able to face a strong competition and to maintain biodiversity.

Keywords: rural area, preserving biodiversity, rural development strategy

INTRODUCTION

Operating tourism activities in rural boarding houses and on agri-tourism farms in better conditions needs the observance of two major conditions: **management and marketing** [*Programul Strategic de Dezvoltare a turismului la nivelul zonei formate din județele Timiș, Caraș-Severin și Mehedinți.* (2005). Uniunea Europeană – Prefectura Județului Timiș; *Stăncioiu Aurelia Felicia, Căescu S., Constantinescu Mihaela, Filip Alina, Ionescu F. T.* (2005). *Planificarea de marketing în turism – concept și aplicații.* Ed. Economică. București; *Țuclea Claudia Elena.* (2004). *Managementul întreprinderilor mici și mijlocii din turism și servicii.* Ed. ASE. București; *Benea M., Petroman I.* (2010). *Bazele turismului.* Ed. Eurostampa. Timișoara; *Petroman, I.* (2010). *Managementul turismului cultural în județul Timiș.* Ed. Eurostampa. Timișoara; *Petroman I., Petroman P.* (2006). *Turismul cultural.* Ed. Eurostampa. Timișoara].

Rural development strategy in Romania has benefited from **the Leader Initiative** designed to encourage the appearance and testing of new approaches **concerning integrated, sustainable development**, and the completion and recovery of the rural development policy in the European Community. The Leader Initiative has had three programme steps (from 1991 to 2006): Leader I, Leader II, and Leader +, reaching a level of maturity that allowed competent authorities and Local Action Groups in the Member-States to implement the Leader approach widely in the rural development programme.

MATERIAL AND METHOD

To conduct the present research, we documented specialty materials concerning the rural development opportunities in the Banat area, as well as certain European programmes such as LEADER concerning territorial approaches at micro-regional level that concern rural areas diversity.

RESULTS AND DISCUSSION

The Leader approach is no longer a European Community initiative. It is the State that needs to define its strategic role in rural development policies guided by the strategic guiding outlines in the DECIZIA CONSILIULUI din 20 februarie 2006 privind orientările strategice ale Comunității pentru dezvoltare rurală (perioada de programare 2007-2013) (2006/144/CE) [DECIZIA CONSILIULUI din 20 februarie 2006 privind orientările strategice ale Comunității pentru dezvoltare rurală (perioada de programare 2007-2013) (2006/144/CE)]. The LEADER Initiative has been implemented in two large stages:

- **First stage: 2007-2009.** During this period, they selected the first pilot **Local Action Groups (LAG)** that supported the training process in order to select the 2nd LAGs before 2010. They thus set the bases for institutional construction and for skill developing in:
 - developing local development integrated strategies;
 - financing research/studies on rural areas and preparing support applications;
 - making up representative local development partnerships.

GALs play an important role in the reunion of all public, private, and civil society organisations that act within a certain territory and that create, gradually, common working methods and practices for common goals.

- **Second stage: 2010-2013.** It aims at implementing integrated development strategies through:
 - LAGs;
 - skill acquirement and territory animation;
 - implementing strategies developed during the first stage;
 - cooperation projects.

The support supplied by the Leader Axe also supplies the opportunity of combining the objectives below in the context of the development of local development strategies based on local needs and of strong points:

- life quality/diversification;
- competitiveness;
- environment.

Integrated approaches involving farmers, foresters, and other actors of the rural area can protect and improve local and cultural heritage and protected areas, and they can ensure increased awareness on the environment, investment enhancement, and service promotion in sustainable tourism and in fuel renewing resources.

The authorities responsible for the implementing of the LEADER Axis in Romania are:

- the Ministry of Agriculture, Forests, and Rural Development – a Management Authority for PNDR;
- the Offices for Agriculture and Rural Development as representatives of the Management authority at county level;
- the Offices for Payments in Agriculture and Rural Development as authorities of technical and financial implementing tools;
- the Local Action Groups as responsible for the development of local development strategies and for the project selection.

We need to say, as a conclusion, that the **Leader Programme is an instrument allowing the development of a territorial approach at micro-regional level aiming at preserving rural area diversity.** The real advantage of the Leader approach is its high ability of covering the complexity of the territorial system (*Figure 1*).

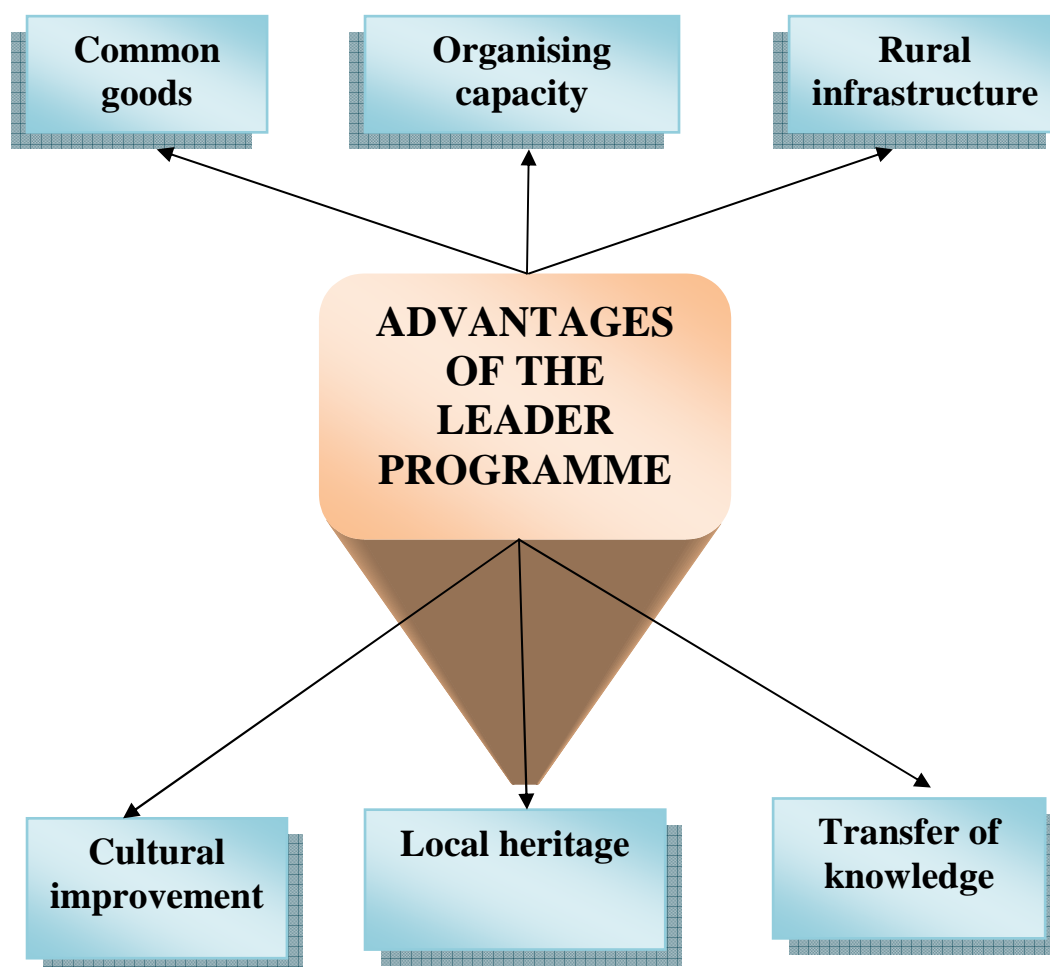


Figure 1. Advantages of the LEADER Programme

In order to meet the needs of **trained personnel and competent labour force** for hospitality and tourism, we need an institutional structure that supplies gradual institutionalised professional training programmes for students from the area and active involvement in hospitality and tourism in the area. For the Banat area, they suggested, in the **Master Plan for the Development of the National Tourism 2007-2026**, two centres: Timișoara and Băile Herculane. The new training institutions in the field of hospitality could be established by turning the existing tourism complexes or by activating inactive ones. **To train the necessary human resources in the field of hospitality and tourism to meet modern European and international standards and to increase competitiveness we need training courses for medium management focused on the following:**

- developing tourism information skills;
- training tourism guides.

High-school and academic institutions raining in the field of tourism in the Banat area are as follows:

- Universitatea Creștină Dimitrie Cantemir in Timișoara, specialising in:
 - Tourism and Trade Management;
- Universitatea Eftimie Murgu in Reșița, specialising in:
 - Marketing;
 - Tourism-Services;

- **Universitatea de Științe Agricole și Medicină Veterinară a Banatului in Timișoara, specialising in:**
 - Engineering and Management in Food Services and Agri-tourism;
 - Engineering and Management in Tourism;
- Universitatea de Vest in Timișoara, specialising in:
 - Tourism Geography;
 - Management;
 - Marketing;
 - Tourism-Services;
- Universitatea Europeană Iosif Drăgan in Lugoj, specialising in:
 - Tourism;
- Universitatea Mihai Eminescu in Timișoara, specialising in:
 - Tourism, Trade, and Hospitality Management;
- Economic High-schools in Reșița and Timișoara.

CONCLUSIONS

In this respect, we need to draw the conclusion that, in order to train the human resource necessary in the tourism and hospitality industry that meets modern European and international standards, and to increase competitiveness we need to develop training courses for medium level that:

- develop tourism information skills;
- train tourism guides.

LITERATURE

1. *Programul Strategic de Dezvoltare a turismului la nivelul zonei formate din județele Timiș, Caraș-Severin și Mehedinți.* (2005). Uniunea Europeană – Prefectura Județului Timiș. [Ștăncioiu Aurelia Felicia, Căescu S., Constantinescu Mihaela, Filip Alina, Ionescu F. T., (2005), *Planificarea de marketing în turism – concept și aplicații*, Ed. Economică, București. Țuclea Claudia Elena. (2004), *Managementul întreprinderilor mici și mijlocii din turism și servicii*, Ed. ASE, București. Benea M, Petroman I., *Bazele turismului*, Ed. Eurostampa, Timișoara. Petroman I. (2010), *Managementul turismului cultural în județul Timiș*, Ed. Eurostampa, Timișoara. Petroman I., Petroman P., (2006), *Turismul cultural*, Ed. Eurostampa, Timișoara;
2. DECIZIA CONSILIULUI din 20 februarie 2006 privind orientările strategice ale Comunității pentru dezvoltare rurală (perioada de programare 2007-2013) (2006/144/CE)

THE EFFECT OF UV LIGHT ON THE VITAMIN D CONTENT AND MYCELIAL GROWTH OF OYSTER MUSHROOM

ANNA SZABÓ, JÚLIA GYÓRFI

Corvinus University of Budapest
Faculty of Horticultural Science, Department of Vegetable and Mushroom Growing
H-1118 Budapest, Villányi str. 29-43., Hungary
gomba@uni-corvinus.hu

ABSTRACT

Vitamin D₂ is essential for maintaining the proper functioning of a human body, and to prevent and help cure various diseases. Mushrooms are one of the few natural sources of vitamin D. Many experiments aimed to increase the vitamin D level of cultivated mushrooms, by irradiating them with UV light to turn their ergosterol content into vitamin D. The subjects of most of these studies were post-harvest sliced or whole mushrooms. Our goal was to treat pre-harvest oyster mushroom with UV light, while the mushrooms are still growing and biologically active. UV lamps (operating on 254 and 312 nm) and 6 time periods of irradiation (15 to 90 minutes) were used. After three consecutive days of treatments the yield were measured and samples were taken for vitamin D₂ analysis. A parallel, *in vitro* experiment took place in the laboratory as well, where the same treatments (wavelengths and irradiation times) were applied on the tissue cultures of the same oyster mushroom cultivar used in the *in vivo* experiment. The mycelia growth was measured in case of all treatments. Data showed considerable increase in vitamin D₂ levels of the treated oyster mushrooms at every time period. UV irradiation caused no change in yield, but affected the growth of the *in vitro* tissue cultures significantly.

Keywords: Vitamin D, UVB light, *Pleurotus*, ergosterol, fungi

INTRODUCTION

Vitamin D has been acknowledged for almost a 100 years as being essential for a healthy human body. It promotes calcium and phosphorus absorption, and has an effect on cellular growth. Vitamin D supports the immune system as well and helps preventing different kind of illnesses (e.g. heart diseases, obesity, diabetes, arthritis etc.) (GRANT&HOLICK, 2005; HOLICK, 2006; HOLICK, 2008). Recent studies aimed at finding possible ways of using vitamin D in cancer prevention and treatment (MEHTA&MEHTA, 2002; BOUILLON ET AL., 2006; GARLAND ET AL., 2006). Due to studies aimed at estimating the adequacy of vitamin D of the world's population (CHAPUY ET AL., 1997; OVERSEN ET AL., 2003; GORDON ET AL.; CALVO&WHITING, 2006; RODRÍGUEZ ET AL., 2008; LOOKER ET AL., 2011), expert find the European population to have more or less inadequate vitamin D level. Vitamin D deficiency has been recognized as a pandemic for a few years now (HOLICK&CHEN, 2008). Various compounds with similar biological effects are called vitamin D. Vitamins D₂ and D₃ are the ones almost exclusively responsible for providing the adequate vitamin D intake for a human body, which is 400 to 800 IU= 10 to 20 µg (D₃ equivalent) (CHAPUY ET AL., 1997; INSTITUTE OF MEDICINE, FOOD AND NUTRITION BOARD, 2010). Ergocalciferol (vitamin D₂) can be obtained from a few natural food sources, from fortified foodstuff and from supplements, while cholecalciferol (vitamin D₃) is produced in the human skin by sunlight (OVERSEN ET AL., 2003; SHRAPNEL&TRUSWELL, 2006). In order to prevent diseases deriving from vitamin D deficiency (rickets in children, osteopenia, osteoporosis and fractures in adults), it is essential to consume food-products with high level of vitamin D (MAU ET AL., 1998; HOLICK&CHEN, 2008). There are only a few natural sources (seafood, animal and milk products) of vitamin D₂. One serving of

these food types covers 6-80% of the daily value (U.S.D.A., AGRICULTURAL RESEARCH SERVICE, 2009).

The source of vitamin D₂ is ergosterol, which is the most abundant phytosterol in mushrooms. When exposed to UV light it undergoes photolysis and form previtamin D₂ and other photoirradiation products. Previtamin D₂ then yields vitamin D₂ by spontaneous thermal rearrangement (MATTILA ET AL., 2002). Many mushroom species contain distinct levels of vitamin D₂ and ergosterol (MATTILA ET AL., 1994).

Wild grown mushroom species have higher level of vitamin D₂ than the cultivated ones. One serving of wild grown mushrooms (80-90 g) can cover 90-500% of the daily value of vitamin D (U.S.D.A., AGRICULTURAL RESEARCH SERVICE, 2009). Although they consist less vitamin D₂, cultivated mushrooms contain more ergosterol than wild grown mushroom species (TEICHMANN ET AL., 2007; JASINGHE ET AL., 2007).

Number of experiments and studies proved that ergosterol content of post-harvest mushrooms can be converted into vitamin D₂ by artificial UV irradiation, this way the vitamin D₂ concentration in cultivated mushroom can be enhanced up to nine folds (JASINGHE ET AL., 2005; MAU ET AL., 1998).

At the time there is no sufficient reference or published data which would indicate how ergosterol and vitamin D₂ concentration would change in cultivated mushroom, if they were treated with UV radiation not post-harvest, but before picking, still during their growing period. That is why in our study the aim was to irradiate mushrooms with UV light during cultivation, in pre-harvest stage, while they are still biologically active and still growing.

The subject of our experiment was the oyster mushroom (*Pleurotus ostreatus* (JACQ.) P. KUMM). UVB radiation in different time periods was applied to study the effect of UVB light and duration of irradiation on changes in vitamin D₂ level.

UV lamps are long time used for sterilizing surfaces and equipment in laboratories, as UV light is capable of significant inhibition of tissue growth. During the UV treatments not only the fruiting bodies got irradiated but the mycelia on the surface of the bags as well. That is why tissue cultures of the oyster mushroom were prepared for in vitro treatments in order to see, how UVB radiation affects mycelia growth. The same conditions (wavelengths, irradiation time and distance) were set up in the laboratory.

MATERIALS AND METHODS

The mushrooms studied in this experiment were cultivated in the test chamber of the Department of Vegetable and Mushroom Growing, Corvinus University of Budapest.

For the study 140 kg straw-based oyster mushroom substrate was prepared (inoculated with strain 'HK 35'). 14 bags were filled with 10 kg substrate, respectively.

Vilbert Lourmat-115M type UV lamps were set up (operating on 312 nm - in the 'B' range of UV light) above the bags, approx. 32 cm from the surface of the fruiting bodies.

During the entire growing period, in every development stage of the oyster mushroom, ideal ambient conditions were provided.

Six different irradiation time periods (5, 10, 15, 20, 25 and 30 minutes) were applied in 3 repeats (one treatment per day, for three consecutive days), this way in the end, the treated surfaces got 15 to 90 minutes irradiation.

The treatments of oyster mushroom were carried out in 2 repeats (2 bags with total 20 kg substrate). The UV irradiation went on from 4 days after the primordia appeared. 2 bags of untreated control were grown as well.

RESULTS AND DISCUSSION

The results of vitamin D₂ analysis of the oyster mushroom samples are given in µg/g fresh weight and shown on *Figure 1*. Besides the accurate values, a curve demonstrates the trend of changes in vitamin D₂ level too (where the stated R² values represent the strength of correlation).

As *Figure 1*. shows, the vitamin D₂ level started increasing from 0.67 µg/g (measured in the untreated control sample) and continued rising all the way. The longest (90 min.) treatment proved to be the most efficient, as the vitamin D₂ level measured in those samples was 3.68 µg/g. Even the shortest treatment (15 min.) caused the vitamin D₂ level to grow by 14% (compared to the control), but after 90 minutes the growth was 450%.

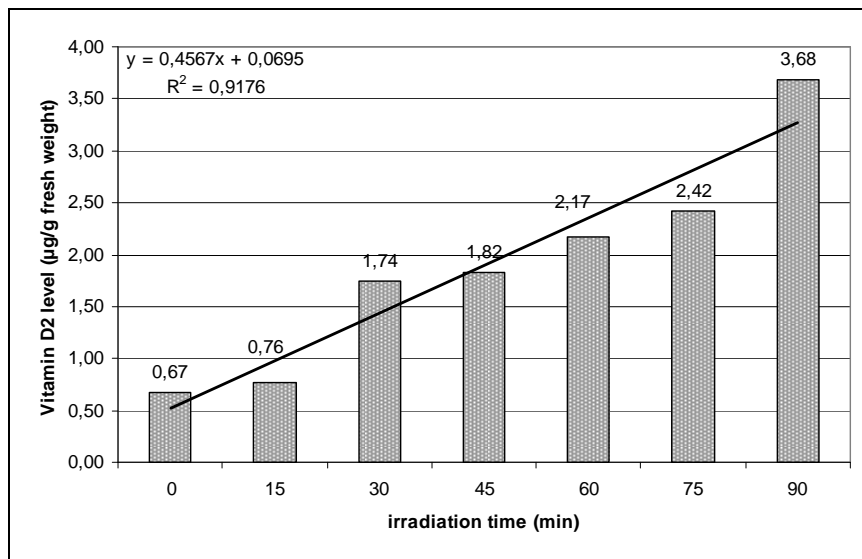


Figure 1. Changes in vitamin D₂ content in oyster mushrooms after 0 to 90 minutes of UVB treatments

Figure 2. shows the results of the in vitro UV treatments. Due to data, UVB light causes substantial changes in mycelia growth. After three days of treatments, the treated tissue cultures grew only by an average 40-50%, while the untreated ones got almost twice as big (grew by 90%). No significant difference can be seen between each treatment, the rate of set back in growth was similar.

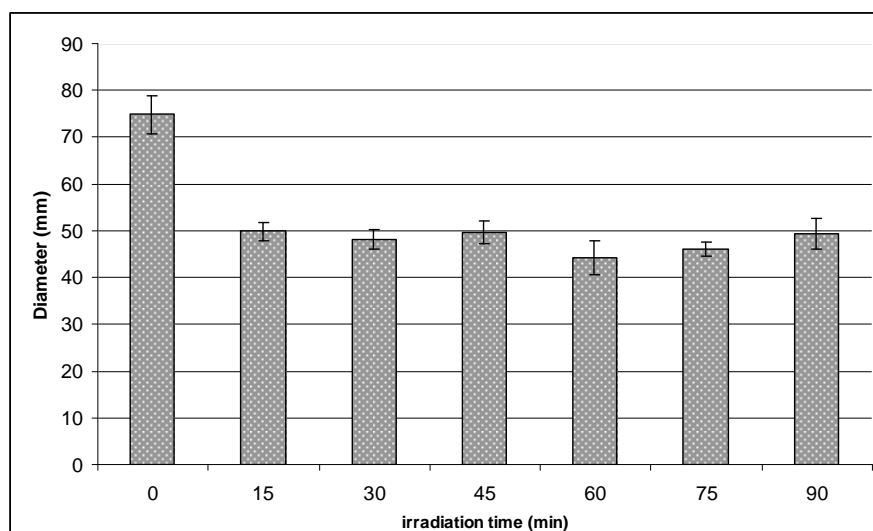


Figure 2. Size of the tissues cultures of oyster mushrooms after 0 to 90 minutes of UVB treatments

Besides measuring the changes of vitamin D₂ content, the appearance of the treated mushrooms was studied as well, because during *in vitro* UV treatments, a slight browning of the tissue cultures was observed. No coloration could be registered on the originally brownish-colored caps of oyster mushrooms. UVB radiation only affected the gills (turned their white into light-yellow) if they somehow were not covered by the caps and suffered direct radiation.

CONCLUSIONS

In the experiment pre-harvest oyster mushrooms were treated with UVB radiation for different time periods in order to increase the vitamin D₂ content of the fruiting bodies. Due to analysis of vitamin D₂ concentration of the mushroom samples, UV treatments of pre-harvest mushroom cultures have similar efficiency as those of post-harvest cultures. Pre-harvest UVB treatment of the oyster mushrooms resulted a maximum 450% growth in vitamin D₂ level.

The mycelial growth of the UV treated tissue cultures of the same cultivar were measured as well. Data shows, that UV light sets back the growth of the mycelia by around 40-50%. In order to see, whether the inhibition of mycelial growth appears in the cultivation by lowering the yield of the UV treated mushroom culture, it is important to repeat the experiment with higher sample numbers, in a higher scale.

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REFERENCES

- BOUILLON, R., EELEN, G., VERLINDEN, L., MATHIEU, C., CARMELIET, G., VERSTUYF, A. (2006): Vitamin D and cancer. *J. Steroid Biochem.* 102, 156–162.
- CALVO, M.S., WHITING, S.J. (2006): Public health strategies to overcome barriers to optimal vitamin D status in populations with special needs. *J. Nutr.*, 4, 1135–1139.
- CHAPUY, M.-C., PREZIOSI, P., MAAMER, M., ARNAUD, S., GALAN, P., HERCBERG, S., MEUNIER, P.J. (1997): Prevalence of vitamin D insufficiency in an adult normal population. *Osteoporosis Int.*, 7, 439–443.
- GARLAND, C.F., GARLAND, F.C., GORHAM, E.D., LIPKIN, M., NEWMARK, H., MOHR, S.B., HOLICK, M.F. (2006): The role of vitamin D in cancer prevention. *American Journal of Public Health*, vol. 96, no. 2., 252-261.
- GRANT, W. B., HOLICK, M.F. (2005): Benefits and requirements of Vitamin D for optimal Health: a review. *Altern. Med. Rev.* 2, 94–111.
- GORDON, C.M., DEPETER, K.C., FELDMAN, H.A., GRACE, E., EMANS, S.J. (2004): Prevalence of vitamin D deficiency among healthy adolescents. *Arch. Pediat. Adol. Med.*, 158, 532–537.
- HOLICK, M.F. (2006): The role of vitamin D in cancer prevention. *Am. J. Public Health*, 2, 252–261.
- HOLICK, M.F. (2008): Vitamin D: a D-Lightful health perspective. *Nutr Rev.*, 66 (10 Suppl 2), S182–94.
- HOLICK, M. F., CHEN, T.C. (2008): Vitamin D deficiency: a worldwide problem with health consequences. *Am. J. Clin. Nutr.*, 4, 1080S–6S.
- INSTITUTE OF MEDICINE, FOOD AND NUTRITION BOARD. DIETARY REFERENCE INTAKES FOR CALCIUM AND VITAMIN D (2010): Washington, DC: National Academy Press.
- JASINGHE, V.J., PERERA, C.O. (2005): Distribution of ergosterol in different tissues of mushrooms and its effect on the conversion of ergosterol to vitamin D₂ by UV irradiation. *Food Chemistry*. Vol (92): 541–546.
- JASINGHE, V.J., PERERA, C.O., SABLANI, S.S. (2007): Kinetics of the conversion of ergosterol in edible mushrooms. *J. Food Eng.*, 79, 864–869.
- LOOKER, A. C., JOHNSON, C.L., LACHER, D.A., PFEIFFER, C.M., SCHLEICHER, R.L., SEMPOS, C.T. (2011): Vitamin D Status: United States, 2001–2006. NCHS Data Brief, Number 59.
- MATTILA, P.H., PIIRONEN, V.I., UUSI-RAUVA, E.J., KOIVISTOINEN, P.E. (1994): Vitamin D contents in edible mushrooms. *J. Agr. Food Chem.*, 42, 2449–2453.
- MATTILA, P.H., LAMPI, A.-M., RONKAINEN, R., TOIVO, J., PIIRONEN, V. (2002): Sterol and vitamin D₂ contents in some wild and cultivated mushrooms. *Food Chem.* 76, 293–298.
- MAU, J.L., CHEN, P.R., YANG, J.H. (1998): Ultraviolet irradiation increased vitamin D₂ content in edible mushrooms. *J. Agr. Food Chem.*, 46, 5269–5272.
- MEHTA, R.G., MEHTA, R.R. (2002): Vitamin D and cancer. *J. Nutr. Biochem.*, 13, 252–264.
- OVERSEN, L, ANDERSEN, R., JAKOBSEN, J. (2003): Geographical differences in vitamin D status, with particular reference to European countries. *Proc. Nutr. Soc.*, 4, 813–21.
- RODRÍGUEZ SANGRADOR, M., BELTRÁN DE MIGUEL, B., QUINTANILLA-MURILLAS, L., CUADRADO VIVES, C., MOREIRAS TUNY, O. (2008): The contribution of diet and sun exposure to the nutritional status of vitamin D in elderly Spanish women: the five countries study (OPTIFORD Project). *Nutr. Hosp.*, 6, 567–76.
- SHRAPNEL, W., TRUSWELL, S. (2006): Vitamin D deficiency in Australia and New Zealand: What are the dietary options? *Nutrition & Dietetics*, 4, 206–212.
- TEICHMANN, A., DUTTA, P.C., STAFFAS, A., JÄGERSTAD, M. (2007): Sterol and vitamin D₂ concentrations in cultivated and wild grown mushrooms: Effects of UV irradiation. *LWT*, 40, 815–822.

U.S. DEPARTMENT OF AGRICULTURE, AGRICULTURAL RESEARCH SERVICE (2009): USDA
Nutrient Database for Standard Reference, Release 22.

INVESTIGATION OF NUTRIENT CONTENT AND FERMENTATION OF DIFFERENT FOLIAGE SILAGES

DÁNIEL SZEMETHY¹, SZILVIA OROSZ², LÁSZLÓ SZEMETHY¹,

Szent István University
Institute for Wildlife Conservation¹,
Department of Nutrition²,
Gödöllő 2103 Páter K. St. 1.
szemethy.daniel@gmail.hu

ABSTRACT

The aim of the research was to investigate ensilage, nutrient content and fermentation characteristics of elder (*Sambucus nigra*), black locust (*Robinia pseudo-acacia*), blackberry (*Rubus spp.*) and hawthorn (*Crataegus spp.*) shoots. Early summer shoots were collected, wilted (4-6 h), chopped, mixed with 20% dried corn (*Zea mais*) and then ensiled (n=5), with the same packing density of 600 kg/m³ (200kg/m³ DM). The fresh, the wilted pre-ensiled material were sampled immediately and the silages were sampled after 70 days of fermentation. Dry matter-, crude protein-, crude fibre- and NDF- content were determined in each sample, pH, lactic acid, acetic acid, propionic acid, butyric acid and ethanol were measured in silages (n=5). CP/CF and CP/NDF rate were calculated (MÁTRAI ET AL., 2002). The dry matter content of elder- and blackberry silages was optimal for fermentation (no significant difference P>0.05). Relatively high DM was found in the case of black locust- and hawthorn- silages (P≤0.05). Crude protein results of elder- and black locust were higher and differed significantly from the other two (P≤0.05). Similar and low crude fibre contents were found in elder-, black locust- and hawthorn silages (P>0.05), blackberry had a higher CF content (P≤0.05). NDF content of black locust and blackberry were similar (P>0.05), with elder silage lower, and hawthorn higher NDF values were found (P≤0.05). All four silages differed significantly in CP/CF and CP/NDF ratios (P≤0.05). It is recommended to use NDF-content and CP/NDF ratio of the shoot silages in further investigations, as NDF analyses give more adequate data for fibre content. The pH values were relatively high and the total amount of fermentation products was low in the silages. The fermentation intensity was low in all cases. Fermentation quality was optimal in elder- and blackberry silages. In the case of black locust and hawthorn silages presence of unfavourable fermentation products was found. To improve fermentation quality, DM must be kept between the optimal 30-40% values. In conclusion elder and black locust young shoots mixed with dried cracked corn seemed to be the best raw materials for shoot silage making and can be effectively preserved by fermentation providing good rules for ensiling are followed. These foliage mixed silages could provide high quality and nutritious feedstuffs for wild ruminants.

Keywords: shoot silage, wild ruminants, ensiling, supplemental feeding, foliage silage

INTRODUCTION

The aim of the research was to investigate the ensilage, nutrient content and fermentation character of shoots derived from some of the preferred plant species by wild ruminants. Arboreal shoots are the main components in the diet of wild ruminants (GEBERT ET AL., 2001). In terms of biomass supply in habitats used by ungulates elder (*Sambucus nigra*), black locust (*Robinia pseudo-acacia*), blackberry (*Rubus spp.*) and hawthorn (*Crataegus spp.*) are dominant species (MÁTRAI, 1994; MÁTRAI ET AL., 2000; MÁTRAI ET AL., 2002)., Positive seasonal preference was found for black locust, elder and blackberry by investigating the diet of wild ruminants (MÁTRAI AND SZEMETHY, 2000). Preference for these species could be a result of favourable nutrient content. MÁTRAI (2002) used crude protein/crude fibre rate to evaluate nutrient content (MÁTRAI ET AL., 2002). In this study we followed this practice. High crude protein and relatively low crude fibre content was

determined in shoots of elder and black locust by investigating nutrient content (SZEMETHY ET AL., 2000; SZEMETHY ET AL., 2003). Ruminant degradability and nutritive value of tetraploid black locust was investigated in China. These results confirmed; black locust is a potential forage species for ensiling (CHEN ET AL., 2011; ZANG ET AL., 2010).

MATERIAL AND METHOD

Elder (*Sambucus nigra*), black locust (*Robinia pseudo-acacia*), blackberry (*Rubus spp.*) and hawthorn (*Crataegus spp.*) were studied as silages. Dried cracked corn (20%) was applied in order to reduce the hazard of effluent production and un-desirable fermentation processes, moreover to increase energy content of shoot silages, as winter feed for game. Collecting and ensiling of the raw materials was executed in June 2010 (elder, black locust: 7th; blackberry, hawthorn: 8th). After collecting, the fresh shoots were wilted (4-6 hours), chopped with a compost-shredder, mixed with 20% dried corn and then ensiled in buckets (elder, black locust, n=5, respectively) and in model silos (blackberry, hawthorn, n=5, respectively) with a packing density of 600 kg/m³ (200kg/m³ DM). The fresh, the wilted raw material and the silages were sampled (on the 70th day of fermentation) and analyzed (n=5). Dry matter-, crude protein-, crude fibre- and NDF- content were determined in each sample. Additionally, pH, lactic acid, acetic acid, propionic acid, butyric acid and ethanol were determined in silages to evaluate the fermentation quality. Total volatile fatty acid, organic acid and lactic acid/acetic acid (LA/AA) ratio were calculated. Crude protein/crude fibre (CP/CF) and crude protein/NDF (CP/NDF) ratio were used (MÁTRAI ET AL., 2002) to estimate nutritive value of the silages. One way ANOVA and Tukey-Kramer Multiple Comparisons Test were used for statistical analysis of the results.

RESULTS

Nutrient content

The dry matter (DM) contents of elder- and blackberry silages were about optimal. There was no significant difference between the results of these two silages ($P>0.05$). Relatively high dry matter content was found in the case of black locust- and hawthorn- silages. They differed significantly from elder and blackberry and also each other ($P\leq 0.05$). Crude protein content of elder- and black locust silages were similarly higher ($P>0.05$) and differed significantly from blackberry and hawthorn ($P\leq 0.05$). Relatively low crude fibre (CF) content was found in elder-, black locust- and hawthorn silages ($P>0.05$). CF content of blackberry silage was significantly higher than the others ($P\leq 0.05$). By measuring NDF content of the silages, no difference was found between the results of black locust and blackberry ($P>0.05$). Significantly lower NDF content was found in elder silage ($P\leq 0.05$). Hawthorn silage differed from all the others significantly with an extremely high value ($P\leq 0.05$). All four silages differed significantly in CP/CF and CP/NDF rates ($P\leq 0.05$). Nutrient content of the different foliage silages (+20% dried corn) are shown in Table 1.

Table 1. Nutrient content of the different foliage silages mixed with 20% dried cracked corn (n=5)

		Elder + 20% corn		Black locust + 20% corn		Blackberry + 20% corn		Hawthorn + 20% corn	
		mean	SD	mean	SD	mean	SD	mean	SD
DM	g/kg	351,6a	17,61	430,2b	26,56	386,2a	26,20	518,9c	20,80
Crude protein	g/kg DM	159,1a	10,00	165,4a	13,64	119,1b	6,90	124,9b	4,63
Crude fibre	g/kg DM	118,0a	15,76	102,3a	12,41	203,3b	33,01	119,9a	12,42
NDF	g/kg DM	230,5a	21,30	342,2b	13,61	354,2b	56,49	481,5c	31,54
CP/CF	g/g	1,35a	0,11	1,62b	0,20	0,59c	0,08	1,04d	0,07
CP/NDF	g/g	0,69a	0,03	0,48b	0,03	0,34c	0,05	0,26d	0,01

Different letters show significant differences at level of $P \leq 0.05$

Fermentation

Lower pH values of elder- and blackberry silages differed significantly from the results of black locust and hawthorn ($P \leq 0.05$). No-significant difference was found between the lactic acid (LA) values of black locust- and hawthorn silages ($P > 0.05$). The highest LA value was found in elder ($P \leq 0.05$) blackberry differed significantly from all the others ($P \leq 0.05$). Also the highest acetic acid (AA) value was found in elder silage ($P \leq 0.05$). Black locust and blackberry had the similar values ($P > 0.05$), in hawthorn significantly less AA was found ($P \leq 0.05$). In elder and blackberry similarly low propionic acid (PA) content was found ($P > 0.05$). PA was the highest in black locust silage ($P \leq 0.05$). In the case of hawthorn no difference was found from the others ($P > 0.05$). The ethanol content of elder silage was significantly lower than all the others ($P \leq 0.05$). The other three silage had the same ethanol content ($P > 0.05$). Volatile Fatty Acid (VFA) content of elder silage was significantly higher than the others ($P \leq 0.05$). VFA content in black locust and blackberry was similar ($P > 0.05$). The lowest VFA content was found in hawthorn silage ($P \leq 0.05$). Organic acid (OA) content of black locust- and hawthorn silages were similarly low ($P > 0.05$). The highest OA content was found in elder silage ($P \leq 0.05$). Blackberry had lower OA content and differed from all the others ($P \leq 0.05$). In the case of fermentation products similar ranking was found in VFA. Similarly a high LA/AA rate was found in elder- and blackberry silages ($P > 0.05$), and they differed significantly from the results of black locust and hawthorn ($P \leq 0.05$). No significant difference was found between LA/AA rates of black locust and hawthorn ($P > 0.05$).

Fermentation profiles of the different foliage silages (+20% dried corn) are found in Table 2.

Table 2. Fermentation profile of the different foliage silages mixed with 20% dried corn (n=5)

			Elder + 20% corn	Black locust + 20% corn	Blackberry + 20% corn	Hawthorn + 20% corn
pH		mean	4,4a	5,7b	4,6a	5,7b
		SD	0,10	0,18	0,06	0,06
Lactic acid	g/kg DM	mean	25,4a	5,5b	17,2c	2,1b
		SD	5,32	3,34	2,97	0,61
Acetic acid	g/kg DM	mean	10,5a	4,7b	5,2b	1,7c
		SD	1,12	1,28	1,24	0,43
Propionic acid	g/kg DM	mean	0,2a	0,6b	0,2a	0,3ab
		SD	0,05	0,21	0,11	0,10
Butyric acid	g/kg DM	mean	0,0a	0,6b	0,0a	0,6b
		SD	0,00	0,24	0,00	0,32
Ethanol	g/kg DM	mean	4,6a	12,0b	8,5b	9,9b
		SD	0,49	0,44	0,76	4,03
Volatile fatty acids	g/kg DM	mean	10,7a	5,9b	5,4b	2,5c
		SD	1,15	1,25	1,28	0,69
Organic acids	g/kg DM	mean	36,1a	11,4b	22,5c	4,6b
		SD	5,71	3,97	4,05	0,84
Fermentation products (organic acids and ethanol)	g/kg DM	mean	40,7a	23,5b	31,0b	14,6c
		SD	6,11	3,90	4,57	4,46
LA/AA ratio	g/g	mean	2,4a	1,1b	3,4a	1,3b
		SD	0,52	0,51	0,62	0,60

Different letters show significant differences at level of $P \leq 0.05$

DISCUSSION

Nutrient content

It can be concluded, that crude protein content of the silages derived from the examined species can reach a substantial level above other common forages. Only the blackberry reached the average crude fibre content of common forages (like alfalfa or maize silage), in all the other cases CF was much lower (about half) of this value. From the results of MÁTRAI (2002) we can conclude, that wild ruminants try to optimize CP/CF rate by reducing CF intake, so the relatively low CF value of these silages can be optimal for these ruminant species. The high crude protein and low crude fibre level provided an advantageous CP/CF and CP/NDF ratio. Earlier studies, related to CP/NDF ratio of these species, are poor. The CP/CF ratio of elder-, black locust- and hawthorn silages were in the same range as found by MÁTRAI (2002). It is recommended to use NDF-content and CP/NDF ratio of the shoot silages in further investigations, as NDF analyses give more accurate data for fibre content and digestibility of forages.

Fermentation

According to the pH values and fermentation profile, it can be concluded that the fermentation intensity was low in all silages, especially in black locust and hawthorn silages. The pH values were relatively high in the above mentioned two silages. The amount of lactic acid was considerably lower than 60g/kg DM (minimum level in well fermented maize and alfalfa silages) in all inspected cases. Acetic acid content was lower

than 15g/kg DM in all cases (applied maximum level in well fermented maize and alfalfa silages). Butyric acid values were undetectable or low. The LA/AA ratio was found close to the optimal 3:1 in elder- and blackberry silages. The LA/AA ratios were significantly lower in the case of black locust and hawthorn as compared to elder- and blackberry silages. The total amount of fermentation products in foliage silages were less than in maize- or alfalfa silages with similar dry matter content. Fermentation quality based on the LA/AA ratio and the amount of different unfavourable volatile fatty acids were optimal in elder- and blackberry silages. In the case of two species (black locust, hawthorn) butyric acid- and ethanol content were relatively high compared to the other two silages. However, the quantity of these unfavourable fermentation products is negligible. The low quality and intensity of fermentation was a consequence of high dry matter content (black locust: 43% and hawthorn: 52%), so it is suggested to keep the dry matter content within the optimal range of 30-40%.

CONCLUSIONS

According to the results of nutrient content (CP/CF ratio) and fermentation quality, it can be summarized that elder and black locust young shoots mixed with dried cracked corn seemed to be the best raw materials for making shoot silage and can be effectively preserved by fermentation provided good ensiling techniques are followed. These foliage mixed silages could provide high quality and nutritious feedstuffs for wild ruminants. However, further investigations are proposed (ensiling of large quantities, investigation of ruminal degradability, feeding experiments, determination of microbiological status and aerobic stability, inoculation to improve fermentation quality and therefore palatability). It is recommended to use NDF-content and CP/NDF ratio of the shoot silages in further investigations.

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REFERENCES

- CHEN, Y., ZHAO, Y., FU, Z. Y., MA, Z. W., QIAN, F. C., AIBIBULI, A., YANG, B., ABULA, R., XU, X.L., ANIWAER, A. (2011): Chemical Composition and in vitro Ruminal Fermentation Characteristics of Tetraploid Black Locust (*Robinia pseudoacacia* L.), *Asian Journal of Animal and Veterinary Advances* 6 (7) pp. 706-714.
- GEBERT, C., VERHEYDEN-TIXIER, H. (2001): Variations of diet composition of red deer diet (*Cervus elaphus* L.) in Europe, *Mammal Rev.*, London. Volume 31. Number 3. pp. 189-201.
- MÁTRAI, K. (1994): A gímszarvas, a dám és a muflon őszi tápláléka és élőhelyhasználata a Gödöllői-dombvidéken, *Vadbiológia*, Volume 4. pp. 11-17.
- MÁTRAI, K., KATONA, K., SZEMETHY, L., OROSZ, SZ., (2002): A szarvas táplálékának mennyiségi és minőségi jellemzői a vegetációs időszak alatt egy alföldi erdőben, *Vadbiológia*, Volume 9. pp. 1-9.
- MÁTRAI, K., SZEMETHY, L. (2000): A gímszarvas szezonális táplálékának jellegzetességei Magyarország különböző élőhelyein, *Vadbiológia*, Volume 7. pp. 1-9.
- SZEMETHY, L., MÁTRAI, K., KATONA, K., OROSZ SZ. (2003): Seasonal home range shift of

red deer hinds, *Cervus Elaphus*: are there feeding reasons?, *Folia Zool.*, 52(3) pp. 249-258.

SZEMETHY., L., MÁTRAI, K., OROSZ, SZ., PÖLÖSKEI, B., SZAKA, GY. (2000): A gímszarvas táplálékválasztása erdei és mezőgazdasági élőhelyen tavasszal, *Vadbiológia*, Volume 7. pp. 10-18.

ZANG, G., MI, W., LI, Y., JIANG, J., LU, C., NIU, C. (2010): Effects of different supplements on tetraploid black locust (*Robinia pseudoacacia* L.) silage, *For. Stud. China*, 2010, 12(4) pp. 176-183.

EFFECT OF GENOTYPE AND HENS' STARTING BODY FAT CONTENT ON THE CHANGES IN THE BODY FAT CONTENT OF THE HENS AND ON THE WEIGHT AND COMPOSITION OF THE EGGS PRODUCED IN THE FIRST EGG LAYING PERIOD

SZENTIRMAI E.¹ – MILISITS G.¹ – DONKÓ T.¹ – SÜTŐ Z.¹ – ORBÁN A.² – UJVÁRI J.¹ – PÓCZE O.¹ – REPA I.¹

¹Kaposvár University, Faculty of Animal Science, Guba Sándor u. 40, Kaposvár, Hungary

²Bábolna Tetra Ltd., Petőfi Sándor u. 18, Uraiújfalu, Hungary

szentirmai.eszter@ke.hu

ABSTRACT

The aim of this study was to examine the effect of genotype and hens' starting body fat content on the changes in the body fat content of the hens and on the weight and composition of the eggs produced in the first egg laying period. The experiment was carried out with altogether 30 hens (15 TETRA SL brown egg layers and 15 TETRA BLANCA white egg layers), which were chosen from altogether 45 TETRA SL and 45 TETRA BLANCA hens based on their CT (computer tomography) predicted body fat content at 20 weeks of age (hens with the highest (n=5), hens with the lowest (n=5) and hens with average (n=5) body fat content in both genotype). For the *in vivo* determination of changes in the body composition of these hens, computer tomography (CT) measurements were carried out at every fourth week between the 20th and 72nd week of age. During the CT measurements hens were fixed with belts in a special plexiglass container without using any anaesthetics. The measurements covered the whole body of the hens using overlapping 10 mm slice thickness on a Siemens Somatom Emotion 6 multislice CT scanner. After collecting, weighing and breaking the eggs produced by the experimental birds on the days of the CT measurements their yolk ratio was determined. Based on the results, it was established that the body fat content of the hens increased continuously in both of the genotypes in the first phase of the experimental period, while it did not change further in the second phase of the experiment. It was also observed at all examination days, that the body fat content of the white egg layers was higher than that of the brown egg layers. Hens with the highest starting body fat content had the highest body fat content in both genotypes during the whole egg laying period. The egg production of the hens was not influenced by the body fat content of the birds, but it was affected by the genotype. The TETRA SL hens produced significantly more eggs than the TETRA BLANCA hens. The hens with average body fat content produced lighter eggs than the hens with low or high body fat content.

Keywords: body fat content, egg weight, egg composition

INTRODUCTION

Because of the tremendous decrease on the international layer breeding market nowadays only three company groups are operating in this sector. The smallest among of them – and the only one coming out from Eastern Europe – is the Bábolna TETRA Ltd. Bábolna and the nearly twenty-five-year-old trade mark 'TETRA' guarantee the breeding quality on the international market, first and foremost because of the cultivated different poultry hybrids. Parallel with the above mentioned market consolidation the egg production grew dynamically in the last decades. Today the world's egg production reaches 1193 billion pieces (FAO, 2010), out of which 88-90% is produced by layer hybrids for consumption. In the breeding of egg layers the peak production nearly approached the biological limit of one egg a day, but there are some possibilities for the development in the early and late production, in the length of the persistence. The persistence of the egg production is defined nowadays as the decline in the egg production after the peak production, and it is measured by the slope of the decline (GROSSMANN et al., 2000). The breeders of laying hens concentrate on the maximum number of the saleable eggs per hen housed, on the lowest feed cost per egg or per kg egg mass, on the optimal internal and external egg

quality and on the low mortality and high adaptability to different environments (THIRUVENKADAN et al., 2010).

It is well known from former experiments that the success in the hen house is dependent upon the success in the pullet house. However, during the pullet's rearing period we are mainly focusing on managing pullet body weight and body weight uniformity, but we should also realize that the cumulative nutrition program can have a significant effect on pullet's body composition. We now know that pullet feeding programs can develop pullets of similar body weight, but with markedly different body compositions and subsequent reproductive patterns. Therefore, the optimal body conformation at photostimulation seems to be more important for reproductive success than just obtaining the recommended body weight targets (POWELL, 2004).

While 50% of the world's egg consumption is covered by Leghorn type hybrids (white eggshell layers), this hybrid has not been bred in Hungary since 1983 and has not been distributed since 1999 despite the fact that the white shelled eggs are more suitable from many aspects for the increased industrial egg processing than the brown ones.

Therefore, Bábolna TETRA Ltd. planned to breed and introduce a new Leghorn type layer hybrid (called TETRA Blanca), which would enlarge the range of types and could help to cover the world's industrial egg need and could give a further alternative to all of the egg market participants.

Based on the above mentioned things, this study had two main goals:

1. comparison of changes in the body and egg composition of the newly developed white egg layer (TETRA Blanca) and the well-known brown egg layer (TETRA SL) during the first egg laying period; and
2. comparison of the production and changes in the body and egg composition of hens in both genotypes starting the egg laying period with different amount of fat reserves in their body at the photostimulation.

MATERIAL AND METHODS

The experiment was carried out with altogether 30 hens (15 TETRA SL brown egg layers and 15 TETRA BLANCA white egg layers), which were chosen from altogether 45 TETRA SL and 45 TETRA BLANCA hens based on their CT (computer tomography) predicted body fat content at 20 weeks of age (hens with the highest (n=5), hens with the lowest (n=5) and hens with average (n=5) body fat content in both genotype). By TETRA SL the group of the hens with low body fat content was characterized with 20-23, the group of hens with average body fat content with 24-26, and the group of the hens with high body fat content with 27-32 fat index (see below). The same groups by TETRA Blanca were characterized with 25-27, 28-30 and 33-36 fat index. The differences in the fat content between the same groups of the two genotypes are originated from the difference in the body fat content of the examined genotypes (see the results).

The hens were kept in cages (1.800 cm² basic area), in a closed building at the Test Station of the Kaposvár University, Faculty of Animal Science, in Hungary. In order to the correct identification of which egg was produced by which hen, two hens (one TETRA SL and one TETRA BLANCA) were placed into one cage. The hens were fed *ad libitum* with the same commercial diet during the whole experimental period. Drinking water was also continuously available from self-drinkers.

The changes in the body and egg composition of the hens were monitored four-weekly between 20 and 72 weeks of age. The body composition 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.

The CT measurements consisted of overlapping slices covering the whole body using a Siemens Somatom Emotion 6 multislice CT scanner. Following scanning parameters were set in: tube voltage 130 kV, X-ray radiation dose 90 mAs, mode spiral, pitch 1, FoV 500 mm, slice thickness 10 mm, matrix 512x512. Using the images obtained so-called fat indices were calculated for the determination of the fat content in the hens' body *in vivo*. The calculation was performed according to Romvári (1996) by determining the ratio of number of pixels with X-ray density values of fat to the total number of pixels with density values of muscle, water and fat, i.e. the range between -200 to +200 on the Hounsfield-scale:

$$\text{Fat index} = \frac{\Sigma(-200)-(-20)}{\Sigma(-200)-(+200)} \times 100$$

After the CT measurements, all of the eggs, which were produced by these birds on the CT examination days were weighed and broken. After separating and weighing their yolk and albumen content the ratio of the yolk to the whole egg weight was calculated.

For the statistical evaluation of the between group differences in the liveweight and body and egg composition of the hens the One-Way ANOVA was used. The statistical analysis was carried out by the SAS statistical software package, version 9.3.1.

RESULTS

Examining changes in the body fat content of the laying hens it was established that it was increasing continuously in both of the examined genotypes in the first phase of the experimental period, while it did not change further in the second phase of the experiment (Figure 1).

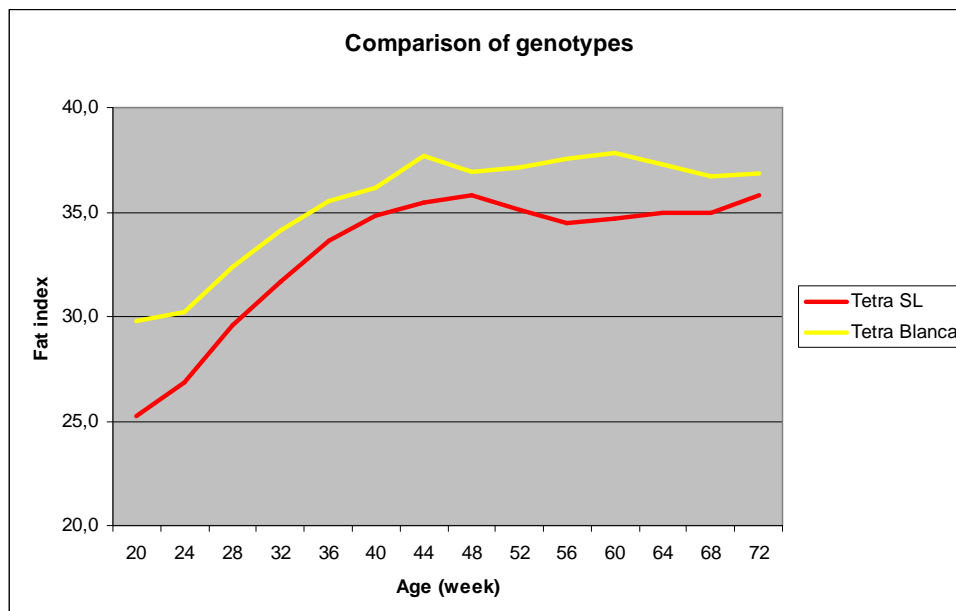


Figure 1: Changes in the fat index of TETRA SL and TETRA Blanca laying hens between 20 and 72 weeks of age

It was also pointed out that the body fat content of the white egg layers was higher than that of the brown egg layers at all examination days.

The body fat content of the hens, which were started the laying period with the highest body fat content, remained the highest in both genotypes during the whole egg laying period (Figure 2 and 3).

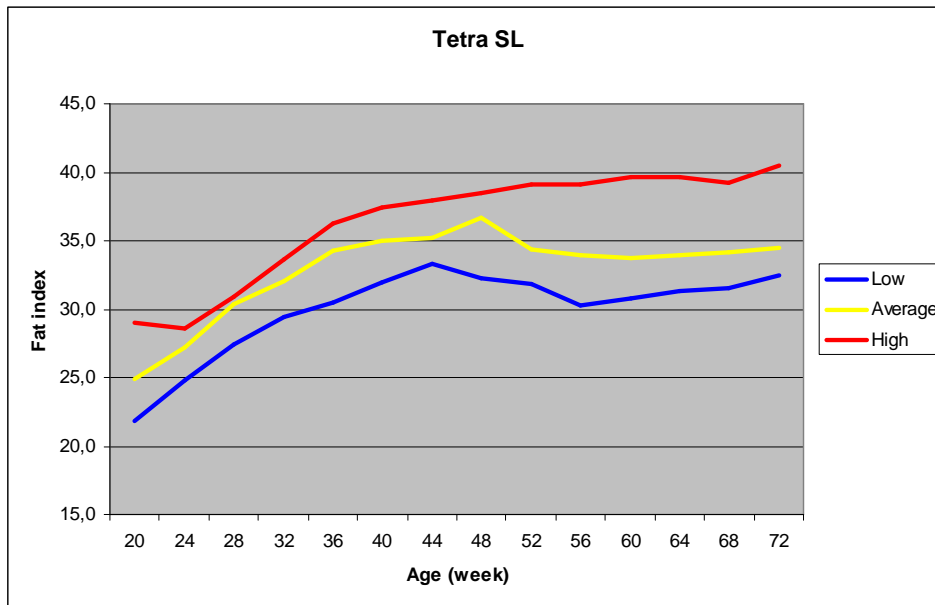


Figure 2: Changes in the fat index of TETRA SL laying hens between 20-72 weeks of age

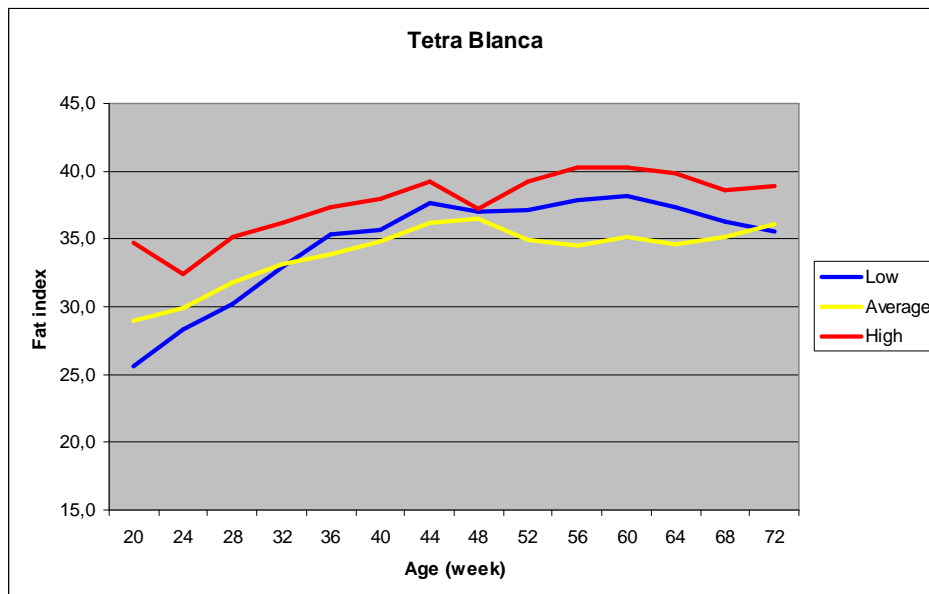


Figure 3: Changes in the fat index of TETRA Blanca laying hens between 20-72 weeks of age

The TETRA SL hens, which were started the laying period with average or low body fat content had the same (average or low) body fat content during the whole experimental period. In the case of the TETRA BLANCA hens the birds, which were started the laying period with low body fat content had higher fat content in their body from the 36th week of age on than those, which had the lowest body fat content at the photostimulation.

Similarly to the changes in the body fat content, the yolk ratio of the eggs produced increased also mainly in the first phase of the experiment and it remained almost at the same level thereafter (*Figure 4.*).

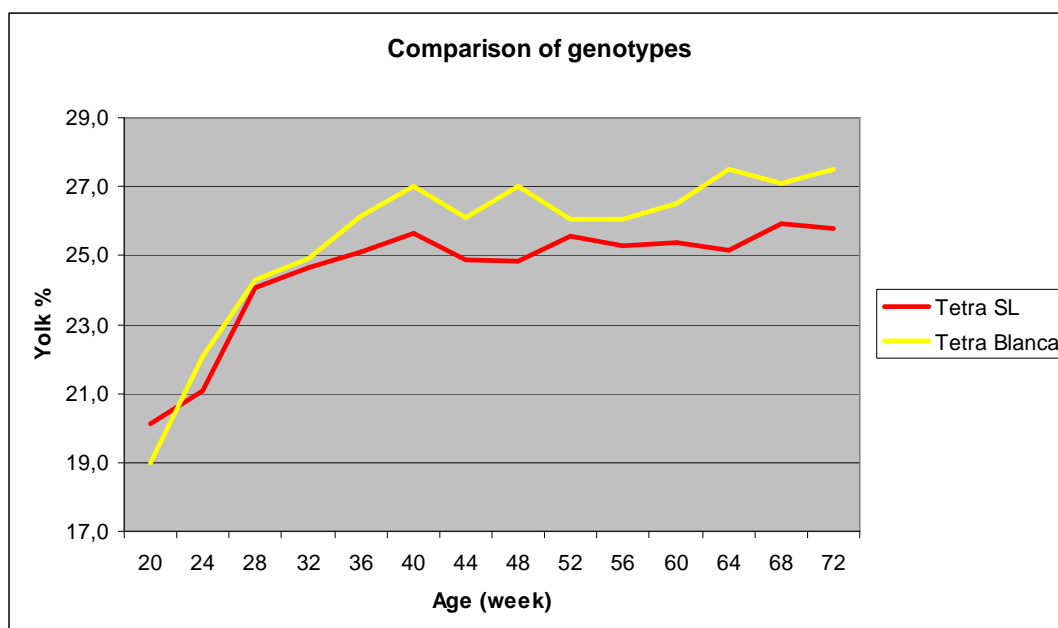


Figure 4: Changes in the yolk ratio of TETRA SL and TETRA Blanca laying hens between 20 and 72 weeks of age

The yolk ratio in the eggs of the TETRA SL and TETRA BLANCA hens was very similar till 32 weeks of age, but the TETRA BLANCA hens produced eggs with higher yolk ratio (+1-2%) thereafter.

In the case of the hens with different body fat content at 20 weeks of age no clear tendencies were observed in the changes of the average yolk ratio in the produced eggs with increasing the starting body fat content of the hens. (Eggs of TETRA SL hens with low body fat content had 24,8 %, with average body fat content 24,2 % and with high body fat content 25 %. Eggs of TETRA BLANCA hens had 24,8 %, 26,9 % and 25,9 % yolk ratio.)

The change in the number of produced eggs during the whole experimental period showed a descending tendency in the TETRA SL genotype with increasing the starting body fat content of the hens (number of produced egg was in the groups 337, 329 and 326). In the case of the TETRA BLANCA hens no clear tendency was observed, but the least number of eggs was produced by those hens also in this case, which had the highest body fat content at 20 weeks of age (hens with low and average body fat content produced 297 eggs, and with high body fat content 288 eggs).

When the egg production of the different genotypes was compared it was found that the TETRA SL hens produced more eggs in every month of the examined period than the TETRA Blanca hens. (*Figure 5.*)

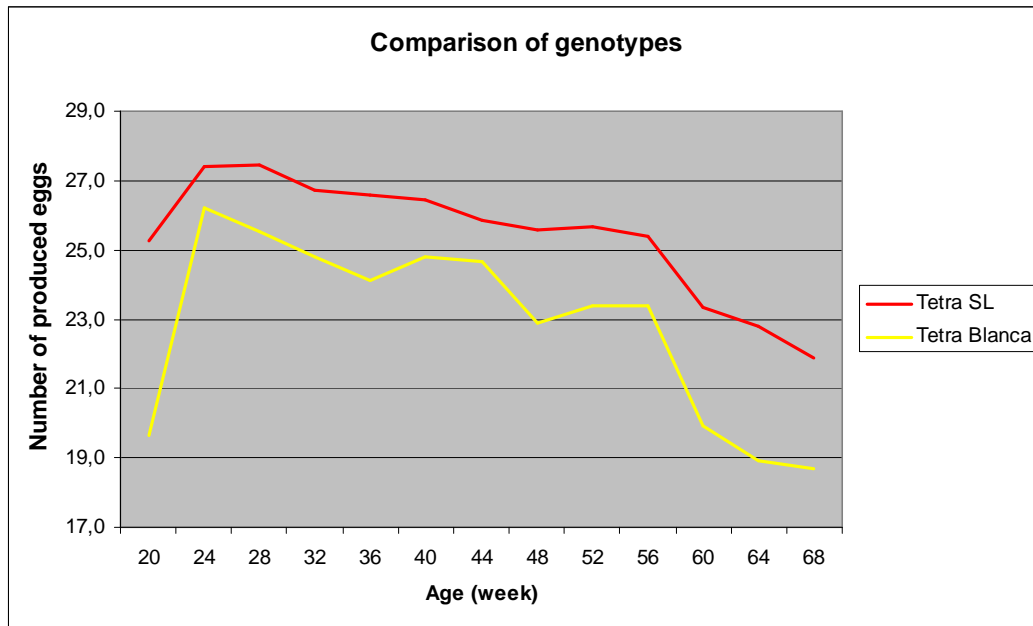


Figure 5: Changes in the number of produced eggs of TETRA SL and TETRA Blanca laying hens between 20 and 72 weeks of age

In the weight of the eggs no significant differences were found between the genotypes, but the hens with average starter body fat content produced lighter eggs than the other two groups in both genotypes.

CONCLUSIONS

The results of this experiment indicates that both of the genotype and the body fat content of the hens at the photostimulation has effect on the egg production and on the changes of body and egg composition during the first egg laying period. To clarify these effects further investigations seem to be needed involving more animals into the trials.

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REFERENCES

- GROSSMANN, M. – Gossman, T. N. – Koops, W. J. (2000): A model for persistency of egg production. *Poultry Science*. 79. (12) 1715-1724.
- POWELL, K. C. (2004): Early lay mortality in broiler breeders – causes, costs and solutions. http://www.ces.ncsu.edu/depts/poulsci/conference_proceedings/broiler_breeder/2004/poweII_2004.pdf
- ROMVÁRI, R. (1996): A komputeres röntgen tomográfia alkalmazásának lehetőségei a húsnyúl és brojlercsirke testösszetételének és vágási kitermelésének in vivo becslésében. Doktori (PhD) értekezés. PANNON Agrártudományi Egyetem, Állattenyésztési Kar, Kaposvár.
- THIRUVENKADAN, A.K. – PANNEERSELVAM, S. – PRABAKARAN, R. (2010): Layer breeding strategies: an overview. *World's Poultry Science Journal*. 66, 477-502.

OCCURRENCE OF *ASPERGILLUS FLAVUS* ON CEREALS IN HUNGARY

BEÁTA TÓTH¹, NIKOLETT BARANYI², ADRIENN BERKI², ORSOLYA TÖRÖK¹, ÉVA KÓTAI¹, ÁKOS MESTERHÁZY¹, JÁNOS VARGA²

¹ Cereal Research Nonprofit Ltd., 6726 Szeged, Alsó kikötő sor 9.

² University of Szeged, Faculty of Science and Informatics, Department of Microbiology, 6726 Szeged, Közép fasor 52.
jvarga@bio.u-szeged.hu

ABSTRACT

Climate change affects the occurrence of fungi and their mycotoxins in our foods and feeds. A shift has recently been observed in the occurrence of aflatoxin producers in Europe, with consequent aflatoxin contamination in agricultural commodities in several European countries not facing with this problem before including Northern Italy, Serbia, Slovenia, Croatia, Romania and Ukraine. Although aflatoxin contamination of agricultural products is not treated as a serious threat to Hungarian agriculture due to climatic conditions, these observations led us to examine the mycobiota and mycotoxin content of different cereals including maize, wheat and barley collected from different locations in Hungary. The surface-sterilized cereal seeds were placed on selective media, and the isolated fungal strains were identified using morphological and sequence-based methods. Several *Aspergillus flavus* isolates were identified, which are potential aflatoxin producers. This species was identified on cereal seeds in different regions of Hungary. Maize, wheat and barley seeds were contaminated with infection rates of 0.83%, 3.17% and 2%, respectively. Further studies are in progress to examine the aflatoxin producing abilities and genetic variability of the isolates, and mycotoxin content of the cereal samples.

Keywords: cereals, *Aspergillus flavus*, aflatoxins, sequence-based identification, climate change

INTRODUCTION

Mycotoxins are secondary metabolites of filamentous fungi which are harmful to animals and humans, and able to provoke various disease symptoms (VARGA et al., 2009a). Aflatoxins are among the most important mycotoxins, which are produced by species assigned to the *Aspergillus* genus. Among the numerous aflatoxins described, aflatoxin B₁ (Figure 1) is the most toxic aflatoxin, being a potent genotoxic carcinogen in laboratory animals and there is strong evidence for its liver carcinogenicity in humans (WILD and TURNER, 2002). Aflatoxin B₁ exhibits hepatocarcinogenic and hepatotoxic properties, and is referred to as the most potent naturally occurring carcinogen. The International Agency for Research on Cancer has classified aflatoxin B₁ as a group I carcinogen (IARC, 1982). The most important producer, *Aspergillus flavus* is also an important pathogen of various cultivated plants including maize, cotton and peanut, and cause serious yield losses throughout the world. Since aflatoxin production is favoured by moisture and high temperature, *A. flavus* is able to produce aflatoxins in warmer, tropical and subtropical climates (VARGA et al., 2009b). Consequently, aflatoxin contamination of agricultural products in countries with temperate climate, including Central European countries is not treated as a serious health hazard. However, climate change associated with global warming seems to change the scenario. Recently, several papers have dealt with the effects of climate change on the appearance of aflatoxin producing fungi and aflatoxins in foods (PATERSON and LIMA, 2010; TIRADO et al., 2010; MIRAGLIA et al., 2009; COTTY and JAIME-GARCIA, 2007). Based on these studies, aflatoxin producing fungi and consequently aflatoxins are expected to become more prevalent with climate change in countries with temperate climate. Indeed, several recent reports have indicated the occurrence of aflatoxin

producing fungi and consequently aflatoxin contamination in agricultural commodities in several European countries that did not face with this problem before, including Northern Italy (GIORNI et al., 2007), Romania (TABUC et al., 2009), Serbia (JAKSIC et al., 2011), Slovenia (TORKAR and VENGUST, 2007) and Croatia (BILANDZIC et al., 2010). Regarding Hungary, RICHARD et al. (1992) examined the mycotoxin producing abilities of 22 isolates collected from various sources in Hungary, and none of the isolates were found to produce aflatoxins. However, more recently, BORBÉLY et al. (2010) have examined mycotoxin levels in cereal samples and mixed feed samples collected in eastern Hungary, and detected AFB₁ levels above the EU limit in some of the samples. Besides, DOBOLYI et al. (2011) identified aflatoxin producing *A. flavus* from maize kernel collected in various parts of Hungary. These observations led us to examine the occurrence of potential aflatoxigenic species in Hungarian cereals. The obtained isolates were identified using morphological and molecular methods.

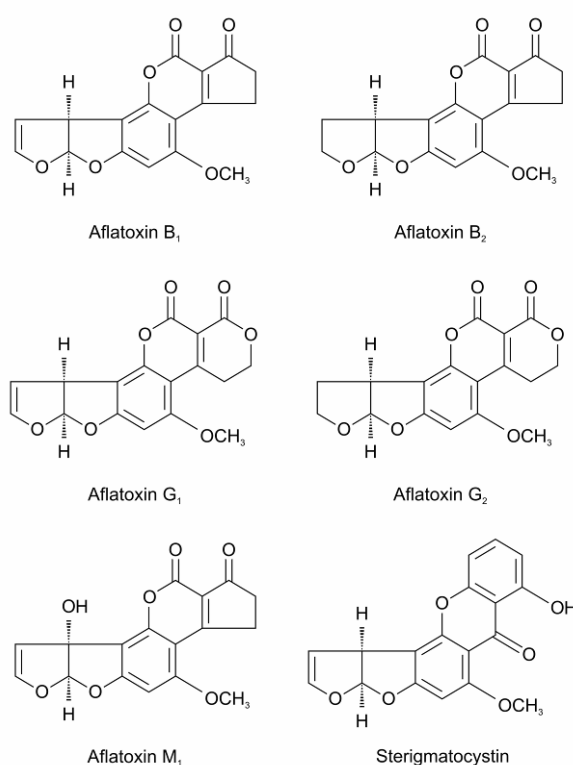


Figure 1. Chemical structures of aflatoxins and sterigmatocystin

MATERIALS AND METHODS

Sample collection

The samples were collected from various cereal growing regions of Hungary in 2010 and 2011. The cereals examined included wheat, maize and barley. The samples were surface sterilized using ethanol, and plated onto dichloran rose bengal (DRBC) media (KING et al., 1979). Plates were incubated at 25 °C in darkness and monitored periodically for characteristic mycelium growing from the kernels. Outgrowing mycelia were purified and transferred to malt extract agar (MEA) and/or Czapek-Yeast Extract agar (CYA) media without antibiotics. Isolates were subcultured as single conidia on MEA, PDA and CYA

plates (SAMSON et al., 2004).

Genotypic studies

The cultures used for the molecular studies were grown on malt peptone (MP) broth for 2 days, and DNA was extracted from the mycelia using the Masterpure™ yeast DNA purification kit (Epicentre Biotechnol.) according to the instructions of the manufacturer. Part of the calmodulin gene was amplified and sequenced as described previously (PILDAIN et al., 2008). Calmodulin sequences were compared using nucleotide-nucleotide BLAST (blastn) with default settings (<http://blast.ncbi.nlm.nih.gov>; ALTSCHUL et al., 1990) to the Genbank database, and to our own sequence database. Species identification was determined from the lowest expect value of the BLAST output.

RESULTS

Several *Aspergillus* species have been identified recently which are able to produce aflatoxins. However, *A. flavus*, *A. parasiticus* and *A. nomius* are the economically most important species regarding aflatoxin contamination of agricultural products (VARGA et al. 2009b). These species can readily be distinguished using sequence analysis of part of their β -tubulin or calmodulin genes (VARGA et al., 2011). In this study, we examined the occurrence of potential aflatoxin producing fungi in cereals in Hungary. The surface-sterilized cereal seeds were placed on selective media, and the isolated fungal strains were identified using morphological and sequence-based methods. The number of primary isolates of each sample was restricted upon the grounds of colony and microscopic features and only the diverging ones were maintained for further investigations. Among the examined samples, several isolates were found to be members of section *Flavi* of the genus *Aspergillus* based on colony morphology and microscopic features (*Figure 2*). Species assignment of the isolates was carried out using partial sequence analysis of the calmodulin gene. In spite of their high morphological variability, concerning the colour of colonies, sporulation, sclerotium formation, and conidiophore structures, all isolates proved to belong to the *Aspergillus flavus* species based on calmodulin sequence data. The proportion of the positive samples varied between 0.83% and 3.17%, depending on the cereal examined (*Table 1*).

CONCLUSIONS

During a survey of aflatoxin producing molds in Hungarian cereal samples in 2010 and 2011, 0.8-3.17% of the maize, wheat and barley samples were found to be contaminated with potentially aflatoxigenic *Aspergillus flavus* isolates. Examination of the aflatoxin producing abilities of the isolates and mycotoxin content of the cereal samples is in progress. A thorough investigation of the mycobiota of other agricultural products also seems to be necessary to estimate the potential effects of climate change on the occurrence of mycotoxin producing Aspergilli in Hungary.



Figure 2. Occurrence of *Aspergillus flavus* in maize seeds collected in Kőszárhegy (left) and Iregszemcse (right)

Table 1. Occurrence of *Aspergillus flavus* on various cereals in Hungary (2010-2011)

Cereal	No. of locations	No. of hybrids/cultivars analyzed	No. of seed samples analysed	No. of <i>A. flavus</i> isolates identified	% of <i>A. flavus</i> -infected samples
Maize	18	6	2160	18	0.83
Wheat	6	4	1200	38	3.17
Barley	3	1	150	3	2.00

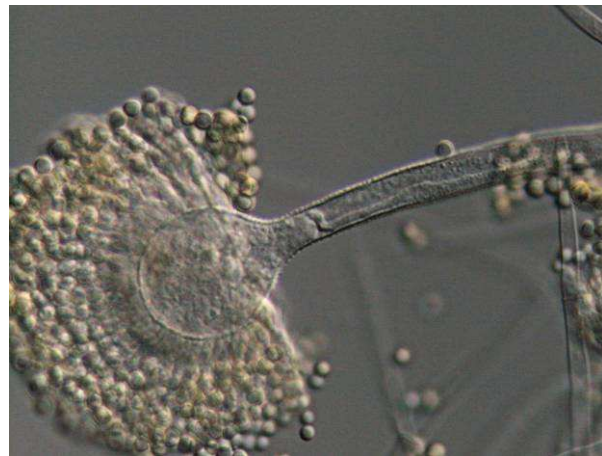
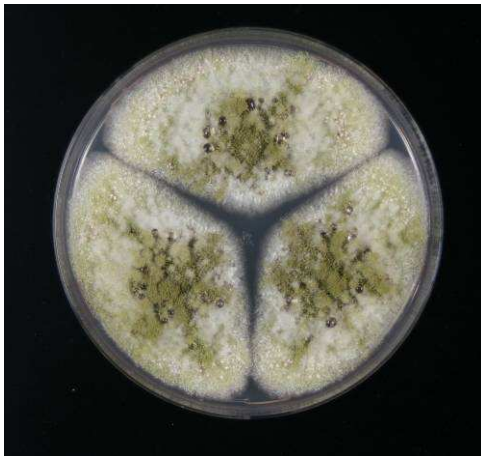


Figure 3. *Aspergillus flavus* colony morphology on CYA medium (left) and microscopic picture of a conidial head (right)

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REFERENCES

- ALTSCHUL, S.F., GISH, W., MILLER, W., MYERS, E.W., LIPMAN, D.J. (1990): Basic local alignment search tool. *Journal of Molecular Biology*, Vol. 215, pp. 403–410.
- BILANDZIC, N., VARENINA, I., SOLOMUN, B. (2010): Aflatoxin M₁ in raw milk in Croatia. *Food Control*, Vol. 21, pp. 1279-1281.
- BORBÉLY, M., SIPOS, P., PELLE, F., GYÖRI, Z. (2010): Mycotoxin contamination in cereals. *Journal of Agroalimentary Processes and Technologies*, Vol. 16, pp. 96-98.
- COTTY, P.J., JAIME-GARCIA, R. (2007): Influences of climate on aflatoxin producing fungi and aflatoxin contamination. *International Journal of Food Microbiology*, Vol. 119, pp. 109-115.
- DOBOLYI, C., SEBŐK, F., VARGA, J., KOCSUBÉ, S., SZIGETI, G., BARANYI, N., SZÉCSI, Á., LUSTYIK, G., MICSINAI, A., TÓTH, B., VARGA, M., KRISZT, B., KUKOLYA, J. (2011): Aflatoxin-termelő *Aspergillus flavus* törzsek előfordulása hazai kukorica szemtermésben. *Növényvédelem*, Vol. 47, pp. 125-133 (in Hungarian).
- GIORNI, P., MAGAN, N., PIETRI, A., BERTUZZI, T., BATTILANI, P. (2007): Studies on *Aspergillus* section *Flavi* isolated from maize in northern Italy. *International Journal of Food Microbiology*, Vol. 113, pp. 330-338.
- IARC (International Agency for Research on Cancer) (1982): The evaluation of the carcinogenic risk of chemicals to humans. IARC Monograph Supplement 4. International Agency for Research on Cancer, Lyon, France, p. 292.
- JAKSIC, S.M., PRUNIC, B.Z., MILANOV, D.S., JAJIC, I.M., ABRAMOVIC, B.F. (2011): Fumonisin and co-occurring mycotoxins in North Serbian corn. *Proceedings of National Sciences Matica Srpska Novi Sad*, Vol. 120, pp. 49-59.
- KING, A.D.JR., HOCKING, A.D., PITT, J.I. (1979): Dichloran-rose bengal medium for enumeration and isolation of molds from foods. *Applied and Environmental Microbiology*, Vol. 37, pp. 959–964.
- MIRAGLIA, M., MARVIN, H.J., KLETER, G.A., BATTILANI, P., BRERA, C., CONI, E., CUBADDA, F., CROCI, L., DE SANTIS, B., DEKKERS, S., FILIPPI, L., HUTJES, R.W., NOORDAM, M.Y., PISANTE, M., PIVA, G., PRANDINI, A., TOTI, L., VAN DEN BORN, G.J., VESPERMANN, A. (2009): Climate change and food safety: an emerging issue with special focus on Europe. *Food Chemistry and Toxicology*, Vol. 47, pp. 1009-1021.
- PATERSON, R.R.M., LIMA, N. (2010): How will climate change affect mycotoxins in food? *Food Research International*, Vol. 43, pp. 1902-1914.
- PILDAIN, M.B., FRISVAD, J.C., VAAMONDE, G., CABRAL, D., VARGA, J., SAMSON, R.A. (2008): Two novel aflatoxin-producing *Aspergillus* species from Argentinean peanuts. *International Journal of Systematic and Evolutionary Microbiology*, Vol. 58, pp. 725-735.
- RICHARD, J.L., BHATNAGAR, D., PETERSON, S., SANDOR, G. (1992): Assessment of aflatoxin and cyclopiazonic acid production by *Aspergillus flavus* isolates from Hungary. *Mycopathologia*, Vol. 120, pp. 183–188.
- SAMSON, R. A., HOEKSTRA, E. S., FRISVAD, J. C. (2004): Introduction to Food- and Airborne Fungi. 7th edition. CBS Fungal Biodiversity, Center, Utrecht, Netherlands.
- TABUC, C., MARIN, D., GUERRE, P., SESAN, T., BAILLY, J.D. (2009): Molds and mycotoxin content of cereals in southeastern Romania. *Journal of Food Protection*, Vol. 72, pp. 662-665.
- TIRADO, M.C., CLARKE, R., JAYKUS, L.A., MCQUATTERS-GOLLOP, A., FRANK, J.M. (2010): Climate change and food safety: A review. *Food Research International*, Vol. 43, pp. 1745-1765.
- TORKAR, K.G., VENGUST, A. (2007): The presence of yeasts, moulds and aflatoxin M₁ in

raw milk and cheese in Slovenia. *Food Control*, Vol. 19, pp. 570-577.

VARGA, J., TÉREN, J., RIGÓ, K., TÓTH, B., KOCSUBÉ, S. (2009a): Gombák másodlagos anyagcseretermékei: mikotoxinok, gombamérgek. JATE Press, Szeged (in Hungarian).

VARGA, J., FRISVAD, J.C., SAMSON, R.A. (2009b): A reappraisal of fungi producing aflatoxins. *World Mycotoxin Journal* Vol. 2, pp. 263-277.

VARGA, J., FRISVAD, J.C., SAMSON, R.A. (2011): Two new aflatoxin producing species, and an overview of *Aspergillus* section *Flavi*. *Studies in Mycology*, Vol. 69, pp. 57-80.

WILD, C. P., TURNER, P. C. (2002): The toxicology of aflatoxins as a basis for public health decisions. *Mutagenesis*, Vol. 17, pp. 471-481.

THE EFFECTS OF GIS ON COMPETITIVENESS

TÖRÖK ÁRON

Corvinus University of Budapest, Department of Agricultural Economics and Rural
Development
1093 Budapest, Fővám tér 8.
aron.torok@uni-corvinus.hu

ABSTRACT

The importance of geographical indicators is continuously increasing and PGI products are currently playing an important role in the first pillar of the EU quality policy. However, the link between PGI products and their competitiveness remains unclear and very little research has been conducted on analysing the competitiveness of products with geographical indication. Therefore, the aim of this paper is to analyse whether products with protected geographical indication have competitive and/or comparative advantage in European markets. In order to meet this aim, the paper analyses the competitiveness of traditional fruit spirits produced by NMS in the EU15 markets. The results suggest that the majority of NMS fruit spirits were both competitive and had a comparative advantage in the EU15 beverages market between 2001 and 2009, although competitive positions have continuously deteriorated after EU accession. The results also suggest that two-way fruit spirit trade with the EU15 was ultimately unsuccessful in quality and in terms of price after EU accession, although country performances differ significantly. From the above results, it appears that NMS are continuously losing market positions in their traditional fruit spirit sector in the EU15 beverages market despite the fact that the majority of these products have a geographical indication. Meeting future challenges requires that this situation be acknowledged within agricultural policy-making and targeted policies for PGI producers be implemented such as the protection of the name of the produce, the enhancement of proper marketing strategies, and the enhancement of competitiveness of PGI producers.

Keywords: PGI, fruit spirit, New Member States

INTRODUCTION

In 2004 and 2007, twelve Central and Eastern European Countries joined the European Union, bringing about several changes in the field of European agriculture. One of the major changes was the transformation of national agricultural trade, as indicated by several authors (BOJNEC-FERTŐ 2007, FERTŐ 2004). EU membership has made the New Member States part of a large market, thereby changing the competitiveness of their agricultural products, realised through agricultural trade. In such an enlarged competitive environment, the role of high-quality, region-specific products have measurably increased. These products, in many cases possessing protected geographical indication (PGI), have special characteristics that European consumers appreciate.

The importance of geographical indicators is increasing and PGI products currently play an important role in the first pillar of the EU quality policy. However, the link between PGI products and their competitiveness remains unclear and very little research has been conducted on analysing the competitiveness of products with geographical indication. Therefore, the aim of this paper is to analyse whether products with protected geographical indication have any competitive and/or comparative advantage in European markets. In order to meet this aim, this paper analyses the competitiveness of traditional spirits produced by the NMS in the EU15 markets. Established Member States have long traditions of producing highly matured spirits

including such famous products as whisky, brandy and cognac, while the NMS have their own specialty – spirits distilled from fruits – and many of them are considered as PGI.

MATERIAL AND METHOD

The various methods elaborated around the theory of revealed comparative advantages provide the basis for this analysis. The original index of revealed comparative advantages was first published by BALASSA in 1965 who defined the following (BALASSA, 1965):

$$B_{ij} = \left(\frac{X_{ij}}{X_{it}} \right) / \left(\frac{X_{nj}}{X_{nt}} \right), \quad (1)$$

where x means export, i indicates a given country, j is for a given product, t stands for a group of products and n for a group of countries. It follows that revealed comparative advantage or disadvantage index of exports to reference countries can be calculated by comparing a given country's export share in its total export - in correlation with the focus country's export share in their total export. If $B > 1$, a given country has a comparative advantage compared to focus countries - or, in contrast, a revealed comparative disadvantage.

Vollrath suggested three different specifications of revealed comparative advantages in order to eliminate the above disadvantages (VOLLRATH, 1991): relative trade advantage index, logarithm of relative export advantage and relative competitiveness. Relative trade advantage index (RTA) takes both exports and imports into account and is the difference between relative export advantage index (RXA) and the relative import advantage index (RMA).

Expressed pro forma:

$$RTA_{ij} = RXA_{ij} - RMA_{ij} \quad (2)$$

where $RXA_{ij} = B_{ij}$ and $RMA_{ij} = (m_{ij} / m_{it}) / (m_{nj} / m_{nt})$ (m means the import), that is,

$$RTA_{ij} = [(x_{ij} / x_{it}) / (x_{nj} / x_{nt})] - [(m_{ij} / m_{it}) / (m_{nj} / m_{nt})] \quad (3)$$

If $RTA > 0$, this reveals that a given country has a comparative advantage compared to focus countries - or, in contrast, a revealed comparative disadvantage. This index takes into consideration effects of demand as well as those of supply therefore it is closer to the comparative advantages approach than indices based on exports.

International and national literature interlinks the model of revealed comparative advantages with new streams of trade theories, allowing the execution of even deeper competitiveness analyses (GEHLHAR-PICK, 2002, FERTŐ, 2004). This approach stresses that price and quality competition in two-way trade is worth separating. To achieve this goal, the literature introduced a new concept: unit value difference (UVD), which is the difference between export and import unit values, defined as follows:

$$UV^x_{ij} = X_{ij} / Q^x_{ij} \text{ and } UV^m_{ij} = M_{ij} / Q^m_{ij}, \text{ so } UVD_{ij} = UV^x_{ij} - UV^m_{ij} \quad (4)$$

where X means export, M means import, Q stands for quantity, i indicates products, and j indicates the partner-country. The formula above means that the difference of a product group's unit value can be defined (UVD) if import unit value (UV^m_{ij}) is deducted from export unit value (UV^x_{ij}); that is, export value achieved from a country's given product group (X_{ij}) is

divided by export quantity (Q_{xij}), then divide import value (M_{ij}) by import quantity (Q_{mij}) and deduct the two values from each other. Trade balance (TB) can also be easily calculated from the formula above: ($TB_{ij} = X_{ij} - M_{ij}$), and is the difference between export and import values of a given product group running to/coming from the focus country.

By using the two new concepts (UVD and TB), the literature creates the following categories in order to separate price-quality competition (GP-INDEX ON THE BASIS OF GEHLHAR-PICK, 2002):

Category A (successful price competition): $TB_{ij} > 0$ and $UVD_{ij} < 0$,

Category B (unsuccessful price competition): $TB_{ij} < 0$ and $UVD_{ij} > 0$,

Category C (successful quality competition): $TB_{ij} > 0$ and $UVD_{ij} > 0$,

Category D (unsuccessful quality competition): $TB_{ij} < 0$ and $UVD_{ij} < 0$

The four categories above are well able to separate what competitive position a country's product groups has from a price and quality point of view. It should not be forgotten that these categories implicitly refer to two-way and not one-way trade (the latter of which means just export or import from a product group).

RESULTS

By analysing competitiveness and comparative advantages of NMS fruit spirit trade with the EU15, it is clear that all four Balassa-indices show similar results for each country analysed, for the exception of Poland, the only examined country without PGI fruit spirit. On the whole, all countries except Poland had a revealed comparative advantage and all were competitive on the EU15 beverages market in the average of the period 2001-2009 (*Table 1*). Values of variation are normal (except for Romania and Slovenia in some cases), indicating small deviations between years. However, in addition to the overall picture, it can be clearly seen that values for Hungary and Poland are fundamentally lower than those for other countries analysed here, indicating that individual country performances differ significantly.

Table 1: Revealed comparative advantages or disadvantages of NMS fruit spirit trade on the EU15 beverages market, based on the average of the period 2001-2009

Denomination	Average, 2001-2009				Variation, 2001-2009 (%)			
	B	RTA	lnRXA	RC	B	RTA	lnRXA	RC
Revealed comparative advantage, if:	>1	>0	>0	>0				
Bulgaria	11.73	11.62	1.78	4.61	20.23	20.27	1.35	2.25
Czech Republic	26.19	25.90	2.73	4.28	30.24	30.16	1.12	1.24
Hungary	4.65	4.55	0.69	2.77	8.80	8.84	1.20	1.26
Poland	0.36	0.32	-1.82	1.55	0.42	0.42	1.52	1.59
Romania	48.25	47.75	2.33	3.44	103.29	103.34	2.14	2.07
Slovenia	31.47	31.10	2.07	3.17	62.79	62.84	2.05	2.32

Source: Authors' own calculations based on EUROSTAT (2011)

In addition to the overall picture, it is worth analysing the ways EU accession has affected the comparative advantages of the NMS fruit spirit sector by using the classification of Hinloopen-van Marrewijk (2001). As indicated in *Figure 1*, revealed comparative advantages of fruit spirits on the EU15 beverages market has been deteriorating since EU accession. While 17% of fruit spirits was in short of comparative advantages in 2004, this indicator has reached 50% by 2008, indicating signs of losing market positions. The share of fruit spirits with strong comparative advantages has remained stable after accession, while that of average comparative advantages remained stable on the regional level (*Figure 1*).

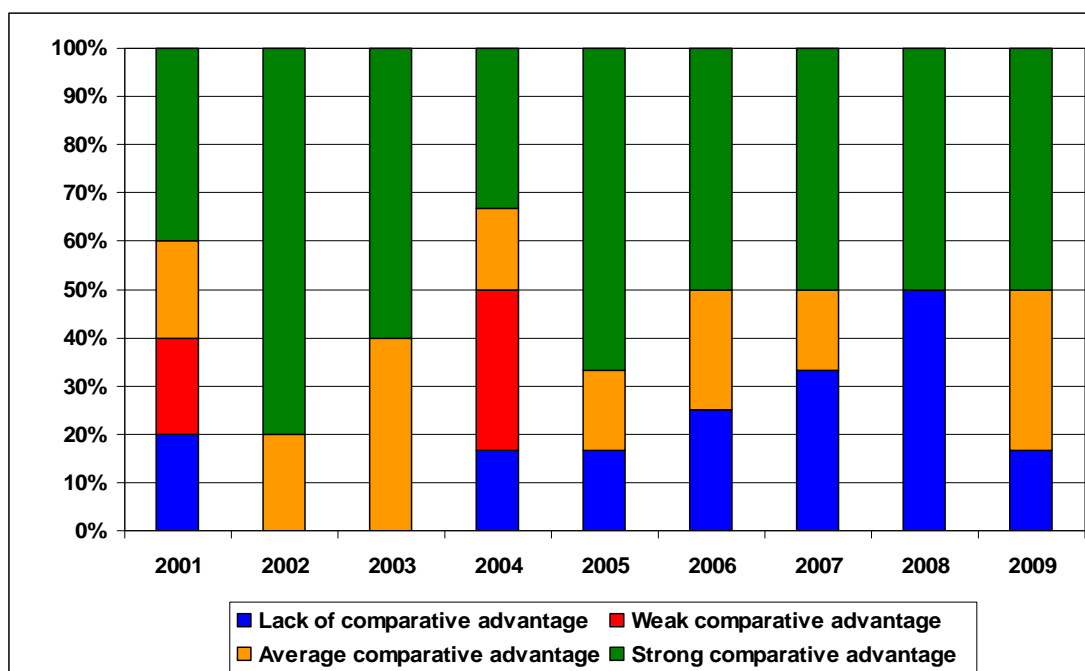


Figure 1: Changes of B-index by categories in the EU15 beverages markets

Source: Author's own composition based on EUROSTAT (2011)

Table 2: GP-indices in the NMS fruit spirit two-way trade by countries and categories*

Country	2001	2002	2003	2004	2005	2006	2007	2008	2009
Bulgaria	D	D	A	A	A	-	B	A	D
Czech Republic	A	C	D	D	B	B	C	C	B
Hungary	C	-	-	A	B	B	B	B	D
Poland	-	-	-	B	B	D	B	D	D
Romania	D	C	B	D	A	-	B	B	B
Slovenia	A	B	B	D	D	D	B	D	D

* A= successful price competition, B = unsuccessful price competition, C = successful quality competition, D = unsuccessful quality competition

Source: Authors' own calculations based on EUROSTAT (2011)

Analysis of price and quality competition in time shows similar results. Two-way fruit spirit trade with the EU15 – which was decisive in the period analysed – was ultimately unsuccessful in quality and in terms of price. It is apparent that a growing number of fruit spirits became unsuccessful in price and quality competition after EU accession, while the

share of successful competition has been diminishing over time. The only one-way trades in some year were caused by the lack of export in some of the selected NMS.

Behind the overall picture, country performances have differed significantly (*Table 2*). Bulgaria and the Czech Republic show signs of successful price and quality competition, in many cases, while other countries analysed can be characterized by unsuccessful price and quality competition in the majority of the cases.

Compared to 2001 when three of the six countries were competitive in two-way fruit spirit trade in the EU15 beverages markets, all countries have become uncompetitive by 2009.

Until now, different indices have been analyzed separately. The aim of the next exploration is, nevertheless, to analyse RTA and GP-indexes together in order to demonstrate the relationship between comparative advantage and price/quality competition. It is hypothesized that the higher comparative advantage a product group has, the higher price/quality competitive position it possesses.

Table 3: Combined RTA and GP-index in NMS fruit spirit trade with EU15

Denomination		RTA			
		2003		2009	
		a	b	a	b
GP	0	0.00	0.20	0.00	0.00
	A	0.00	0.20	0.00	0.00
	B	0.00	0.40	0.00	0.33
	C	0.00	0.00	0.00	0.00
	D	0.00	0.20	0.00	0.67

RTA-index types: a (revealed comparative disadvantage), b (revealed comparative advantage),

GP-index types: 0 (one-way trade), A (successful price competition), B (unsuccessful price competition), C (successful quality competition), D (unsuccessful quality competition)

Source: Authors' own calculations based on EUROSTAT (2011)

It is clearly observable in the example of NMS fruit spirit trade with the EU15 that in 2003 20% of those products with a comparative advantage obtained successful price competition (*Table 3*). This rate changed to zero in 2009, which means that in the EU15 markets, products with a comparative advantage became uncompetitive on both price and quality basis. Products with comparative advantage but unsuccessful quality competition have significantly increased from 2003 to 2009, although the comparative advantages and unsuccessful price competition of these products have slightly decreased.

Moreover, no product existed without a comparative advantage but with a competitive position, although there were many products with a comparative advantage but unsuccessful in competition. It can therefore be concluded that the joint analyses of RTA and GP indices revealed that comparative advantages and competitiveness are not moving together in NMS fruit spirits trade in the EU15 beverages market.

CONCLUSIONS

This paper has analysed the competitiveness of products with protected geographical indications as realised through the NMS fruit spirit trade with the EU15 beverages markets and has reached a number of conclusions. First, it has been revealed that the majority of NMS fruit spirits was both competitive and had a comparative advantage on the EU15 beverages market in the given period, though competitive positions have continuously deteriorated after EU accession. Second, the analysis suggests that two-way fruit spirit trade with the EU15 was ultimately unsuccessful in quality and in terms of price and a growing number of fruit spirits became unsuccessful in price and quality competition after EU accession, although there are significant differences in individual country performances. Third, it also became clear that comparative advantages and competitiveness do not move together in NMS fruit spirits trade on the EU15 beverages market. Fourth, results indicate that the NMS is losing market positions in their traditional fruits spirit sector on the EU15 beverages market despite the fact that the majority of these products have a geographical indication. Meeting future challenges requires that this situation be acknowledged within agricultural policy-making and targeted policies for PGI producers be implemented such as the protection of the name of the produce, the enhancement of proper marketing strategies, and the enhancement of competitiveness of PGI producers.

REFERENCES

- BALASSA, B. [1965]: Trade Liberalization and „Revealed” Comparative Advantage. The Manchester School, Vol. 33. pp. 99–123.
- BOJNEC, S. – FERTŐ, I. [2007]: Determinants of competition in agro-food trade between Central European Countries and the European Union. IAAE-104th EAAE Seminar, Budapest
- FERTŐ, I. [2004]: Agri-Food Trade Between Hungary and the EU, Századvég Publishing, Budapest, Hungary
- GEHLHAR, M. J. – PICK, D. H. [2002]: Food Trade Balances and Unit Values: What can They Reveal about Price Competition? Agribusiness, vol. 18, pp. 61–79.
- HINLOOPEN, J. – VAN MARREWIK, C. [2001]: On the Empirical Distribution of the Balassa Index. Weltwirtschaftliches Archiv, vol. 137 pp. 1-35.
- VOLLRATH, T. L. [1991]: A Theoretical Evaluation of Alternative Trade Intensity Measures of Revealed Comparative Advantage. Weltwirtschaftliches Archiv, Vol. 130 (2) pp. 265–279

THE IMPACT OF DISSEMINATION ON TEENEGERS

NIKOLETT UJHEGYI, LÁSZLÓ PATKÓ, MIKLÓS HELTAI

Szent István University of Gödöllő
Institute for Wildlife Conservation
Gödöllő 2100 Páter Károly St. 1.
raszttiniti@gmail.com

ABSTRACT

Several things can influence us when our opinion is being shaped. Media, traditions and superstitions can be harmful factors of influence. The most receptive and vulnerable age group is the 8-14 year old teenagers. During this period outside impacts are playing decisive role to shape their personality (these effects can predict what kind of person they will become). We have done an attitude survey in this age group. Our question was as follows: Can significant difference be detected between "treated" school group and "control" school group due to the dissemination? A paper-based questionnaire was used, about bats and what children think about bats. The questionnaire included 22 items based on the works of ADDAMS & LINDSEY (2009) and LETENYEI & NAGY (2007). The questionnaires were summarized as "treated" and "control" groups, then Microsoft Excel was used to perform Chi-square tests. From 22 questions only four were shown significant difference and three differences out of four were shown in the control group. The wrong answers percentage was increased all the three times. Treated group was shown strong significant difference ($p=0,001$) in one question ("How do you relate to bats?"). In this case the positive attitude has been increased due to the dissemination. Since there is not any significant difference in the vast majority of these questions (before and after the dissemination), the effect of the dissemination is questionable. Presumably, there will not be increase in the population's knowledge, but the emotional attitude can be changed with dissemination.

Keywords: dissemination, bat, urban wildlife management, questionnaire, teenagers

INTRODUCTION

In recent years, various animals appeared in cities. Wild animals can cause conflicts with public, due to this their management is necessary. This management should be extremely important if the species are protected. The management techniques can only be performed by professionals and within legal limits (ADAM et al., 2006). In the future, urban wildlife manager experts can deal with these problems and these experts' education is solved in wildlife management BSc and MSc. However, the attitude of the population has to be known to create an economically valuable field (HILL et al., 2002). Attitude surveys usually based on questionnaires (KISS et al., 2006; BUDA, 2008) to reject or confirm a just conjecture.

The most receptive and vulnerable age group is the 8-14 year old teenagers. At this age a changeover took place when the teenagers' autonomous decision-making is being developed (LORENZ, 1973; BUDA, 2008; CSEKE, 2010). Because of this, children in this age group are the most suitable individuals to be surveyed and examined the potential changes in their attitude. Only a few similar studies have been done in this field in Hungary (OLÁH, 2010; BOGÁRNÉ, 2008), although questionnaires are being used by urban wildlife management in foreign countries to survey public opinion (ADAMS et al., 2006; ADAMS & LINDSEY, 2009). ADAMS & LINDSEY (2009) released a study guide on questionnaire techniques. CADE et al. (1993) has used this guide to study peregrine falcons in urban environment. Questionnaires were also used in a long-term national monitoring related to mammalian predators and birds of prey (SZEMETHY, 2004).

Some studies in Hungary have shown that scientific knowledge barely depends on the attitude of the 13-17 years old teenagers, but it is highly depends on their inductive thinking, complex problem solving and reading comprehension. Analyzes show us that this knowledge might not comes from formal education but informal studying outside the school (OLÁH, 2010; BOGÁRNÉ, 2008).

Our general question was: Are there any significant differences in the answers of the treated group and the control group? (H_0 = there are not any significant differences. CI= 95%). To find out this, the aims were as follow: (1) compile a flexible, paper-based questionnaire to the teenager age group, (2) survey their general knowledge and their relation to bats, (3) apply the questionnaire to find out if there are any uses of dissemination in the teenager age group.

MATERIAL AND METHOD

We made the survey at Ferenc Erkel Elementary School and the Sándor Petőfi Elementary School. In both schools we chose a 7th class (approximately 13-14 years old) and another one for control group. We distributed the questionnaires (which consist of 22 items) in the classes and three weeks later a dissemination lecture about bats was provided. Three weeks later we distributed the questionnaires to both groups again. Thereafter, the lecture was given for the control groups as well, but it has not influenced the results.

Former researches proved that the paper-based survey is more efficient than computer-based (MOLNÁR, 2010; CSAPÓ et al., 2008, 2009), therefore we choose this way. This method also let us kept contact whit the children, what was important as well. During the compile of the survey we tried to follow the instructions of ADDAMS & LINDSEY (2009) and LETENYEI & NAGY (2007) to get a flexible survey. Thus, during the compile of question we focused on the simple questions which's not require further explanations and can be measured on a scale. We have compiled the questions that the children only have a few alternatives to choose from.

We created the questions and the possible answers according to the language style of the teenager age group. We had a trial-filling with teachers, classmates and friends in order to control its understandably, readability and professionalism. After that, we made the final questionnaire. After the filling, we summarized data and analyzed them with Microsoft Excel. We used Chi²-test to investigate the differences.

RESULTS

In lack of space we only can show the most important result. More than 2/3 of the children have seen bats in their life, and more than the half about these detections were in urban environment.

The changes of the children's basic knowledge and emotional attitude can be seen in *Figure 1*. The vast majority of children know real biological facts about bats but most of them feel negative emotions when they hear the word "bat". The number of answers in "biologically false" has decreased (6% → 1%) and the "negative emotional" answers also decreased (36% → 30%). The percentage of "biologically real" has increased (39% → 49%), although significant difference cannot be shown.

40% of the children did not know the difference between flying and gliding and many of them classify "birds" to flying mammals. Their knowledge did not improved after the

dissemination, but in the control group the incorrect answers percentage has increased (37% → 56%).

After the second questionnaire the percentage of correct answers about the species numbers in Hungary have been increased in both groups (treated: 7% → 19%, control: 4% → 23%) (treated: $n_1=42, n_2=38, x_2=8,280259, df=4, p=0,081835 \rightarrow h_0$ accepted. control: $n_1=48, n_2=47, x_2= 19,63187, df=4, p= 0,00059 \rightarrow h_0$ rejected (strong significance).

After the second questionnaire the percentage of wrong answers about bats protection in Hungary have been increased (treated: 9% → 24%, control: 12% → 32%) (treated: $n_1=43, n_2=37, x_2=3,487228, df=1, p=0,17489 \rightarrow h_0$ accepted, control: $n_1=48, n_2=47, x_2= 6,516891, df=1, p= 0,038448 \rightarrow h_0$ rejected (significant).

Nearly 80% of the children know true biological facts about bats' orientation (e.g.: ultrasound).

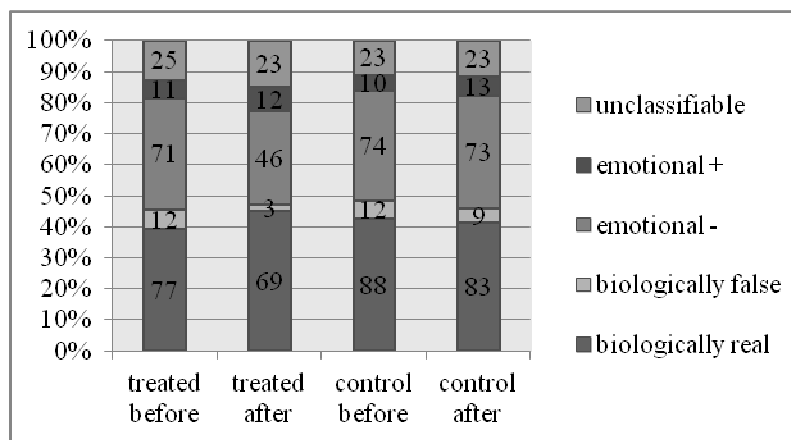


Figure 1. List five features that come to your mind when you hear the word “bat”!

Treated: $n_1=196, n_2=153, x_2=6,10168, df=4, p=0,29645 \rightarrow h_0$ accepted

Control: $n_1=207, n_2=201, \chi^2$ vagy $x_2= 0,884833, df=4, p= 0,884833 \rightarrow h_0$ accepted

The answers about bats diet can be seen in *Figure 2*.

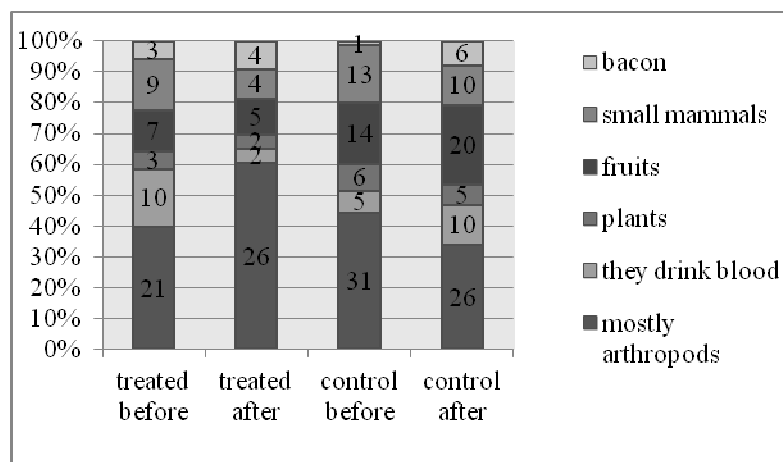


Figure 2. What do bats eat in our country?

Treated: $n_1=53, n_2=43, x_2=7,457852, df=5, p=0,18576 \rightarrow h_0$ accepted

Control: $n_1=70, n_2=77, x_2= 6,900042, df=5, p= 0,22818 \rightarrow h_0$ accepted

Basically, the proportion of correct answers was in the vast majority in both groups. The answer “bacon” increased, “plants” and “fruits” decreased in both group. The percentage of the correct answer (“mostly arthropods”) increased in the treated group (39% →60%), but decreased in the control (44% →33%), however this is not a significance difference. The children’s knowledge about bats’ winter hibernation is mainly correct. In the control group the incorrect answers percentage significantly increased. Treated: $n_1=42, n_2=36, x_2=0,956597, df=2, p=0,956597 \rightarrow h_0$ accepted, Control: $n_1=49, n_2=46, x_2= 6,361607, df=2, p= 0,041552 \rightarrow h_0$ rejected. Questions about attitudes and emotions are rearranged after the second questionnaire. At *Figure 3.* and *4.* it can be seen that neutral emotions (for example: “I don’t know” or “I don’t mind”) have changed into extreme emotions (“I like them” or “Very useful”).

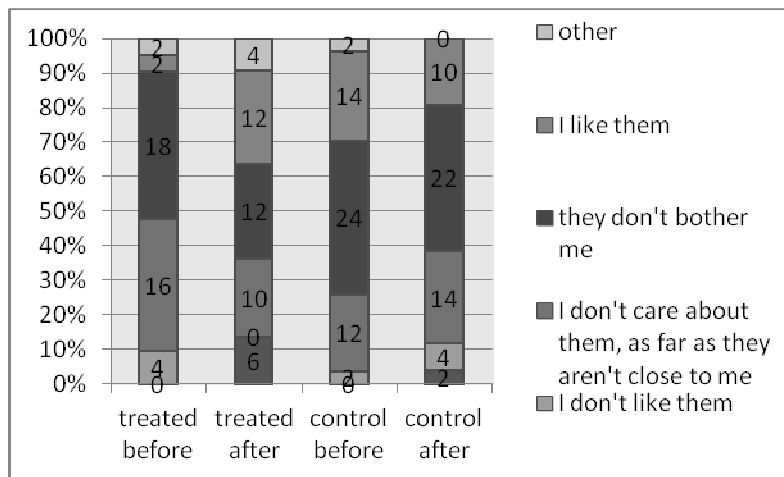


Figure 3. How do you relate to bats?

Treated: $n_1=42, n_2=44, x_2=20,35864, df=5, p=0,00107 \rightarrow h_0$ rejected (strong significance)
 Control: $n_1=54, n_2=52, x_2= 5,538372, df=5, p= 0,35376 \rightarrow h_0$ accepted

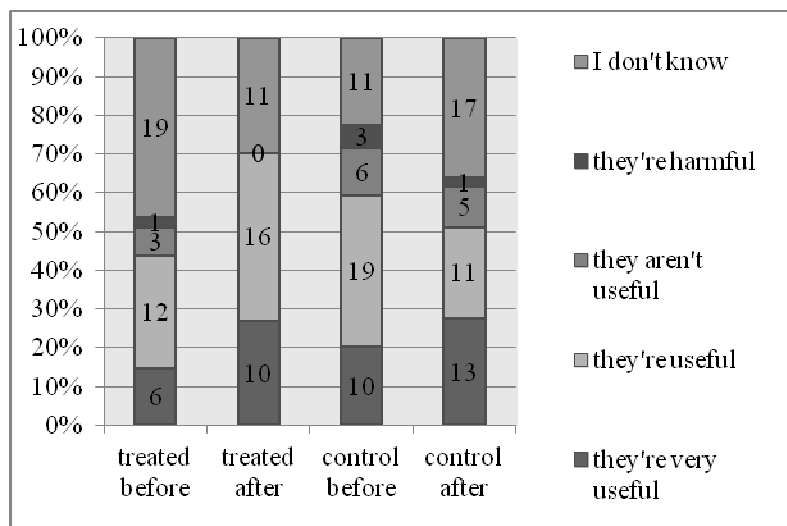


Figure 4. What do you think about bats?

Treated: $n_1=41, n_2=37, \chi^2$ vagy $x_2=6,61697, df=4, p=0,11086 \rightarrow h_0$ accepted
 Control: $n_1=49, n_2=47, \chi^2$ vagy $x_2= 4,861705, df=4, p= 0,30178 \rightarrow h_0$ accepted

The percentage of “I like them” (4% → 27%) and “I don’t like” (0% → 11%) has been increased. The negative emotions have been increased in the control group (*Figure 3.*).

The numbers of answers in the “I don’t know” category have been decreased. The answers in “they’re harmful” and “they aren’t useful” categories have been decreased in both groups. The percentage of “they’re useful” has increased (29% → 43%) in the treated group, but decreased (38% → 23%) in the control group. The percentage of “they’re very useful” has been increased in both groups (treated: 14% → 27%, control: 20% → 27%) (*Figure 4.*).

CONCLUSIONS

Generally, we can say that we have received some unexpected results. In most of the questions there were not many significant differences between the treated and the control group. The number of „emotionally negative” answers did not decrease significantly and number of „biologically real” answers did not increase significantly. Basically, the number of the incorrect answers did not decrease after the dissemination course, but the number of incorrect answers increased at the control group. So it is possible that the dissemination course has not conveyed the effect of “dissemination”.

In the control group, there were significant changes in the rate of correct and incorrect answers, thus it is possible that the children looked the correct answers up at home, or persuaded each other what were the right or wrong answers. A good example for the increasing number of incorrect answers in the control group was the answer “flying squirrel”, for the question “Do you know any other mammal species beside bats, which able to fly?”. A good example for the increasing number of right answers was the correct answers about bats’ orientation.

There were more accurate changes in emotions. The given answers in the “unclassified” category have decreased, but the number of the extreme emotions has increased (*Figure 1.*). A good example for the extreme emotions might be the increase in “I like them” answers and the increase in “I don’t like” answers (*Figure 3.*).

Our results show us that, the knowledge about bats has not been increased (although there was a minimal development), the changes mostly realized in the children’s attitude. The raw data about species might not help in the attitude changes, but the lecturer and his/her emotions that he/she conveyed. Our suggestion is to divide the treated and the control groups in different schools, so it can be avoided that they can speak to each other about the tests. If the answers will be the same with the modified method, then the dissemination campaigns effect is questionable.

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REFERENCES

- ADAMS, C.E., LINDSEY, K.J. (2009): Urban wildlife management second edition. CRC Press Inc 432 pp.
- ADAMS, V.E., LINDSEY, K.J. (2006): Urban wildlife management by CRC Press - 328 pp
- BOGÁRNÉ NÉMETH, M. (2008): Az iskolában szerzett természettudományos tudás tanórán kívüli alkalmazhatóságának változása 1999 és 2006 között. in: VIII. Országos Neveléstudományi Konferencia Budapest, 2008. november 13–15. ed.: PERJÉS, I. and OLLÉ, J. Aula Nyomda, Budapest 348 pp.
- BUDA, M. (2008): Iskolai zaklatás- Egy kutatás első tanulságai az elmélet és a gyakorlat számára. in: VIII. Országos Neveléstudományi Konferencia Budapest, 2008. november 13–15. szerk: Perjés, I. és Ollé, J. Aula Nyomda, Budapest 348 pp.
- CADE, T.J., MARTELL, M., REDIG, P., SEPTON, G.A. and TORDOFF, H.B. (1993): Peregrine Falcons in Urban North America. In: D. BIRD, D. VARLAND and J. NEGRO (ed.). Raptors in Urban Landscapes, Academic Press INC, San Diego 387 pp.
- CSAPÓ, B., MOLNÁR, GY. and R. TÓTH, K. (2008): A papír alapú teszteltől a számítógépes adaptív tesztelésig: a pedagógiai mérés-értékelés technikájának fejlődési tendenciái. Iskolakultúra, 3-4. sz. 3-16.
- CSAPÓ, B., MOLNÁR, GY., PAP-SZIGETI, R. and R. TÓTH, K. (2009): A mérés-értékelés új tendenciái, a papír alapú teszteléstől az online tesztelésig. In: PERJÉS ISTVÁN and KOZMA TAMÁS (ed.): Új kutatások a neveléstudományokban. Hatékony tudomány, pedagógiai kultúra, sikeres iskola. Magyar Tudományos Akadémia, Budapest. 99-108.
- CSEKE, B. (2010): A média hatása a gyermekek kulturálódási folyamataira. Hallgatói dolgozat BTK
- [http1: Ipsos Média, -Reklám,-Piac és Véleménykutató zrt kid.comm. A 8-14 éves gyerekek kommunikációs szokásai 2008](http://www.ipsosmedia.com)
- http://www.mediatanacs.hu/elemezsek/21/1234535285kidcomm_20090213.pdf
- [http2: <http://folk.uio.no/ohammer/past/>](http://folk.uio.no/ohammer/past/)
- KISS, P., SZABÓ, M., UJHELYI, A. and BERKICS, M. (2006): Kutatásmódszertan: szociálpszichológia. Bölcsész konzorcium. 306 pp.
- LETENYEI, L. and NAGY, D. G. (2007): A standard kérdőív kritikái és javaslat a kérdőíves adatgyűjtés terepközeli alkalmazására* in: Szociológiai Szemle 2007/1–2, 29–46.
- LORENZ, K. (1973): A civilizált emberiség nyolc halálos bűne. Cartaphilus Kiadói KFT. 2001 134 pp.
- MOLNÁR, GY. (2010): Papír- és számítógép-alapú tesztelés összehasonlító vizsgálata problémamegoldó környezetben. In: PERJÉS ISTVÁN and KOZMA TAMÁS (ed.): Új Kutatások a Neveléstudományokban. Aula Kiadó, Corvinus Egyetem, Budapest. 135-144.
- OLÁH, M. (2010): A természettudományos oktatás helyzete tanulók kérdőíves felmérése alapján. in: DE--TEK--Természettudományi és Technológiai Kar--Biológiai és Ökológiai Intézet. Hallgatói dolgozat
- SZEMETHY, L. (2004): A vadgazdálkodás szempontjából fontos emlős ragadozók és ragadozó madarak hosszútávú országos, kérdőíves adatgyűjtésen alapuló monitoringja in: Life Natura Projekt

THE NECESSITY OF A FLOOD RISK MANAGEMENT STRATEGY FOR A SUSTAINABLE RURAL DEVELOPMENT

RALUCA VĂDUVA

“Politehnica” University of Timișoara
Department of Hydrotechnical Engineering
Timișoara, George Enescu Street, No 1A, 300022
ralucavdv@yahoo.com

ABSTRACT

Flooding is a natural process; they become a risk to society as human develop activities in the riparian areas without paying attention to the measures required by each situation. In rural areas, floods have significant impacts on agriculture and can cause visible damages for property and settlements, as a consequence of land cover change. The development plans of rural areas must take into account the Directive 2007/60/EC on the assessment and management of flood risk, because its implementation is a necessary measure for a sustainable development. Flood risk management re presents the application of policies, procedures and practices, having as objectives risk identification, their analysis and assessment, treatment, monitoring and reassessment of risks in order to reduce them, undertaking of preventive measures in order to limit the effects of floods. The core objective of the research is to enhance the role of the land use planning in the flood risk management plans. Planning purposes to guide the new development of the area to reduce the vulnerability and the flood risk; if not, the development could be compromised. The article includes several proposals for the issues which must be taken into account for a flood risk strategy.

Keywords: floods, land use planning, rural areas, flood risk management strategy, sustainable development

INTRODUCTION

Floods are a natural phase of the water cycle, resulting from the temporary covering by water of land that is normally dry. Vulnerability to floods increased as human occupation of floodplains intensified. Floodplains and deltas offer favourable conditions for human settlement and economic development (VIS et al, 2003): floodplains provide fertile farmland, drinking water, food and they act as corridors for transport etc (PETROW et al, 2006). The rural space appeared with the arising of first settlement and first amenities in order to achieve agricultural production. Under the impact of industrialization and urbanization, in rural space there are obvious structural changes, amenities and improvements to increase the capacity of production of farmland, development of communication routes and the quality of live. At the same time, rivers have negative effects on human activities and human himself, so settlements may experience high damage if they are affected by floods. This is the case when human activities in the river channel and the adjacent floodplain have been developed without taking into account the associated risks (UNECE, 2009). Many floodplains have been embanked, streamlined and drained for agricultural purposes. This had a negative impact on the river bad, as the appearance of flood events was enabled. Water flows rapidly, through a narrow channel, and the flash flood is amplified. Floods in the river floodplains should be seen as a normal process; that is the nature of things as continuous rain causes the river to overflow their usual banks and human activities such as agriculture, industry, roads or human settlements been affected. Due to an increasingly human intervention on natural system, its normal evolution is disturbed. If the changes are fundamental, the intervention breaks the rhythm of the natural evolution (IANOȘ, 2000). Human interventions in the river runoff, deforestation or intensive grazing play an important role in the evolution of the system.

The land cover change caused a disorder of water cycle, by accelerating the runoff and the soil erosion and by reducing water infiltration into the soil. Human intervention on the environment must be limited to certain intensity and certain components because of the brutal intervention that generates instability in the system.

Risk (an expression of the combination of the flood probability and the magnitude of the potentially adverse effects for human health, environment, cultural patrimony and economic activity) is inherently related to human presence in a certain area, because human is able to understand the causes and the consequences of the natural hazard. The existence of a community impose the term of “risk”, if the society would not exist (people and material goods), then we would only talk about the term of “natural hazard” (which is viewed as a naturally occurring or human-induced devastating event, in a certain period and for a certain territory) (ARMAŞ, 2006). A flood produces in unpopulated areas, where the natural land cover had not suffered changes (so it is not used for agricultural or settlement use), would cause less damages than a similar one, where anthropic intervention is visible. Although the environment and natural landscape are very important for society, they are less priority than threats to people life or property. An absolute protection against floods shall never be possible, and floods risk management is not a synonymous to flood protection. Floods cannot be prevented, but it can be mitigated by technical measures. Therefore, a flood management plan in a hydrographical basin should focus on the activities of preparedness and prevention, for a sustainable protection against floods.

There are many areas which are already undergoing a periodical risk to floods, and after such an event, everyone agrees that measures must be taken, but nobody dares to implement them for a better protection against floods. As time passes by, such measures seem to be partially abandoned and forgotten, even if they are legally required, although these are precisely the opportunities to adopt the policies against floods. Three causes explain this: the absence of a planning framework of the land (in default of any control regulation of the land market), the absence of competent authorities, able to take measures for such purpose and human’s indifference. The process of learning from past experiences and possibly past mistakes needs to be improved. Examples from past situations should be assessed, documented, taken into account for a good planning and for a good risk management. A new flood should be the feedback into the risk management cycle.

MATERIAL AND METHOD

This article is about the importance of land use planning and how it should be integrated in a flood risk strategy management for a sustainable development. The effects of climate change, as the production of more violent rainfall (after a period of drought) will increase the floods risk in areas which have never been flooded before. Therefore, the planning process must take it into account and must integrate flood risk, starting from a local scale, up to regional, national and cross-border. Thus, planning must integrate the flood vulnerability and flood risk, from local scale, continuing with regional, national and even transboundary scale. Land use planning is a step in the activity of flood prevention and it is managed by the public sector. Thus, it will be promoted a control of land use for a new development, reducing or limiting the impact of natural disaster (SMITH, PETLEY, 2009). To manage flood risk, the planning authorities must take into account the development trends of society, both long and short time. Also, the communities have to manage effectively the land use and the development in flood-prone areas. Early identification and communication of risk is viewed as a factor in community’s success.

The research points the most important aspects that should be pursued in the development of localities: population, settlements and economic activities. Each of these aspects may be at flood risk, so must be protected from any potential damage.

RESULTS

Flooding can cause significant detrimental environmental effects (like soil erosion, bank erosion, land sliding and damages to vegetation), damages to the infrastructure and properties, but the most important is the social impact (like the physical injury, illness and loss of life). In most cases, social and environmental flood risks are often neglected, because risk assessment often focuses to damages that can be easily measured in monetary terms. The ability of people to respond and recover from a flood can vary. Vulnerable people, such as those who are old, disabled or have a long-term illness, are less able to cope with floods than others. Some people may have difficulty in replacing household items damaged in a flood and may lack the financial means to recover and maintain acceptable living conditions after a flood (<http://www.flooding.ie/en/>).

Tunstall, Johnson and Penning Roswell (2004), identified, in the flood hazard context in UK, three phases of change, each characterised by terms commonly used at the time to describe the main policy approach:

- land drainage (focused on structural flood defences);
- flood defence (with flood warning systems and public awareness raising);
- flood risk management (with land use planning and development control for flood risk areas). In flood risk management most attention is given to prevention and mitigation.

Flood risk management strategies should follow all the steps of the risk management cycle: preparedness, response, recovery and reconditioning of the management system. Preparedness aim is to minimize the vulnerability of people and material assets to natural hazards through preventive (like land use planning, hazard assessment and hazard maps, technical and biological measures) and precautionary measures. The main duty is to correctly convert the results of the disaster-analysis and to integrate them into planning (<http://www.planat.ch/>).

Land use planning is beneficial because it promotes a better quality of the environment in certain areas, creating better conditions for development and investment. The flood risk management strategy has to promote sustainable land use practices, particularly in vulnerable areas. Here are some directions to be applied in the land use planning: care for the environment, care for the people, their settlements and their activities.

Farmland

Agriculture still plays a dominant position in the land use and countryside, although this economic sector suffered a decline in recent years. Spontaneous vegetation diminished the surface due to increased demand for agriculture land, being mostly replaced with crop plants. Unsustainable agricultural practices, such as downslope ploughing, suppression of hedged farmland or fragmentation of plots, enhance the effects of floods (CHAMLEY, 2003). The decline of agriculture is best seen in periurban areas, where the extension of cities and industrial sites changed the land use. So, many farmlands were replaced with impervious surfaces, namely buildings and paved areas. These land cover changes will modify the infiltration of precipitation, the evapotranspiration, the soil moisture, the interception and accumulation of water in microdepressions, the surface runoff and even the drainage basin.

A solution of this is the control of new development, on the one hand promoting the re-use

of brownfield and on the other hand the protection against hazards (SMITH, PETLEY, 2009, UNECE, 2008). Re-use of land is necessary because it protects the greenfield land and reduces the degradation of the natural system. Land most vulnerable to flooding should be used as grassland and meadows, and if it used as arable land, people should take out property insurance in case of floods, to recover the losses.

Settlements

In most cases, the development of rural settlements has been made without taking into account the further rapid development. Settlements situated in river floodplains are most vulnerable, especially in densely populated areas, where measures of prevention and protection are low. The flooding hazard is increased also due to deforestation practices or due to rapid snow melting or dam breaking.

Particularly in periurban areas, local authorities tend to allow new, but unsustainable development plans, obtaining rapidly financial resources. A sustainable rural development aims to improve the quality of people's life, preserving the landscape and permitting a controlled development of the rural area: not only what investor wants, but also what the environment allows. There is a close relationship between the intensity of flooding and the area affected by flood; the higher are the intensity and duration of the rainfall, the greater the surface will be flooded. So, the identification of flooding areas and the classification of flood vulnerability of different types of development are essential. We distinguish three types or levels of flood zones: high, moderate and low probability of flooding. So, the use of high probability of flooding zone should be avoided for settlement development, it should be used for grassland and meadow. If there is a construction in these areas, the solution would be to transfer it in a safe area. People should be also encouraged to take out home insurance to recover the cost necessary for reconstruction. For each case, it is necessary to identify priority areas for land use planning or solving the existing problems. Floodplains are important in attenuating or storing floodwater, so areas of floodplain and wetlands should be recognized and preserved to the extent possible as natural defences against flood risk. This is an important element of the now internationally accepted philosophy of "giving more space to the rivers".

The social dimension

Flooding can cause significant detrimental environmental effects (like soil erosion, bank erosion, land sliding and damages to vegetation, impacts on water quality, habitats and flora and fauna caused by bacteria and other pollutants carried by flood water), damages to the infrastructure and properties, but the most important is the social impact (like the physical injury, illness and loss of life) (<http://www.environ.ie>). In addition to number of deaths during the event, a large number of people would be unsheltered or would live in makeshift camps and the society would suffer economic losses, mainly as agricultural losses.

In most cases, social and environmental flood risks are often neglected, because risk assessment often focuses to damages that can be easily measured in monetary terms. The ability of people to respond and recover from a flood can vary. Vulnerable people, such as those who are old, disabled or have a long-term illness, are less able to cope with floods than others. Some people may have difficulty in replacing household items damaged in a flood and may lack the financial means to recover and maintain acceptable living conditions after a flood (<http://www.flooding.ie>).

Flood risk strategy management should take into account the good communication and cooperation between authorities, different specialists and community. Also, a risk culture is required because it allows and enables society to assess, evaluate and show the prevailing risks and their changes as well as the necessary protection measures. Although people

know that floods and other natural phenomena exist, they often find it hard to recognise it. It is easily to attribute the problems elsewhere, to somewhere safely, behind a blue door. Land use controls are most successful in areas that are growing and still have undeveloped land available. In areas where the pressure for land development is high, zoning will be less effective. There are some limitations of land use planning, like the presence of existing development, high cost of hazard mapping, local resistance to land controls, market forces, and even the opposition of authorities (SMITH, PETLEY, 2009).

CONCLUSIONS

People shape the environment, building settlements and working the farmland. These artificial changes in the natural system cannot remain without effect on the hydrological cycle. Extreme phenomena such as floods have caused damages to the environment, to the socio-economic system, even loss of human life. Early identification and communication of risk is viewed as a factor in community's success. The uncertainty, fear and lack of useful information to guide individual and common actions are risk factors that affect personal and community's safety. In this sense, land use planning authorities have to establish flood risk management plans, focusing on prevention, protection and preparedness.

The flood risk management strategy should aim to reduce the potential risks to people, property and environment through a sustainable land use planning. The community and local authorities have to manage effectively the development of settlements in flood-prone areas and the land use. Development should be located in areas with little or no flood hazard, thereby avoiding or minimizing the risk. It is preferably to chose lower risk flood zones for new development.

An absolute protection against floods will never be possible, so we have to learn how to live with floods.

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REFERENCES

- CHAMLEY, H., (2003): Geosciences, environment and man. Elsevier Science, Amsterdam, pp. 527.
- IANOȘ, I., (2000): Sisteme teritoriale. O abordare geografică. Ed. Tehnică, București, pp. 197.
- PETROW, T., THIEKEN, A.H., KREIBICH, H., BAHLBURG, C.H., MERZ, B., (2006): Improvements on Flood Alleviation in Germany: Lessons Learned from the Elbe Flood in August 2002, in Environmental Management, Volume 38, Number 5, pp. 717-732.
- SMITH, K., PETLEY, D., (2009): Environmental hazards: assessing risk and reducing disaster. 5th edition. Ed. Routledge, London, pp. 383.
- TUNSTALL, S.M., JOHNSON, C.L., PENNING ROWSELL, E.C., (2004): Flood Hazard Management in England and Wales: From Land Drainage to Flood Risk Management, at

World Congress on Natural Disaster Mitigation, 19-21.02.2004, New Delhi, Volume 2, pp. 447-454.

VIS, M., KLIJN, F., DE BRUIJN, K.M., VAN BUUREN, M., (2003): Resilience strategies for flood risk management in the Netherlands, in International Journal of River Basin Management, Volume 1, Number 1, pp. 33-40.

Directive 2007/60/EC of the European Parliament and of the Council of 23 October 2007 on the assessment and management of flood risks, Available on <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2007:288:0027:0034:EN:PDF>, Accessed on 20 February 2012.

<http://www.environ.ie/en/Publications/DevelopmentandHousing/Planning/FileDownload,21708,en.pdf>, accessed on 25 February 2012.

<http://www.flooding.ie/en/>, accessed on 28 February 2012.

http://www.unece.org/fileadmin/DAM/hlm/documents/Publications/spatial_planning.e.pdf, United Nations Economic Commission For Europe (UNECE), (2008): Spatial planning: Key Instrument for Development and Effective Governance with Special Reference to Countries in Transition (accessed on 24 February 2012).

<http://www.unece.org/publications/oes/>, United Nations Economic Commission For Europe (UNECE), (2009): Transboundary flood risk management: experiences from the UNECE region, published by United Nations (UN), (accessed on 24 February 2012).

<http://www.planat.ch/en/specialists/risk-management/>, (accessed on 25 February 2012);

http://www.unibuc.ro/uploads_ro/49903/1770/hazard_risc.pdf, Armaş, I., Riscuri naturale (cultura riscului), 2006, (accessed on 25 February 2012);

THE EFFECT OF FERTILIZATION AND LIMING ON SOME GRAIN QUALITY PROPERTIES OF WHEAT

VESELINKA ZEČEVIĆ¹, JELENA BOŠKOVIĆ¹, DESIMIR KNEŽEVIĆ², DANICA MIĆANOVIĆ³

¹ Faculty of Biofarming, Bačka Topola, Megatrend University Belgrade, Serbia

² Faculty of Agriculture, Zubin Potok, University of Pristina, Serbia

³ Serbian Chamber of Commerce, Belgrade, Serbia

joca@kg.ac.rs

ABSTRACT

The present research was carried out to investigate fertilizer and lime effect on some grain quality properties of wheat cultivars (thousand grain weight and hectoliter weight). The experiment was set up at the experimental field of the Small Grains Research Centre Kragujevac over 2003/2004-2004/2005 seasons. The soil was smonitza (vertisol) with very high natural acidity. The trial consisted of a completely randomized block experimental design with three replications, the size of each plot being 14 m². The research included six winter wheat varieties (Takovčanka, Studenica, KG-100, Matica, Ana Morava and Toplica) created in Small Grains Research Centre of Kragujevac. The following variants of fertilization were applied: Control -T₁ (no fertilization), mineral fertilizer-T₂ (500 kg ha⁻¹ NPK - 15:15:15), nitrogen fertilizer + lime fertilizer-T₃ (75 kg N ha⁻¹ in form of KAN + 2.0 t ha⁻¹ CaCO₃ in form of "Njival Ca" - 98.5% CaCO₃), mineral fertilizer + lime fertilizer-T₄ (500 kg ha⁻¹ NPK + 2.0 t ha⁻¹ CaCO₃), and mineral fertilizer + lime fertilizer + organic fertilizer -T₅ (500 kg ha⁻¹ NPK + 2.0 t ha⁻¹ CaCO₃ + 35.0 t ha⁻¹ manure). The results showed significant influence of all kinds of fertilizers on the physical grain quality properties of wheat (thousand grain weight and hectoliter weight). The best results for both these components have been achieved with the combination of fertilizers (500 kg ha⁻¹ NPK + 2.0 t ha⁻¹ CaCO₃ + 35.0 t ha⁻¹ of manure). High values for thousand grain weight and hectoliter weight were also recorded in the application of NPK fertilizers only. The lowest value for this properties are achieved in the control treatment (no fertilizer), and then on the combined fertilizers (N + CaCO₃).

Key words: wheat, 1000-grain weight, hectoliter weight, fertilization, acid soil

INTRODUCTION

Acid soils reduce crop production in 30-40% of the total world's arable land and 70% of potentially arable land. Acid soils in the Republic of Serbia account for more than 60% of total arable land, and most acid soils are located in the central parts of Serbia (STEVANOVIĆ et al., 1995). The acidity of these soils, their high contents of H⁺ ions and low contents of essential plant nutrients, primarily P and Ca, are limiting factors for high yield of cultivated cereal crops. Acid soils have increased iron content, aluminum and other toxic elements and heavy metals, and have low productive capacity and poor chemical, biological, physical and water-air properties. These soils can be improved by different ameliorative interventions, like calcification and fertilization.

Soil acidity and associated infertility and mineral toxicities are major constraints to agricultural production in several parts of the world. The natural process of soil acidification is often intensified by agricultural practices, particularly nitrogen fertilization, and acid precipitation (RAO et al., 1993). Aluminium toxicity is a major yield-limiting factor in winter wheat production in many parts of the world (KARIUKI et al., 2007). Low-acidity soils causes a very complex problem (cultural, management, and lime application) are required. One possible solution is to choose and grow tolerant genotypes (JELIĆ et al., 2000). Plant species and genotypes within species differ widely in their soil-acidity tolerance (Al resistance).

Aluminium can react with other nutrients in the soil such as P to form less available compounds. In addition aluminium can interfere with the uptake and transport of substances in plant such as Ca, Mg, P, K, and water (RAYBURN et al., 2002; ZHANG et al., 2004). The major limiting factor for plant growth on acid mineral soils is Al toxicity, which is the most important yield-limiting factor (MARSCHNER, 1991).

Liming represents an effective management strategy in overcoming or minimizing soil acidity and related Al toxicity. A continuous acidification without liming may result in deterioration of soils that can make even the acid-tolerant genotypes useless. By raising pH up to above 5.5 through lime (i.e., CaCO₃) applications soluble and exchangeable Al are precipitated as hydroxy-Al species (DE PAUW, 1994; ČAKMAK, 2002).

This research has been determining the individual and combined effects of chemical and animal manure, and lime on some physical grain quality properties of winter wheat.

MATERIAL AND METHOD

Experimental design

Experiment was set up at the experimental field of Small Grains Research Centre Kragujevac Serbia (20°55'12"E, 44°01'12"N, 185m asl) during 2003/2004-2004/2005 growing seasons. The soil was smonitza (vertisol) with very high natural acidity (pH H₂O=5.6 and in KCl = 4.2). The trial consisted of a completely randomized block experimental design with three replications, the size of each plot being 14 m² (7 m x 2 m). The research included six winter wheat varieties (Takovčanka, Studenica, KG-100, Matica, Ana Morava and Toplica) created in the Small Grains Research Centre of Kragujevac.

The following variants of fertilization were applied: Control -T₁ (no fertilization), mineral fertilizer-T₂ (500 kg ha⁻¹ NPK – 15:15:15), nitrogen fertilizer + lime fertilizer-T₃ (75 kg N ha⁻¹ in form of KAN + 2.0 t ha⁻¹ CaCO₃ in form of "Njival Ca" - 98.5% CaCO₃), mineral fertilizer + lime fertilizer-T₄ (500 kg ha⁻¹ NPK + 2.0 t ha⁻¹ CaCO₃), and mineral fertilizer + lime fertilizer + organic fertilizer -T₅ (500 kg ha⁻¹ NPK + 2.0 t ha⁻¹ CaCO₃ + 35.0 t ha⁻¹ manure).

Hectoliter weight (HW) determined using standard method. Thousand grain weight (TGW) was determined by counting and weighing samples of two times 500-kernels and then found values were averaged and multiplied by two. Both properties are determined on an average of samples from three replicates.

The analysis of variance was calculated according to randomize complete block design with three factors: genotype (G), treatment (T) and year (Y) using ANOVA (MSTAT-C program, 1989). The significant differences among the means were grouped according to least significant difference (LSD).

Climatic conditions during the experiment

For the better understanding of the efficiency of the applied doses of different fertilizers, the climatic conditions prevailing during the trial should be described (*Table 1*). Average temperatures were similar during first (8.7°C) and second (8.5°C) investigated years, which also were similar according to the long-term period (8.5°C). Mainly differences were in the winter period when plants were in hibernation that did not significant influenced on plant growing.

Sums of precipitation were higher in 2004/05 (490.8 mm) than in 2003/04 (480.2 mm) investigated year. According to long-term period, precipitations in both 2003/04 and 2004/05 vegetative period were higher for (62.4 mm and 73.0 mm, respectively). In May of 2004/05 year

was higher precipitation for about 20 mm in relation with 2003/04 investigated year and long-term period (17.6 mm). In April 2003/04 was higher precipitation for 22.3 mm in relation with the same period of 2004/05.

Table 1: Average of monthly temperatures (°C) and monthly sums of precipitation (mm)

Month	Temperature (°C)			Precipitation (mm)		
	2003/04	2004/05	1990-2000	2003/04	2004/05	1990-2000
Oct	10.6	14.7	11.83	83.2	50.1	61.02
Nov	8.9	6.8	6.4	28.6	121.3	44.29
Dec	2.2	3.0	1.71	37.2	19.7	44.65
Jan	- 0.9	1.5	- 0.1	86.4	36.6	30.04
Feb	3.0	-1.5	2.62	59.5	66.9	29.87
Mar	7.1	4.5	5.99	21.3	43.6	33.21
Apr	12.8	11.6	11.6	52.3	43.3	52.88
May	14.5	16.4	16.37	50.3	70.2	52.57
Jun	19.8	19.2	20.37	61.4	39.1	69.28
\bar{x} / Σ	8.7	8.5	8.5	480.2	490.8	417.8

RESULTS AND DISCUSSION

The results showed that all fertilizer treatments gave higher TGW and HW than the control, and that NPK applications positively influenced these grain quality properties (*Table 2*). Differences between two seasons 2003/04 and 2004/05 were visible significant. In this investigation, the TGW and HW varied in accordance with genotype, applied treatments and years. The use of ameliorative fertilization significantly increased TGW and HW. Average values for TGW were ranged from 35.0g (T₁) to 42.0g (T₅). Matica cultivar had the highest average value for TGW (41.7g), and then Toplica, KG-100 and Studenica. Average values for 1000-grains weight varied by investigated year. In the second year of research 1000-kernels weight was higher by about 3 g compared with the first year.

The results of hectoliter weight showed that in average the best results achieved in T₅ variant when was applied NPK + manure + CaCO₃ (78.1 kg hl⁻¹) and then in T₄ variant when was applied NPK and CaCO₃ (77.1 kg hl⁻¹). In average for all treatments, cultivar Toplica had the highest value of HW (77.2 kg hl⁻¹) and then Takovčanka and Studenica (76.5 kg hl⁻¹ and 76.4 kg hl⁻¹, respectively).

The least improvement of investigated traits was observed by nitrogen and lime fertilizers application, while the best results were obtained by together NPK, manure and lime fertilizer application, which is in accordance to previous research (ZEIDAN et al., 2001; KISIC et al., 2004; KIANI et al., 2005; ZIVANOVIC-KATIC et al., 2005).

A wide range of long term trials has proved the positive effect of adequate fertilization on grain quality, like hectoliter weight and thousand kernel weight, protein content, wet gluten

content and falling number. High values for thousand grain weight and hectoliter weight were also recorded in the application of NPK fertilizers only, which is consistent with previous research (VARGA et al., 2003; STIPESEVIC et al., 2009). The yield and quality of wheat will be increased by using animal manure combined with chemical fertilizer (LOTFOLLAHI, 2004).

Table 2: Mean values for thousand grain weight (g) and hectoliter weight (kg hl⁻¹)

Cultivar	Treatments (Variants)											
	0 (T ₁)		NPK (T ₂)		N+CaCO ₃ (T ₃)		NPK+CaCO ₃ (T ₄)		NPK+manure + CaCO ₃ (T ₅)		Average	
	TGW	HW	TGW	HW	TGW	HW	TGW	HW	TGW	HW	TGW	HW
Takovčanka	32.0	70.6	39.1	77.4	36.8	74.3	36.7	78.3	40.5	81.1	37.0	76.5
Studenica	34.9	73.3	40.4	78.4	39.4	75.0	40.1	77.1	42.8	78.4	39.5	76.4
KG-100	37.0	71.4	40.4	74.5	38.0	73.2	39.2	75.0	43.0	75.9	39.5	74.00
Matica	34.8	71.1	43.1	74.2	40.2	75.0	44.0	77.2	46.4	75.5	41.7	74.6
Ana Morava	34.0	72.3	35.0	76.3	33.1	74.2	35.1	76.5	36.4	78.5	34.7	75.6
Toplica	37.0	74.3	40.2	78.4	39.1	76.1	39.4	78.1	43.1	79.2	39.8	77.2
Average	35.0	72.2	39.7	76.5	37.8	74.6	39.1	77.1	42.0	78.1	38.7	75.7
Season means for TGW: 2003/04= 37.26; 2004/05 = 40.15												
Season means for HW: 2003/04= 74.25; 2004/05 = 77.18												

Analysis of variance showed highly significant differences among investigated genotypes (G), treatments (T), years (Y) and among interaction genotype x treatments (G x T) for thousand grain weight. Similar results were obtained for hectoliter weight by analysis of variance. Differences were highly significant for genotypes, treatments, years and interactions (G x T, G x Y) and differences were significant for interactions T x Y. The strongest individual influence for both TGW and HW had treatments and years, and than genotypes (*Table 3*).

Table 3: Analysis of variance for thousand grain weight (TGW) and hectoliter weight (HW)

Source	DF	MS		F		LSD			
		TGW	HW	TGW	HW	0.05		0.01	
						TGW	HW	TGW	HW
Genotype (G)	5	179.332	45.264	1479.955**	744.940**	0.231	0.164	0.362	0.257
Treatment (T)	4	242.288	197.662	1999.497**	3253.061**	0.228	0.162	0.378	0.268
G x T	20	11.608	7.583	95.794**	124.803**	0.419	0.297	0.571	0.406
Year (Y)	1	377.581	386.614	3116.013**	6362.760**	0.204	0.147	0.357	0.258
G x Y	5	0.060	0.254	0.494	4.180**	-	0.234	-	0.364
T x Y	4	0.056	0.156	0.460	2.564*	-	0.229	-	0.379
G x T x Y	20	0.111	0.129	0.918	2.115	-	-	-	-

Acidity is a critical yield-limiting problem in many soils. About 40% of cultivated soils globally have acidity problem leading to significant decreases in crop production despite adequate supply of mineral nutrients such as N, P and K (ČAKMAK, 2002). In acid soils major constraints to plant growth are toxicities of hydrogen (H⁺), aluminum (Al) and manganese (Mn) and deficiencies of P, calcium (Ca) and magnesium (Mg). Among these constraints Al toxicity is the most important yield-limiting factor (MARSCHNER, 1991; ZHANG et al., 2004). The liming caused improvement of some chemical soil traits i. e. decreasing of active and substitution acidity increasing of humus, total nitrogen, easy available phosphorus and potassium content. In

previous investigation was established that use of nitrogenous fertilizer alone aggravated the problem of soil acidity by lowering the pH from 5.8 to 4.7 after 25 years (SHARMA and SUBEHIA, 2003). In their investigations in almost all the treatments, the organic carbon content increased: a marginal decrease occurred in the 100% N and control plots. Even under optimum application rates, the available N and K status decreased with time (SHARMA and SUBEHIA, 2003).

CONCLUSIONS

Ameliorative application of fertilizers positively influenced the 1000 kernel weight and hectoliter weight. The best results were achieved in the implementation of NPK fertilizers combined with lime and manure. These results indicate that the application of ameliorative fertilization can improve acidic soils and thus create favorable conditions for growth of plant species. The acid soils need manure in combination with NPK fertilizers and lime to improve their physicochemical and biological properties and consequently their productivity.

The results suggest that integrated application of N, P, and K fertilizers and manure is an important strategy to maintain or improve soil fertility, and nutrients balance, and minimize potential for pollution to the environment, while also sustaining high crop yield and quality.

ACKNOWLEDGMENTS

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REFERENCES

- CAKMAK, I. (2002): Plant nutrition research: Priorities to meet human needs for food in sustainable ways. *Plant and Soil*, 247, pp. 3–24.
- DE PAUW, E. F. (1994): The management of acid soils in Africa. *Outlook Agric.* 23, pp. 11–16.
- JELIC, M., LOMOVIC, S., ZIVANOVIC, S., MILIVOJEVIC, J., STOJANOVIC, J. (2000): Tolerance of certain Yugoslav genotypes of winter wheat to high soil acidity and Al concentration. *Annual Wheat Newsletter*, Kansas State University, USA, 46, pp. 270-271.
- KARIUKI, S.K., ZHANG, H., SCHRODER, J.L., EDWARDS, J., PAYTON, M., CARVER, B.F., RAUN, W.R., KRENZER, E.G. (2007): Hard red winter wheat cultivar responses to a pH and aluminum concentration gradient. *Agronomy Journal*, 99, pp. 88-98.
- KIANI, J.M., ABBASI, M.K., RAHIM, N. (2005): Use of organic manure with mineral N fertilizer increases wheat yield at Rawalakot Azad Jammu and Kashmir. *Archives of Agronomy and Soil Science*, 51 (3), pp. 299-309.
- KISIC, I., MESIC, M., BASIC, F., BUTORAC, A., VADJIC Z. (2004): The effect of liming and fertilization on yields of maize and winter wheat. *Agriculturae Conspectus Scientificus* 69 (2–3), pp. 51-57.
- LOTFOLLAHI, M. (2004): The yield and quality of wheat affected by individual and combined application of animal manure and chemical fertilizers. 4th International Crop Science Congress, Brisbane, Australia. http://www.cropscience.org.au/icsc2004/poster/2/5/1/400_lotfollahim.htm

- MARSCHNER, H. (1991): Mechanisms of adaptation of plants to acid soils. *Plant Soil* 134, pp. 1-20.
- RAO, I.M., ZEIGLER, R.S., VERA, R., SARKARUNG, S. (1993): Selection and breeding for acid-soil tolerance in crops. *Bio Science* 43 (7), pp. 454-465.
- RAYBURN, L.A., WETZEL, J.B., BALIGAR, V.C. (2002): Mitotic analysis of sticky chromosomes in aluminum tolerant and susceptible wheat lines grown in soils of differing aluminum saturation. *Euphytica*, 127, pp. 193-199.
- SHARMA, S.P., SUBEHIA, S.K. (2003): Effects of twenty-five years of fertilizer use on maize and wheat yields and quality of an acidic soil in the western Himalayas. *Experimental Agriculture*, 39 (1), pp. 55-64.
- STEVANOVIĆ, D., JAKOVLJEVIĆ, M., MARTINOVIĆ, L.J. (1995): Solving the problem of acid soils of Serbia—a precondition to increase food production and soil protection. *Paracin (Serbia), Proceedings*, pp. 7-21.
- STIPESEVIĆ, B., STOSIĆ, M., TEODOROVIĆ, B., JUG, I., JUG, D., SIMON, M., BEDE, Z., SIMIĆ, M. (2009): Comparison of different side-dressings on winter wheat yield. *Journal of Agricultural Sciences*, 54 (3), pp. 189-196.
- VARGA, B., SVECNJAK, Z., JURKOVIĆ, Z., KOVAČEVIĆ, J., JUKIĆ, Z. (2003): Wheat grain and flour quality as affected by cropping intensity. *Food Technol. Biotechnol.* 41 (4), pp. 321-329.
- ZEIDAN, M.S., EL KRAMANY, M.F. (2001): Effect of organic manure and slow-release N-fertilizers on the productivity of wheat (*Triticum aestivum* L.) in sandy soil. *Acta Agronomica Hungarica*, 49 (4), pp. 379–385.
- ZHANG, H., SCHRODER, J.L., KRENZER, E.G., KACHURINA, O.M., PAYTON, M.E. (2004): Yield and quality of winter wheat forage as affected by lime. Plant Management Network, Forage and Grazinglands. <http://www.plantmanagementnetwork.org>.
- ZIVANOVIĆ-KATIĆ, S., NIKOLIĆ, O., JELIĆ, M. (2005): The liming and fertilization influence on changes of chemical traits of soil with acid pH reaction. *Contemporary Agriculture*, Novi Sad, 3-4, pp. 645-649.

OPINIONS OF THE INHABITANTS OF THE CSONGRÁD COUNTY ABOUT THE HUNGARIAN PRESIDENCY

BRIGITTA ZSÓTÉR¹ - EDINA LENDVAI¹ – KATALIN GÁCSI-KISS²

University of Szeged – Faculty of Engineering
H-6724 Szeged, Mars tér 7.
zsoterb@mk.u-szeged.hu

ABSTRACT

Between 1 January and 30 June 2011, Hungary held the rotating presidency of the Council of the European Union for the first time. The presidency is an extraordinary occasion for Hungary for several reasons. In our work we wanted to recognize the main opinion of the Hungarian people about this occasion. To reach our aims we made two investigations: the first one before the Presidency and the second one after the Presidency. We compared our results with the national surveys too.

Keywords: Hungary, Presidency of the Council of the European Union, investigation

INTRODUCTION

The European Economic Commission (EEC) was created in 1957 by the Treaty of Rome. The six established country: Belgium, Netherland, Luxemburg, France, Germany and Italy (HORVÁTH, 2001). Its short history: in 1973 after a long period, was the first enlargement with Great Britain, Ireland and Denmark (BLAHÓ, 2007). In 1965 the Merger Treaty has changed the structure of EEC, there was procreate the European Communities. After new members (Greece, Spain and Portugal in '80s years) in Maastricht in 1991 was born the new name and setup: the European Union (JNAGY, 1999.) In 1995 joined Austria, Sweden and Finland, in 2004 ten new members – including Hungary, and the last ones in 2007: Bulgaria and Romania (BLAHÓ, 2007, <http://europa.eu>).

The main organizations of the European Union are: the European Council, the Council of the European Union, the European Parliament, the European Commission, the Court of Justice of the European Union and the European Court of Auditors (HORVÁTH, 1999.). Every organization has president, but the president of the Council of the EU is not a one person, it is an all country. This denomination means the responsibility for the functioning of the Council of the European Union. It can be hold by the member states of the EU. They rotate themselves every six months. The presidency signifies the task is undertaken by a national government. It is also not the "Presidency of the EU" - although it is sometimes called that. The new possibility is the Presidency Trio, in Lisbon Treaty was created this new formation, it means cooperation between 3 countries, they follow each other in the Presidency - in this case: Spain, Belgium and Hungary (www.eu2011.hu) . Their common logo shows their common work (fig. 1.)

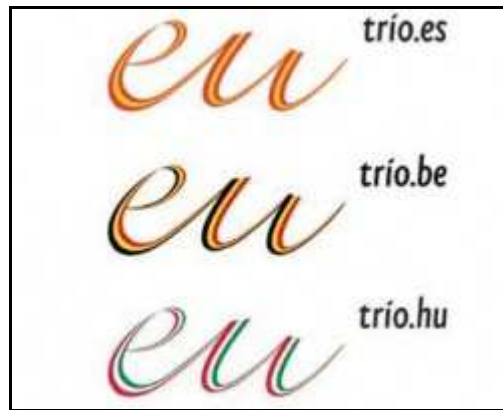


Figure 1. The official Logo of the Presidency Trio

Source: www.mfa.gov.hu

MEANS AND METHODS

We created 2 questionnaires, the first before the Presidency and the second after the presidency. The first one was filled by the Hungarian people on December in 2010. The other one was filled with same people in August-September in 2011.

Some questions are the same in the two investigations, but the others are different. Before the Presidency we wanted to know what people have waited for the Presidency, after the Presidency we asked the population about their opinion and satisfaction.

The main themes of the questions are:

The first questionnaire

- The general information about EU
- The interesting in the EU
- The knowing of the Hungarian Presidency
- The knowing of the Presidency Trio
- The waiting of the effect of the Presidency,
- The waiting advantages of the Presidency

The second questionnaire

- The general information about EU Presidency
- The interesting in the EU Presidency
- The knowing of the date of the Hungarian Presidency
- The effects of the Hungarian Presidency
- The corresponding to the Presidency
- The Presidency's effect to their life
- The respect of our country in the EU

The questionnaire was filled in Csongrád County, by 120 and 90 people. 120 people were answered in 2010 – before the Presidency (first questionnaire), and 90 in the 2nd part of 2012 – after the Presidency (second questionnaire). The answered people are from 2 cities (Szeged, Hódmezővásárhely) and one village (Forráskút). Some people earlier lived in Csongrád County, but they moved to Budapest (because of the work), so 32 people's living place is Budapest. (They are the friends of the student- author).

The answers were processed with Statistica program.

RESULTS AND THEIR ASSESSMENT

The Table1 shows the main data of the answerers. The main characters are: more women (61%) the men (39%) the average is between 18-25 and 26-40 years (40-40%). The main place of living is the city (60%).

Table 1. The demographic data of the interviewed people (n= 210)

Source: own investigation

Category	%	Capita
Sex		
Men	40	84
Women	60	126
Age		
18-25	40,00	84
26-40	40,00	84
41-60	17,15	36
60+	2,85	6
Living place		
Capital	15,24	32
City	60,00	126
Village	24,76	52

We would like to show some interesting answer, from the two questionnaires.

The knowing of the Presidency – in 2010 was 85,83%, but the correct date of this occasion knew only 65%.

In the Hungarian representative investigation by Median and Policy Solution (www.hgv.hu) was determinate, only the 45% of the Hungarian population know the really fact about the Presidency.

In the both investigation we asked people about the effect of the Hungarian presidency.

In the first survey answerers haven't got form opinion, because the average score was 3,52 (figure 2). The 52% of the filler thought the effect will be neutral. About 1/5 of them waited good impact because of the Presidency and less people was pessimist. We have to note the 13% of them, they don't care about it.

In the second research, after the Presidency the opinion could be formed by the experience, people had own insight about this question. The most of the said, that the effect was same that they hope – but we don't know, is it good or not. The really few part of them thought that they got better impact than they waited for, 1/5 of the asked people felt worse facts. The most interesting for us, 378% of the fillers said, they don't mind it. So after the Presidency people have not got opinion, or they can't judge this problem.

The representative survey by Nézőpont in 2011 diagnosed that every 2nd people in Hungary judged the Presidency successful, so they realised positive effect (TAKÁCS – MOLNÁR, 2011).

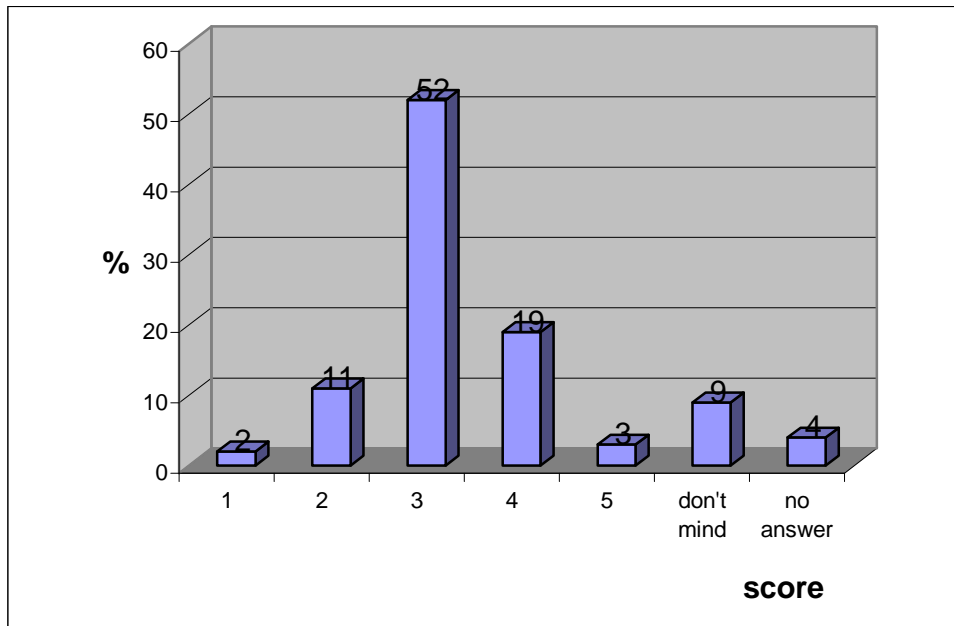


Figure 2. The distribution of the answers by the waiting effect of the Presidency
Source: own investigation

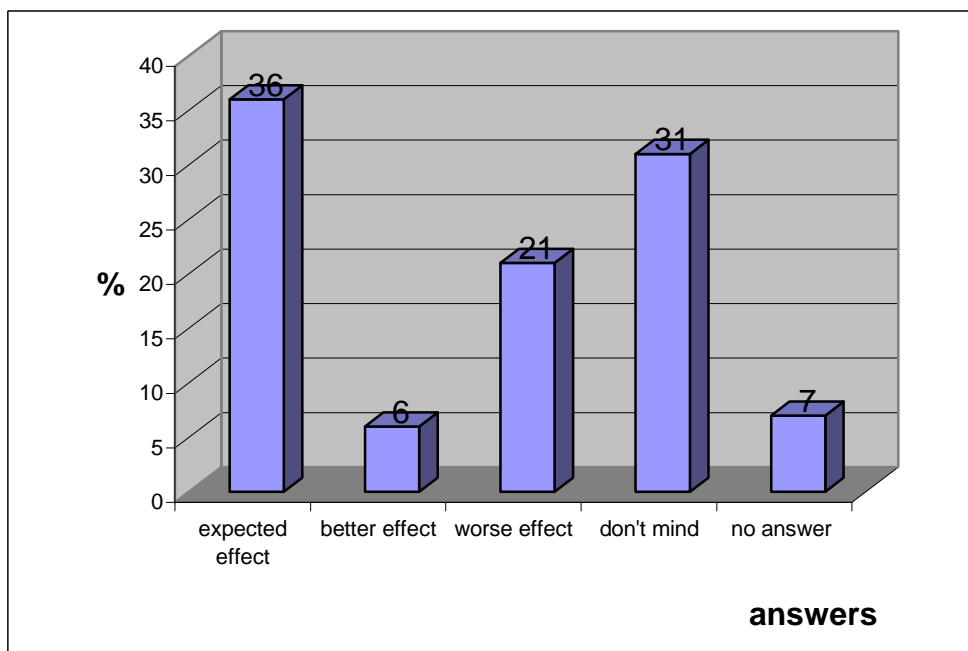


Figure 3. The distribution of the answers by the experienced effect of the Presidency
Source: own investigation

We asked our interviewed persons about some general theme. What they think about the respect of Hungary, after the Presidency has changed it (table 2.) It is sad, but 34,5% of them have not got any idea about it. Maybe it is because of the some problem about our country for example Media – affair. Sometimes in it was stronger European interesting than in our actual work. The 43,4% of the asked population felt the negative discretion about Hungary and only 18 persons believed in the positive changed.

The filler explained their opinion, for example:

- Because of the scandals

- The country couldn't fill well the Presidency
- They couldn't solve the important problems

Table 2. The distribution of the respondents by the growth of the Hungary's respect.
(n=90)

Source: own investigation

	%	Capita
Positive respect	20,0	18
Negative respect	43,4	39
Don't know	34,5	31
Don't answer	2,2	2

The last issue is about the adequacy in the presidency. The Figure 4 shows the opinion of the answered people. They had to score the fitness from 1 to 5. The average score is 3,14. The main score is the 3, but a few more people got 5 than 1 and same people got 2 and 4 scores. Fortunately only a few people had not got idea about this question.

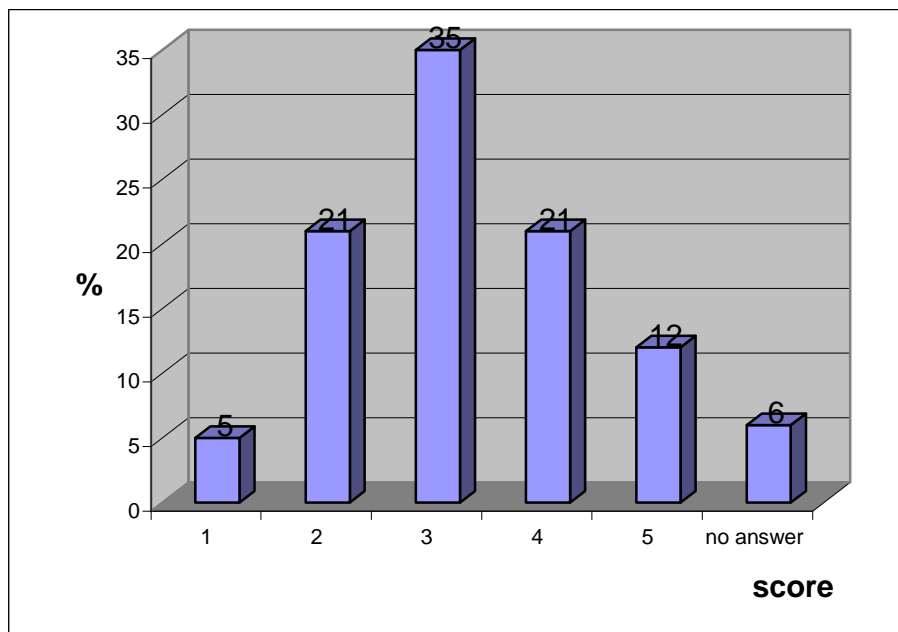


Figure 4. The distribution of the answerers by the adequacy of the Presidency

Source: own investigation

We were interested in the memory of our people; we asked them about the important occasions and results – connected to the Hungarian Presidency. Of course – expected to advance – the most people (69%) could not mention this facts. Only 13,4% could be able to write something. For example: the finish of the join of Croatia, Danube region strategy, expansion of the Schengen Area.

CONCLUSION

In our work we wanted to know Hungarian people's opinion about the Hungarian Presidency in the EU. In our two investigation – before and after the presidency we could

identify that the most of Hungarian population don't mind about this theme. Lot of people didn't know exact date of the Presidency. They don't care about the occasions, problems. The effect of this special event was neutral for people, or they couldn't judge it. Maybe the other affairs connected to Hungary deflect the interest about this theme.

REFERENCES

- BLAHÓ A. (2007): Európai integrációs alapismeretek, Aula Kiadó, Budapest
- J. NAGY L. (1999): Az Európai integráció politikai története, Gradus ad Parnassum Könyvkiadó, Szeged
- HORVÁTH J. (2001): Az európai integráció története napról napra 1945-2000, Osiris Kiadó, Budapest
- HORVÁTH Z. (1999): Kézikönyv az Európai Unióról, Magyar országgyűlés, Budapest
- TAKÁCS G., MOLNÁR Cs. (2011): Hat hónap mérlegen, Heti Válasz, XI. / 26. 2011. 06. 30. pp.: 30-33.
- http://ec.europa.eu/ireland/about_the_eu/presidency/index_en.htm (2012.01.20.)
- http://europa.eu/about-eu/countries/index_hu.htm (2012. 01.05.)
- http://hvg.hu/vilag.eu/20101203_felmeres_EU_elnokseg (2012.01.20.)
- <http://www.eu2011.hu/news/presidency-trio-sets-precedent> (2012.01.20.)
- http://www.mfa.gov.hu/kum/hu/bal/eu/2011_eu_elnokseg/korm_felkeszules_trio_egyuttm/kozos_logo.htm (2012.01.20.)

ARE CYSTEINE AND ITS DERIVATIVES APPLICABLE FOR THE PREVENTION OF FUNGAL DISEASES?

LÁSZLÓ GALGÓCZY, LAURA KOVÁCS, KRISZTINA KRIZSÁN, TAMÁS PAPP,
CSABA VÁGVÖLGYI

University of Szeged, Faculty of Science and Informatics
Department of Microbiology,
Hungary, Szeged 6726 Közép fasor 52.
galgoczi@gmail.com

ABSTRACT

Many filamentous fungi are destructive pathogens of plants and are thus responsible for enormous crop losses worldwide. Therefore, there is a substantial demand for safely applicable, new compounds with extensive antifungal activity. Cysteine and its derivatives are interesting from this respect, as they have effective inhibitory potential against microorganisms and do not harmful effect on animal and plant cells.

Cysteine is a non-essential amino acid, which is an important structural and functional component of many proteins and enzymes. Previous studies demonstrated that cysteine and N-acetyl-cysteine have also been shown to exert antifungal activity.

A number of members of the class Zygomycetes are important as postharvest pathogens of agricultural products; *Rhizopus*, *Mucor* and *Gilbertella* species are among the most frequently isolated causative agents of fungal rots.

In this study we investigated the *in vitro* antifungal activity of cysteine (D- and L-cysteine) and its 4 derivatives (L-cysteine-methyl-ester, N-acetyl-cysteine, N-isobutyryl-D-cysteine and N-isobutyryl-L-cysteine) against 20 zygomyceteous fungal isolates representing 16 genera (*Actinomucor*, *Backusella*, *Gilbertella*, *Lichtheimia*, *Micromucor*, *Mortierella*, *Mucor*, *Mycotypha*, *Phycomyces*, *Rhizomucor*, *Rhizopus*, *Saksenaea*, *Syncephalastrum*, *Thamnostylum*, *Umbelopsis* and *Zygorynchus*).

The inhibitory potential of different concentrations (ranging from 0.625 to 10 mM) of the cysteine and its derivatives were investigated on the germination of sporangiospores and on hyphal extension by broth microdilution method and agar plate test. Cysteine and its derivatives showed a strong inhibitory effect against the most studied strains. Treatment with 10 mM of compounds resulted total growth inhibition in case of some isolates. Severe changes in colony morphology and hyphal growth were observed in presence of 10 mM L-cysteine, N-acetyl-cysteine and N-isobutyryl-L-cysteine when a strain was sensitive to them. Ten mM N-acetyl-cysteine induced dramatic modifications in the structural organization of the hyphae in case of *Rhizopus stolonifer*.

The above mentioned features of the investigated compounds could make them favourable antifungal agents against Zygomycetes in agricultural respect in the future, but it is needed further studies to prove their practical efficiency, for example in plant model experiments.

L. G. holds a postdoctoral fellowship from the Hungarian Scientific Research Fund (OTKA PD 83355).

Keywords: antifungal effect, cysteine, cysteine derivatives, Zygomycetes, microscopic observation

SPECIES COMPOSITION OF *TRICHODERMA* COMMUNITIES IN HUNGARIAN SOILS USED FOR VEGETABLE CULTIVATION

LÁSZLÓ KREDICS¹, TAMÁS MARIK¹, SZABINA OLÁH¹, DÓRA TERHES¹, GORDANA DANILOVIĆ², DEJANA PANKOVIĆ², LÁSZLÓ MANCZINGER¹, CSABA VÁGVÖLGYI¹, PÉTER KÖRMÖCZI¹

¹Department of Microbiology, Faculty of Science and Informatics, University of Szeged, 6726 Szeged, Közép fasor 52., Hungary

²Faculty of Environmental Protection, Educons University, 21208 Sremska Kamenica, Vojvode Putnika 87., Serbia
kormoczpeti@gmail.com

ABSTRACT

Species of the genus *Trichoderma* are commonly found free-living fungi in soil and root-ecosystems. It is known that the rhizosphere of agricultural soils is an ideal source of beneficial *Trichoderma* strains with biocontrol potential, as some of the strains showed excellent antagonistic abilities against plant pathogenic fungi. Others are able to improve plant growth, root in particular, promoting drought resistance in some crops.

Biodiversity of *Trichoderma* isolates from the rizosphere of different vegetables (pepper, tomato, carrot, salad, spinach, pumpkin, cabbage, kohlrabi, parsley, celery, potato and bean) in garden soil samples collected at different locations in Hungary (Szeged-Sziksóstó, Balástya, Hódmezővásárhely, Szentés, Veszprém, Ózd) was comparatively examined during this study. *Trichoderma* strains were isolated directly from the chopped roots of the examined vegetables on dichloran - Rose Bengal medium. DNA isolation and PCR amplification of the internal transcribed spacer (ITS1-5.8S rDNA-ITS2) region have been used for the identification of the isolates and for the investigation of their biodiversity. *Trichoderma* isolates were identified based on their ITS sequences with the aid of the barcoding program *TrichOKEY* 2.0 available online at the home page of the International Subcommittee on *Trichoderma* and *Hypocrea* Taxonomy (www.isth.info).

Among the detected isolates, species known as promising biocontrol agents (*T. harzianum*, *T. virens*, *T. atroviride*, *T. asperellum*) could be identified. Data about the biodiversity of the genus *Trichoderma* in vegetable rhizosphere and surveying the *in vitro* antagonistic abilities of the isolated *Trichoderma* strains may reveal potential biocontrol agents against plant pathogenic fungi.

The project is co-financed by the European Union through the Hungary-Serbia IPA Cross-border Co-operation Programme (PHANETRI, HUSRB/1002/214/068).

PRODUCTION OF INDUSTRIAL ENZYMES IN SOLID STATE FERMENTATION OF AGRICULTURAL WASTES BY ZYGOMYCETES

CSABA VÁGVÖLGYI¹, MIKLÓS TAKÓ¹, ALEXANDRA KOTOGÁN¹, JUDIT KRISCH²,
TAMÁS PAPP¹

¹Department of Microbiology, Faculty of Science and Informatics, University of Szeged,
Közép fasor 52., H-6726 Szeged, Hungary; csaba@bio.u-szeged.hu

²Department of Food Engineering, Faculty of Engineering, University of Szeged,
Mars tér 7., H-6724 Szeged, Hungary

Large amount of corn-stalks and leaves arise as agricultural waste during the agro-industrial processes. Solid-state fermentation to produce different industrial enzymes such as cellulolytic enzymes, lipases and proteases, and bioconversion to ethanol may provide an alternative and economic path to utilize these residues. Zygomycetes fungi have been assumed to play an important role in the decomposition of plant and other organic materials in consequence of their effective extracellular enzyme production. Several members of them are commonly used in different biotechnological applications for the large scale production of industrial enzymes, however, production of these enzymes on agricultural wastes are poorly characterized until to date. The aim of our present study was to investigate the activities of cellulolytic enzymes and the production of lipase and protease by zygomycetous strains on agro-industrial wastes such as corn-stalks, corn-leaves and wheat bran.

The *Mucor*, *Rhizomucor*, *Gilbertella* and *Rhizopus* isolates selected for this study have proven to be good extracellular β -glucosidase producer in our previous experiments in which submerged cultivation on cellobiose and solid-state fermentation on wheat bran were used (TAKÓ et al, 2010). In these studies, solid-state fermentation generally resulted in significantly higher enzyme activities than the liquid cultures. Therefore, two solid state fermentation systems were used in the present assays: mixture of chopped corn stalks and corn leaves, and their mixtures with wheat bran at a ratio of 1:1. Fermentations were carried out for 12 days at 25 °C or 37 °C, and enzyme activities were determined from the crude water extracts obtained every second day of the cultivation. Isolates grew intensively on these substrates, and high activities of the cellulolytic enzymes and lipase have been observed during the fermentation period. The total cellulolytic activity of the crude extracts was determined by using Whatman No. 1 filter paper as substrate; in case of each isolate, the highest amount of reducing sugar was measured at the second day of the fermentation. It is worth to point out that significantly higher total cellulolytic activity was usually detected in the crude extracts derived from fermentation medium containing wheat bran. It might be due to the fact that wheat bran supplied convenient amount of nutrients and porosity for oxygen supply. In both fermentation systems, cellobiohydrolase activity of the tested fungi was found to be significantly lower than their endoglucanase and β -glucosidase activities; additionally, it was detected that the activity of endoglucanase generally reaches its maximum during the first half of the incubation, while β -glucosidase on the sixth day or later. Among the tested representatives of the abovementioned genera, a *Rhizomucor* sp. and a *Rhizopus* sp. strains proved to be outstanding in its lipase, and protease producing ability, respectively. The investigated fungi could potentially be applicable for biodegradation of agro-industrial wastes and efficient production of industrial enzymes on these cheap, easily available substrates.

TAKÓ, M., FARKAS, E., LUNG, SZ., KRISCH, J., VÁGVÖLGYI, CS., PAPP, T. (2010): Identification of acid- and thermotolerant extracellular β -glucosidase activities in Zygomycetes fungi. Acta Biologica Hungarica, Volume 61. pp. 101-110.

EXAMINATION OF INFLUENCING FACTORS OF SECONDARY SCHOOL CHOICE IN MEZŐKOVÁCSHÁZA MICRO-REGION

BRIGITTA ZSÓTÉR

University of Szeged – Faculty of Engineering
H-6724 Szeged, Mars tér 7.
zsoterb@mk.u-szeged.hu

ABSTRACT

My examination is related to secondary school enrollment of four small towns. The inquiry, involving 1342 persons, has resulted in the following consequences: mobility among generations is directed upward, achievements of the last primary school year partly, social background considerably has an effect on secondary school choice; most of the students are from the direct catchment area of the secondary school.

Keywords: secondary school, further education, school choice

INTRODUCTION

Today's Hungarian public education system is going through a transformation, as the number of students is decreasing, efficiency ratio is not appropriate, decision making is decentralised, educational directives of the EU are needed to be adopted, as a result, we need reforms. Education can produce high value and chance for national and international mobility. It is great result, but more important to use competences in the home country. (GÁL, 2006)

As for secondary education, the most conspicuous changes were brought about by institutional merges and appearances of Regional Integrated Training Centres.

After finishing primary school studies, students will have a choice of the following secondary education forms:

- grammar school
- secondary training school
- vocational school (vocational training school)

Main differences are manifested in educational goals. Grammar schools primarily prepare students for further studies. Secondary training schools, in addition to maturity exam, provide professional training as well, which is completed by professional final exam and students receive a certificate according to the National Qualification Register. Vocational schools also provide professional qualification to their graduates according to the National Qualification Register, without maturity exam, and students are prepared firstly for starting a job.

Different further education guides, ranking lists, institutes' own schooling guides and open days, placed out presentations and fairs help orientation. Furthermore, career counselling centres offer self-knowledge and career choice tests.

The object of my research was a territorially limited group of secondary schools. These four settlements – Battonya, Mezőhegyes, Mezőkovácsháza and Tótkomlós – share municipal functions: there is a court and a thermal spa in Battonya, a vocational training institution in Mezőhegyes, a registration office, a specialist clinic, an ambulance station, a grammar school in Mezőkovácsháza, a thermal spa with medical department in Tótkomlós. Among secondary school students of these four settlements I carried out the survey which revealed decision making processes and their background concerning enrolment.



Figure 1. Location of secondary school
Source: lazarus.elte.hu (11th February 2012)

MEANS AND METHODS

Population of the four institutes was 1342 students in September, 2010, from this 908 persons (67.66%) answered my questionnaire. The least number of answers characterized Vocational Training School of Mezőhegyes, 43.2% of students assisted my study. The most number of answers was typical in Kelemen Mikes Grammar School of Battonya, 88.5% of the allocated questionnaires were returned to me with answers. Evaluation and analysis of questionnaires was carried out by Microsoft Excel.

RESULTS AND THEIR ASSESSMENT

Hypotheses, which I wanted to prove with my examination, were the following:

1. Students and their parents were properly informed about the possibilities before application to the secondary educational institute (ANDOR, 1998, 1999). This assumption proved to be correct, as 82.2% of interviewed students used one or more official information sources previous to application. On the grounds of institutional open days 37.7% were informed, enrolment guides were applied by 10.5%, 34% gathered information from both previously mentioned sources.

2. More than one aspects were taken into account and decisions were made based on them. This assumption also proved to be correct. According to the responses, the most essential aspects are the following:
 - range of qualifications in the institute
 - quality of education
 - possibilities of further education
 - school is near the residence
3. There is a connection between the grade point averages of last primary school year and the selected form of secondary education. Students arriving with good, excellent primary school grade point averages behaved as I expected, thus most of them chose grammar schools, least of them chose vocational schools. Almost the same number of students with average educational achievements chose secondary training schools and vocational schools. However, to my surprise students with poor educational achievement are represented with a slightly higher number in secondary training schools than in vocational schools. Consequently, my assumption proved to be true partly.
4. Students' plans after secondary school determine the choice of secondary education form (LANNERT, 1998). This assumption proved to be correct, due to the fact that students who intend to continue their studies in higher education or in specialized education are studying primarily in grammar schools and in secondary training schools, while those who want to start to work after their secondary school years chose vocational training.
5. Mobility among generations is directed upwards (SÁGHY, 2005). With reference to the measured data, this idea is correct as well. In those cases where the student provided information on his/her parents' qualifications as well as on grandparents', 94.2% of parents have higher qualifications comparing to grandparents. Expectedly 81.4% of students will have higher qualifications than their parents (not considering 14.6% who did not provide information on their parents' education).
6. Social background determines the choice of secondary school (LANNERT, 2003, 2008). This hypothesis did not prove to be correct, owing to the fact that aspects regarding social background (occupation of parents, family background, housing, personal estate) did not show clear correlation between social background and school choice of the person.
7. Institutions attract students of the surrounding settlements. Considering secondary schools of Battonya, Tótkomlós and Mezőkovácsháza, the assumption proved to be true. In the previous two institutions a high percentage of students are local residents and only a few students arrive from nearby settlements. Compared to the two previous schools, in Mezőkovácsháza the rate of local students is not too high 27.6% of the total number of students, the remaining 72.4% of students are from 21 – mainly nearby – settlements. Nevertheless, in case of Mezőhegyes the statement is not correct. The population of students consists of 23.2% local residents, the others come from 34 settlements, which include as the farthest ones Gyöngyös, Szeged, Makó, Orosháza, Újkígyós, Füzesgyarmat and Doboz.

CONCLUSION

Most of the students studying in the examined secondary schools made a decision on enrolment by themselves or together with their parents. Students are interested in the decision; therefore they collect information on opportunities properly. It is typical that students who do not study in the secondary school marked at the first place or got to the institution following a parental decision evaluate their institutions negatively. Taking into consideration after-school plans as for secondary school choice tells us about students' deliberate future vision and strategy.

REFERENCES

- ANDOR M. (1998): Az esélyek újratermelődése, *Educatio* 1998/3. sz. pp. 419-435.
- ANDOR M. (1999): Az iskolákon át vezető út, *Új Pedagógiai Szemle*, 1999/10. sz. pp. 3-18.
- GÁL J. (2006): Gondolatok a nemzetközi vándorlás és a tudásáramlás logisztikai értelmezéséről, *Agrár- és Vidékfejlesztési Szemle*, 1. évf. 1. szám SZTE MGK, Hódmezővásárhely, 2006/1, pp. 75-79.
- LANNERT J. (1998): Pályaorientációk, *Educatio* 1998/3. sz. pp. 436-446.
- LANNERT J. (2003): Középiskola-választás a kilencvenes évek végén, *Mindenki középiskolája*, pp. 71-92.
- LANNERT J. (2008): Iskolázottság, iskolarendszer és oktatáspolitiká, *Társadalmi Riport* 2008, pp. 324-343.
- SÁGHY E. (2005): Kritikus idők – öregedő társadalom, *Figyelő* 2005/11. sz.
www.harruckern.hu (2012.01.11.)
www.hunyadi-mkov.sulinet.hu (2012.01.11.)
www.jankojanosiskola.hu (2012.01.11.)
www.mikesk-battonya.sulinet.hu (2012.01.11.)