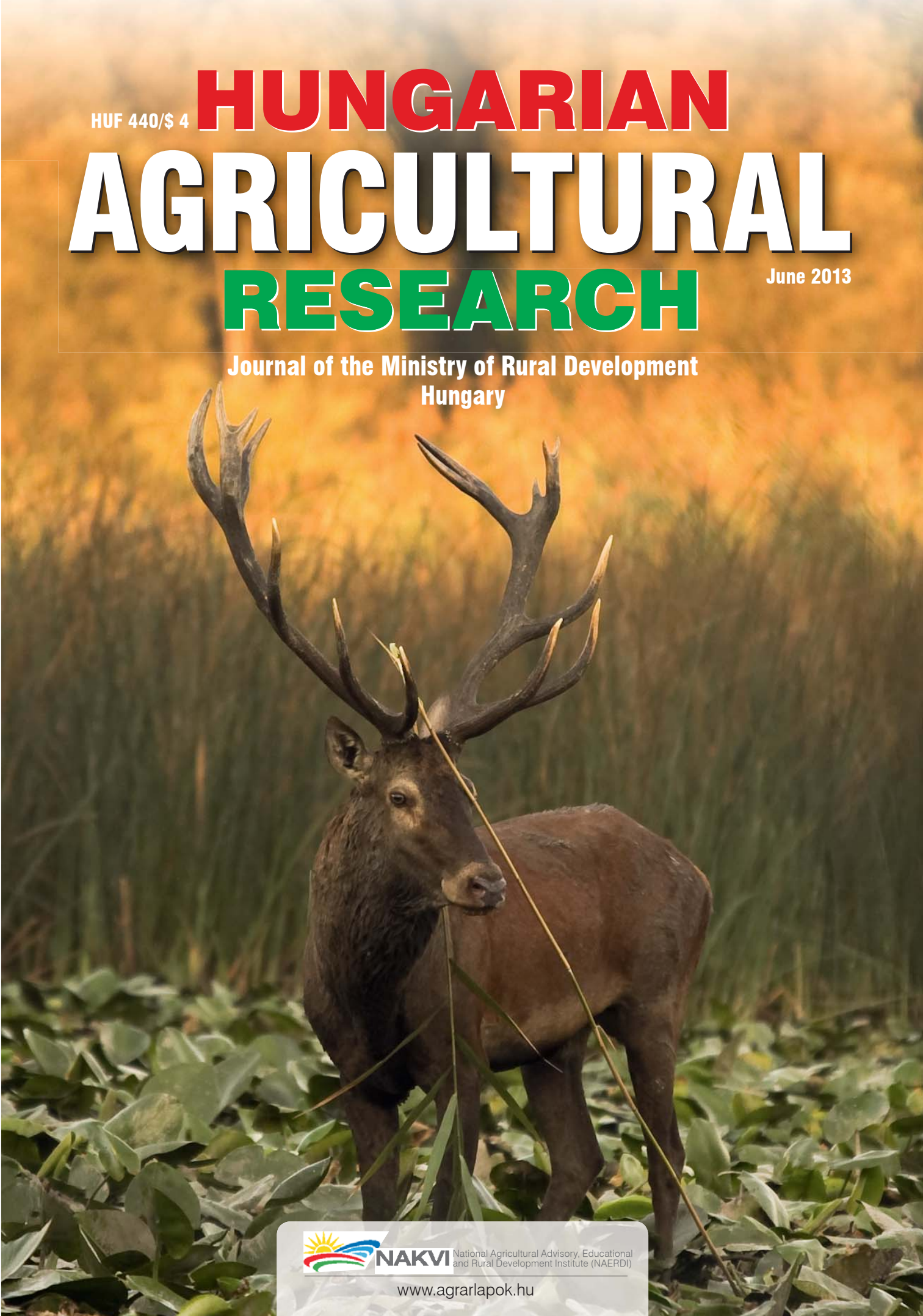
HUF 440/$ 4

HUNGARIAN AGRICULTURAL RESEARCH

June 2013

Journal of the Ministry of Rural Development
Hungary



NAKVI National Agricultural Advisory, Educational and Rural Development Institute (NAERDI)

www.agrarlapok.hu

László Balla is 80 years old

László Balla agricultural engineer, MS in genetics and plant breeding, doctor of the Hungarian Academy of Sciences, university private professor is the most successful wheat breeder of the 20th century.

He was born on 19 February 1933 in Telkibánya. He graduated at the Gödöllő University of Agricultural Sciences as an agricultural engineer in 1957 and acquired MS degree in plant breeding in 1960. He was awarded with his academic titles (PhD 1970, DSc 1981) by the Committee of Scientific Qualifications for his scientific results obtained in the fields of wheat breeding and production.

László Balla started work in the Experimental Farm of the Agricultural Research Institute of the Hungarian Academy of Sciences as a plant production engineer. In 1958, he was reassigned to the Agricultural Research Institute of the Hungarian Academy of Sciences, where he first worked as Junior Research Associate, then as Research Associate, Senior Research Associate, Head of Department, Head of Division, Deputy Director and finally Director.
The first intensive wheat varieties were developed in the 1970's in Martonvásár at the Wheat Breeding Department directed by him. By the end of the 1980's 43 state registered wheat varieties were created. For decades, the majority of Hungarian wheat production fields were sown with the Martonvásár wheat varieties he developed. In cooperation with his workmates, he acquired 10 patents. They also patented 37 varieties. László Balla adapted and spread Polish triticale varieties and Slovakian malting barleys and Austrian winter barley varieties as well.
His scientific work has been noted down in more than 220 publications in Hungarian, Russian and English. From his numerous presentations held in international conferences, the Congresses in Columbia, Missouri USA 1973, Madrid, Spain 1980, Cambridge, Great Britain 1989 were outstanding.
In 1989, he founded the Association of Hungarian Plant Breeders and directed it for 18 years. Now, he is the honorary chairman of the Association. He established the Hungarian Plant Breeders' Foundation in 1990 and is still the chairman of the Foundation. In 1993, he organized the Hungarian Seed Association which has been operating since then. He did pioneering work in the accession of Hungary to the International Union for the Protection of New Varieties of Plants (UPOV), as well as in the patenting of plant varieties, the introduction of variety usage fee and licence fee. He is the member of the European Association for Research on Plant Breeding (EUCARPIA). The Ukrainian Academy of Agricultural Sciences elected him as foreign member in 1993.

His work was recognized by several awards, the three most important ones of which: State Award 1985, Fleischmann Award 1993, Darányi Ignác Award 2012.

After retiring, he worked at the Department of Genetics and Plant Breeding of Szent István University as a university private professor. At present, he performs scientific consultancy for the Karcag Research Institute of the University of Debrecen, adapting Romanian wheat and triticale varieties and implementing his own breeding programme.

As a result of his breeding and educational activity, the national average yield of wheat has quadrupled in comparison to that in the 1960's, wheat can be harvested by combine-harvesters and the former wheat-importing Hungary has become a wheat-exporter.

We, the management and members of the Association of Hungarian Plant Breeders express our heartiest congratulations to the excellent wheat breeder and university lecturer, László Balla professor for his achievements and wish him further new varieties and good health, to the benefit of Hungarian plant breeding and the whole country.

Stag (Cervus elaphus)
(Photo by N. Bleier)

HUNGARIAN AGRICULTURAL RESEARCH

Vol. 22, No. 2.
June 2013
Journal of the Ministry of Rural Development Hungary

2 *László Balla is 80 years old*

4 *Examination of the adaptation of German plum varieties in Hungary*
Szilvia Kovács

12 *Big game meat production in Hungary: A special product of a niche market*
Krisztina Sonkoly, Norbert Bleier, Miklós Heltai, Krisztián Katona, László Szemethy László Szabó, Attila Beregi, and Sándor Csányi

17 *Hunting is Culture at Large! Wildlife knows no borders!*

19 *Juvenile growth of micropropagated black locust (Robinia pseudoacacia L.) clones under arid site conditions in Hungary*
K. Rédei, Zs. Keserű, J. Rásó, B. Antal

23 *Gábor Dénes Award*
Tóth Magdolna

Published by
NAKVI National Agricultural Advisory, Educational and Rural Development Institute (NAERDI)
H-1223 Budapest, Park u. 2. Hungary
www.agrarlapok.hu | info@agrarlapok.hu

Owner
Ministry of Rural Development

Editorial Office
Deparment of Mechanics and Engineering Design
Szent István University, Gödöllő | H-2103 Gödöllő, Hungary

Subscription request should be placed with the Publisher (see above)
Subscription are HUF 1200 (only in Hungary) or
$16 early plus $5 (p & p) outside Hungary

HU ISSN 1216-4526

Szilvia Kovács[1]

Examination of the adaptation of German plum varieties in Hungary

Elena plum

Traditions, present and future of Hungarian plum production

Plum has always been an important fruit in Hungary. It is in the group of fruit species – together with apple and sour cherry – that are produced in the largest quantities in the country. It is favoured due to its long consumption period, favourable fruit characteristics and numerous processing options. It can also be used for medical purposes, it has beneficial dietary effects.

The role of plum in nutrition has always been decisive. The main forms of consumption included jam, dried plum and plum brandy (szilvapálinka), while canning became popular in the 17th century. The fruits were preserved with honey, cane sugar, other dried fruits, as well as grape juice, red wine, rum or cognac. Plum was also pickled in a natural way. Today, plum is used for producing compote, jam, jelly and juice. It is also commonly used as quick-frozen plum or the filler for plum dumplings and stuffed pasta. The distillation of szilvapálinka, a Hungarian speciality acknowledged also by the European Union, from excellent quality plum has been revived these days. From plum, superb alcoholic compote (e.g. with rum or wine), dried plum

[1] *Budapest Corvinus University, Faculty of Horticultural Science, Department of Fruit-bearing Plants, H-1118 Budapest Villányi út 29-43. Telephone: 1-482-6284; E-mail: szilvias.kovacs@uni-corvinus.hu.*

stuffed with roasted nuts, dried plum coated with chocolate or sweet coating can also be prepared. Unfortunately, the production of dried plum – which established the fame of Hungarian plum production – is now insignificant, although the smaller fruits of 'Besztercei szilva' was used in large quantities until the 19th century to produce dried plum, which was highly demanded in foreign markets. The preparation of plum pudding (a special preserve), plum cheese and vinegary plum stuffed with garlic fell into oblivion as well (Surányi, 1980; Kovács, 2009/b; Szabó, 2004).

Jojo plum

Plum is a fruit species cultivated for several thousand years. The Hungarian word for plum, 'szilva' is of Slavic origin, the first Magyar settlers of Hungary were likely to get to know plum through the Slavs. At first they collected the fruits, then – in the Middle Ages – strong varieties that could be propagated by seeds or shoots were grown. As of the 14th-16th century, monarchs and aristocrats were more and more keen on exchanging the reproductive materials of various fruit varieties, and propagating the new varieties by budding and grafting. Many plum varieties arrived from the Turkish Empire, and also from German, Italian and Czech regions. Plum production significantly developed in the 19th century when large-scale production was established. Plantations were created to collect, preserve and assess the varieties. Plum production technology and pomology traits were introduced in books, journals. Varieties were recommended for certain sites and usage purposes.

The main fruit production regions were formed by the end of the 19th century – beginning of the 20th century, where fruit was mostly produced as a private activity. Due to the significant development in fruit production, 31.7 million plum trees were recorded in Hungary in 1895. After World War I, Hungary lost a considerable part of the historical plum producing regions, consequently, the number of plum trees reduced to 6-7 million. When large-scale plum production started in the 1960's, the number of plum trees increased again to almost 30 million, producing 250-300 thousand tons of plum. The yield in the 70's and 80's was around 200 thousand tons. After the change in the regime, both the production area and the yield reduced significantly (Surányi, 1980).

Hanita plum

Today, about 60-70 thousand tons of plum is harvested from 7000 hectares. The main production regions are in Szabolcs-Szatmár-Bereg, Bács-Kiskun and Pest counties. Unfortunately, our plum plantations gradually became aged, and severe technological deficiencies can be observed in many plantations, contributing to the yearly fluctuation in yield. Domestic and foreign marketing potentials were favourable in the last few years, and the demand for Hungarian plum has increased. In order to increase competitiveness, intensive irrigated plantations should be established, variety selection should be modernized and

Katinka plum

storage capacity should be increased (Kovács, 2009/a; 2012).

Changes in the variety selection in Hungary

The climatic conditions of Hungary support the production of European-type plum varieties. This group mainly includes domestic plums (*Prunus domestica* L.) with high ecological tolerance. The role of Ringló plum (*Prunus italica* convar. *claudiana* Poiret) which requires specific production conditions, cherry plum (*Prunus cerasifera* Ehrh.) varieties with large fruits and Mirabelle plum (*Prunus* x *syriaca* Bokh.) is insignificant in Hungarian production. Japanese-type plum varieties (*Prunus salicina* Lindl., *Prunus simonii* Carr.) belonging to the Far-Eastern group are widespread in Mediterranean areas and give a considerable part of the world's plum production, but they demand specific production conditions and thus their production area is not substantial in Hungary (Kovács, 2009/b; 2013; Szabó, 2004).

The Hungarian National List of Varieties involves 27 European-type and 3 Japanese-type state registered plum varieties. The origins of the varieties are varied: beside the 8 Hungarian ones, there are varieties from Germany, Serbia, Bohemia, France, Romania, England, Italy and the United States.

The variety selection changes continuously, which is driven by the spreading of *Plum Pox Virus* (PPV) and the appearance of new high-yielding varieties with greater value. The production of 'Besztercei szilva' dates back to centuries, but its susceptibility to plum pox led to the rapid decrease in its production area in the last decades. Today, it is only planted at a rate of 10-15%.

Presenta plum

The variety 'Stanley' – occupying about 15% of plum production area today - appeared in the plantations at the beginning of the 1970's. Plum varieties from the Serbian Čačak ('Cacanska lepotica', 'Cacanska rana', 'Cacanska rodna') and the American 'Bluefre' and English 'President' varieties became popular with the producers and consumers in the early 80's. In the last 15 yeas, from these varieties, 'Cacanska lepotica' has been planted in the largest area (30%), followed by 'Bluefre' and 'President' with a rate of 8-9%. High-yielding often self-fertilizing German, Serbian, Romanian varieties more resistant to sharka virus (such as 'Jojo', 'Valjevka', Top-series) appeared and play an ever increasing role in our plantations (Kovács, 2009/a, 2013).

Breeding objectives, today's 'ideal' plum variety

In European and North-American breeding stations, an important objective is to improve fruit quality and increase fruit size. At present, the 'ideal' variety produces roundish or oblong juicy fruits with a diameter of 40-50 mm, weight of 45-50 g, bluish or dark blue skin colour, excellent taste, high water

Tegera plum

soluble dry matter content (18-20 Brix%), firm pulp (2.5-3 kg/cm^2 pulp solidity), free-stone, low stone ratio.

Breeders also aim at increasing the yielding ability, liability to self-fertilization, growing features and winter hardiness. Other aims include the development of varieties suitable for certain usage (e.g. juice, jam, dried fruit), the extension of harvest period (early and late varieties). As for disease resistance, breeders focus primarily on varieties resistant to PPV as this causes the largest economic loss (Hartmann, 2010; Butac et al. 2011).

Varieties, locations of examination, methods

The varieties originating from German plum breeding centres (Research Station Geisenheim; University Hohenheim, Stuttgart) were planted in Hungarian plantations after the millennium, and their role in production gradually increases. Data on Hohenheim varieties ('Katinka', 'Tegera', 'Hanita', 'Jojo', 'Elena', 'Presenta') are available for several years and several production sites. The pomological traits of the varieties from the Geisenheim station ('Topfirst', 'Topfive', 'Toptaste', 'Tophit', 'Topend Plus') are only known from last year's data as these varieties started to yield fruit only in 2012 in the gene bank collection in Soroksár.

We started the assessment of German plum varieties in 2006 in the orchard of Kevefruct ZRt in Ráckeve and in the plum variety collection in the Hungarian Fruit and Ornamental Plant Production Research and Development Non-profit Kft (*Állami Gyümölcs- és Dísznövénytermesztési Kutató-Fejlesztő Közhasznú Nonprofit Kft*), in Érd-Elvira major. As of 2009, the examinations are carried out in the plum gene bank plantation in the Soroksár research station of the Budapest Corvinus University, Department of Fruit-bearing Plants.

In the orchards and variety collections, we recorded flowering date, harvest date, yielding ability, growing characteristics and susceptibility to Plum Pox Virus (PPV). The fruit samples were processed in the Fruit Analytical Laboratory of the Department of Fruit-bearing Plants, where morphologic (fruit shape, skin colour, flesh colour, free-stone fruit), physical (fruit weight, height, width, thickness, stone weight, pulp firmness) and nutritional values (water soluble dry matter content (Brix%), titratable acid content) were examined.

Harvest period

The **harvest period** of plum varieties grown in Hungary starts with 'Ruth Gerstetter' at the end of June-beginning of July, and ends with 'President' in the middle of September. The ripening period

Tophit plum

of German varieties grown in Hungary starts in the middle of July ('Katinka', 'Topfist'). The latest ripening variety is 'Topend Plus', the fruits of which can be harvested in the third decade of September and first decade of October. ***Harvest period was extended due to the late-ripening German varieties***. **Figure 1** demonstrates the recorded harvest periods of German varieties. Our examinations show that the ripening of each variety mostly takes 7-10 (14) days. The variety 'Tegera' can be characterised by a relatively quick ripening and a short harvest period (7 days), while 'Katinka', 'Toptaste', 'Jojo', 'Elena', 'Presenta' and 'Topend Plus' has more prolonged ripening (10-12 days). When the weather is favourable (dry and warm), fruits can be harvested from the trees of 'Elena' and 'Presenta' until the end of September, and of 'Topend Plus' until the middle of October.

Results of pomological examinations

The appearance of the fruits of German varieties reflects the targets of the breeding stations well: they have bluish (purple-blue) skin and elongated fruits (Table 1.). The colour of fruit pulp gradually changes from greenish to yellowish during ripening. According to our examinations, ***the fruits of Presenta' and 'Toptaste' are partially free-stone, while all the other assessed varieties are free-stone.*** As for 'Toptaste', this is confirmed by literature data as well (Hartman, 1998; Balmer, 2012).

German authors (Hartamann, 1998; Jacob, 2007) highlight the good taste of their varieties. Our examinations verified that they have ***pleasant sweet-sour taste***. 'Katinka', 'Tegera', 'Hanita' and 'Presenta' have remarkably pleasant taste. Hungarian consumers were also keen on 'Topfive', while 'Tophit' were found characterless in some years.

The **physical and nutritional parameters** of fruits describe the varieties well. To enable the comparability of data, fruits were harvested in nearly the same level of ripeness (85-90% ripeness), and care was taken to ensure representative sampling. Our results are shown in **Tables 2 and 3**.

The ***majority of the plum varieties*** could be described by ***medium-sized fruits*** (25-35 g). ***'Katinka' produces small fruits (25 g >), whereas 'Topend Plus' and 'Tophit' produces very large fruits (55 g <).*** The fruits we harvested from 'Hanita' and 'Jojo' were smaller, while those from 'Topfirst' were larger than those described by literature (Hartamann, 1998; Jacob, 2007; Balmer, 2012; Blazek és Pistekova, 2009).

European plum varieties can be characterised by large stone

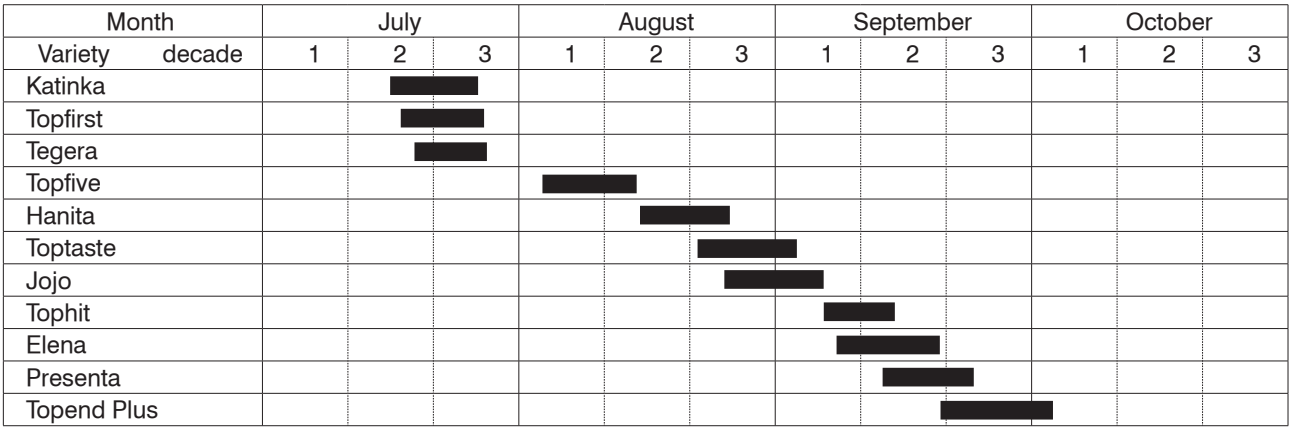


Figure 1: *Ripening periods of German plum varieties*

Topfive plum

relative to fruit size (stone ratio: 4-5-6%), therefore breeders aim at developing varieties with smaller stones. Remarkably ***low stone ratio (3.5-4%) was found in the varieties 'Tophit', 'Topfirst', 'Toptaste' and 'Topend Plus'. High stone ratio (6-6.5%) was observed in 'Jojo', 'Topfive' and 'Hanita***'. The ***stone weight of the majority of the plum varieties examined varied between 1.5 and 2 g.*** The varieties in the Top-series – with the exception of 'Toptaste' – have stone weight above 2 g (**Table 2**).

In order to ensure easy transportability and long shelf life, breeders intend to develop varieties with ***firm pulp*** (***2.5-3 kg/cm²).*** The pulp firmness of ***'Jojo', 'Topfive' and 'Toptaste'*** falls within the desired range. ***'Hanita' and 'Topend Plus' can be characterised by low pulp firmness (1.5 kg/cm² >), while 'Presenta' and 'Tophit' are remarkable for their firm pulp (3.5-4 kg/cm²).*** The pulp firmness values measured by us correspond most to the examination results of Blazek and Pistekova (2009).

The laboratory measurements showed that the ***majority of the varieties*** had ***water soluble dry matter content between 18 and 20 Brix%*** (**Table 3**). This value exceeds those of the varieties produced in Hungary for several decades. However, no significant advancement can be observed in

Variety	Fruit weight (g)	Height (mm)	Thickness (mm)	Width (mm)	Stone ratio (%)	Stone weight (g)	Pulp firmness (kg/cm²)
Elena	25.5	39.5	32.3	32.0	5.6	1.4	1.9
Hanita	33.6	42.7	35.4	35.0	6.0	1.9	0.9
Jojo	31.0	45.8	33.3	32.4	6.4	2.0	2.4
Katinka	22.3	40.7	30.5	31.9	5.2	1.1	1.9
Presenta	26.9	42.6	32.3	32.6	5.4	1.4	3.9
Tegera	32.3	45.5	34.3	35.5	5.7	1.8	1.8
Topend Plus	56.2	53.9	41.0	42.7	4.2	2.3	1.2
Topfirst	62.7	51.6	45.5	42.8	3.8	2.3	1.9
Topfive	38.6	44.0	35.0	38.9	6.3	2.4	3.0
Tophit	61.3	52.6	43.4	45.4	3.5	2.1	3.5
Toptaste	32.5	39.3	35.7	35.4	4.2	1.3	2.9

Table 2: *Average physical parameters of the fruits of plum varieties*

Topend Plus plum

this field with varieties harvested in middle and late July ***('Katinka', 'Tegera', 'Topfirst'***) as they showed ***low water soluble dry matter content (13-14 Brix%)*** similarly to early-maturing plum varieties. ***The values measured for the mid-maturing 'Topfive' and 'Toptaste' were extremely high (27 Brix%).*** Jacob (2007) stated that the fruit dry matter content of 'Toptaste' could reach as many as 32 Brix%, while for 'Topfive' values between 18-20 Brix% can be expected.

The ***titratable acid content*** of the varieties varied between ***0.4% ('Topfirst') and 1.2% ('Tegera').*** The lowest values (0.4-0.5%) were measured for 'Topfirst', 'Presenta' and 'Elena', while Tegera' and 'Hanita' had the highest (1.1-1.2%) titratable acid content. The rates of **water soluble dry matter content** and **titratable acid content** were calculated, which confirm the results of organoleptic assessment. The highest rates were found for '***Topfirst' and 'Topfive'*** and the late-maturing varieties ***('Presenta', 'Elena', 'Topend Plus'***). In their fruits, sweet taste dominates. ***'Tegera', 'Hanita' and 'Katinka'*** showed low rates, ***their fruits have pleasant, refreshingly sour-sweet taste with a light Muscat aroma***.

Variety	Titratable acid content (%)	Water soluble dry matter content (Brix%)	Ratio of water soluble dry matter content and titratable acid content
Elena	0.5	18.2	36.4
Hanita	1.1	17.1	15.5
Jojo	0.6	18.9	31.5
Katinka	0.7	13.0	18.6
Presenta	0.5	20.6	41.2
Tegera	1.2	14.0	11.7
Topend Plus	0.6	21.3	35.5
Topfirst	0.4	14.1	35.2
Topfive	0.5	27.5	55.0
Tophit	0.9	19.9	22.1
Toptaste	0.9	27.9	31.0

Table 3: *Average nutritional value parameters of the fruits of plum varieties*

Cultivation parameters

In accordance with our observations, German varieties have ***diverse flowering dates*** (refer to **Table 4**). The flowering period is started by 'Katinka' and 'Presenta', and is closed by 'Hanita'. In 2012, severe frost damage was observed during flowering in the varieties 'Jojo', 'Tegera' and 'Topfirst'. As per scientific literature sources (Balmer, 2012; Hartmann, 1998) the ***majority of the varieties is self-fertilizing***. '***Topfirst', 'Topfive', 'Tophit' and***

Variety	Flowering date	Yielding ability
Elena	mid-maturing	high-yielding
Hanita	late maturing	high-yielding
Jojo	mid-early/mid-maturing	high-yielding, liable to excessive fruit production, too many twin-plums in certain years
Katinka	early/mid-early maturing	high-yielding, liable to excessive fruit production, liable to cast fruits during ripening
Presenta	early/mid-early maturing	high-yielding, slightly liable to staged fruit production
Tegera	mid-early maturing	high-yielding, slightly liable to cast fruits during ripening
Topend Plus	mid-early maturing	gives average or high yield
Topfirst	mid-maturing	good yielding ability, liable to cast fruits during ripening
Topfive	mid-maturing	high-yielding, liable to excessive and staged fruit production
Tophit	mid-late maturing	high-yielding, liable to excessive fruit production, should be thinned, liable to staged fruit production
Toptaste	mid-late maturing	good yielding ability, liable to excessive fruit production

Table 4: *Flowering date and yielding ability of plum varieties*

'***Toptaste***' are ***partially self-fertilizing,*** therefore a pollen provider is required when they are planted.

Our examinations proved that German varieties ***start producing fruit early and have good yielding ability***. The reason why they can start producing fruit early is that flower buds develop in large quantities not only on the stems but on the fruit branches as well. Certain varieties are liable to produce excessive amount of fruits and staged fruit production (e.g. 'Tophit', 'Topfive'), thus require fruit thinning in certain years in order to maintain the balance of fruit production. Varieties in the early-maturing group ('Katinka', 'Topfirst', 'Tegera') trees may cast their fruits during ripening (**Table 4**).

Due to the more intensive growth of the varieties and the steeper angular position of main branches, greater attention should be paid to the establishment of favourable crown structure. The tree of 'Jojo' with less intensive growth and effuse crown can be formed very easily.

According to literature sources (Balmer, 2012; Hartmann 1998; Jacob, 2007), the varieties ***are tolerant or resistant to plum pox***. ***The most resistant variety, on the basis of literature and our examinations, is the 'Jojo'***. Very little leaf symptoms were observed in 'Toptaste', 'Topend Plus', 'Topfive' and 'Topfirst'. Medium level of leaf infection was found in 'Elena', 'Presenta' and 'Tophit'. Varieties that show only leaf symptoms can be considered as tolerant to PPV. ***Literature sources describe the varieties 'Katinka', 'Hanita' and 'Tegera' as tolerant, too. However, our observations showed that these varieties are not tolerant as fruit symptoms also appeared beside leaf symptoms.*** From these varieties, 'Katinka' was found to be the most susceptible.

Literature

Balmer, M. 2012. Sortensprektrum. In. Balmer, M., Nyéki, J., Apáti, F. (szerk.) Pflaumen- und Zwetschenanbau. Die Herausgabe dieses Buches wurde gefördert von: MAG., Nemzeti Fejlesztési Ügynökség. 12-32.

Blazek, J., Pistekova, I. 2009. Preliminary evaluation results of new plum cultivars in a dense planting. Hort. Sci. (Prague). (2):45-54.

Butac et al. 2011. Overview of plum breeding in Europe. Second Balkan Symposium on Fruit Growing. Romania. 2011. szeptember 5-7. Előadás. http://bsfg2011.icdp.ro/materiale/somepresentations/04Overview%20of%20Plum%20Breeding%20in%20Europe.pdf

Hartmann, W. 1998. New Plum Cultivars from Hohenheim. Acta Horticulturae. 478:171-174.

Hartmann, W. 2010. Opening Address. Acta Horticulturae. 874:19-23.

Jacob, H. B. 2007. Twenty-Five Years Plum Breeding in Geinsenheim, Germany: Breeding Targets and Previous Realisations. Acta Horticulturae. 734: 341-346.

Kovács, Sz. 2009/a. Szilvafajták választékbővítésének lehetőségei Magyarországon. Agrofórum extra 28, 48-50.

Kovács, Sz. 2009/b. Szilva. In. Tóth, M. (szerk.) Gyümölcsfaj- és fajtaismeret. Egyetemi jegyzet. 115-126.

Kovács, Sz., Molnár, Á. Szenci, Gy. Tóth, M. 2012. Commercial varieties of European plums grown in Hungary, a comparison of promising foreign varieties with the wildery grown traditional ones. International Journal of Horticultural Science. 18 (2): 15-22.

Kovács, SZ. 2013. Az európai és a japánszilva nemesítésének főbb irányai és legújabb eredményei. kertesztananyag.hu/gyumolcsfajta-ertekeles/szilva

Surányi, D. 1980. A szilvatermesztés története. In. Tóth, E., Surányi, D. (szerk.) Szilva. Mezőgazdasági Kiadó. Budapest. 100-116.

Szabó, Z. 2004. Szilva. In. Papp J. (szerk.) 2. A gyümölcsök termesztése. Mezőgazda Kiadó. Budapest.235-261.

Krisztina Sonkoly, Norbert Bleier, Miklós Heltai, Krisztián Katona, László Szemethy, László Szabó, Attila Beregi, and Sándor Csányi[1]

Big game meat production in Hungary: A special product of a niche market

Wild ungulate populations are increasing throughout in Europe, with a consequent increase in harvests and availability of their meats (Apollonio et al. 2010; Ramanzin et al. 2010). It is widely known that game meat/venison is not produced under standard conditions like in animal husbandry (Winkelmayer et al. 2011). 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 meat quality parameters that can depend on the foods consumed by the wild animals. The purpose of this paper is to evaluate the trends of available meat from big game in Hungary, and to show the issues related the the increasing availability.

During the last 50 years the composition of the Hungarian hunted fauna showed huge changes. Small game populations declined in a considerable extent and the importance of brown hare, ring-necked pheasant, grey partridge and water-fowl species has seriously diminished. At the same time, big game populations and harvest showed marked and continuous increase: the range of red deer, roe deer and wild boar increased and their population sizes and harvests reached unprecedented levels (Csányi and Lehoczki, 2010). After 2000, approximately 250-300 thousand big game animals (red deer, fallow deer, roe deer, mouflon, and wild boar) had been shot annually (**Table 1**).

Game management in Hungary is based on a well-organised hunting-system that relies on the *Act LV/1996 of game conservation, management and hunting*. The purpose of the Hungarian legislation is to consider the interests of the landowners, the conservation of game species and their habitats, other sectors managing natural resources (agriculture and forestry) as well as the interests of nature conservation. Actually, >55000 Hungarian citizens are hunting and an additional 20-30000 foreign hunters visit Hungary annually (Csányi and Lehoczki, 2010).

The legal framework of game conservation, game management, and hunting including venison distribution are regulated in Act LV/1996. Specific and detailed issues related to the implementation of the Act are provided 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

Decade	Average harvest in the decade	Change of average harvest*	Number of hunters	Change of the hunter number	Harvest/hunter
Big game harvest					
1960-1969	21,492	1.0	19,284	1.0	1.11
1970-1979	80,452	3.7	25,318	1.3	3.18
1980-1989	101,995	4.7	33,124	1.7	3.08
1990-1999	116,391	5.4	45,275	2.3	2.57
2000-2011	221,666	10.3	54,535	2.8	4.06
Small game harvest					
1960-1969	686,214	1.0	19,284	1.0	35.58
1970-1979	1,341,326	2.0	25,318	1.3	52.98
1980-1989	1,244,280	1.8	33,124	1.7	37.56
1990-1999	845,233	1.2	45,275	2.3	18.67
2000-2011	636,646	0.9	54,535	2.8	11.67

* Change compared to the average of the 1960-1969 decade

Table 1. *Changes in big game harvest, small game harvest, and the number of hunters between 1960 and 2011 in Hungary. The magnitude of changes are expressed on the bases of the decal averages.*

[1] Szent István University, Institute for Wildlife Conservation, Gödöllő H-2100

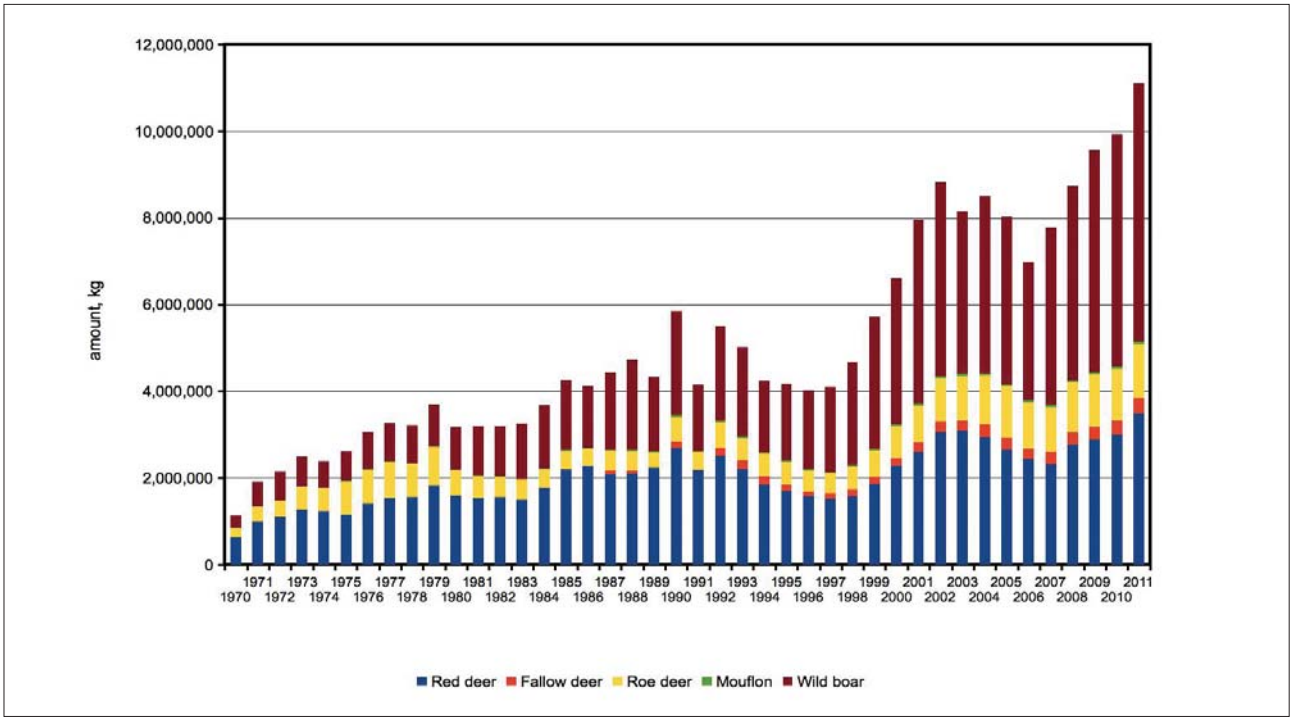


Figure 1. *The changes in the amount of big-game meat produced between 1970 and 2011, kilograms (Source: National Game Management Database)*

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 EC Regulation 852/2004 (29 April 2004) on the hygiene of foodstuffs, and the EC Regulation 853/2004 (29 April 2004) laying down specific hygiene rules for foods and animal origin.

Regarding the handling of harvested game animals and the requirements of food hygiene the Decree No. 43/2011. (V. 4.) of the Minister of Rural Development is especially important. Careful inspection of game before killing and post mortem examination of carcass and organs, as well as the strict adherence to certain rules of good hygiene practice along the food chain ('from forest/field to fork') are necessary to assure that all quality traits are preserved and that game meat is not a risk to the consumer (Winkelmayer et al. 2011). According to EU regulations, game management units selling game to wholesalers or game processing companies, are responsible for meat safety and traceability. Any wild game has to be inspected by a "trained person" before being transferred to the "approved game handling establishment". This person must be able to ascertain abnormal behaviours in the living animal and pathological changes caused by disease, environmental contamination or other factors, which may affect human health. Once the carcass arrives at the approved game handling establishment, it is inspected by a veterinarian and, if relevant, further analyses may be conducted (Ramanzin et al. 2010; Winkelmayer et al., 2011).

According to the official game management statistics, in the 2011/2012 hunting year harvest of 47,700 red deer, 11,717 fallow deer, 93,146 roe deer, 3,485 mouflon, and 128,863 wild bor were reported by the hunting units. The annual hunting bag totalled ca. 285,000 individual big game and more than 500,000 small game. Animals are not only hunted for valuable trophies, but also for their meat for consumption. As a consequence of the changes in the game populations the composition of the game meat produced changed in the last 50 years (**Table 2**). Traditionally the meat of big game species were exported to western European markets and the domestic market was not developed. Passing about 10 thousand tons of available venison to Hungarian customers has not been solved in the last decades.

The available game meat is directly related to the number of animals shot in each year. This is clearly reflected in the changes of the amount of game meat and the total meat produced between 1960 and 2011 (**Figure 1**). Meanwhile in the 1960s the total amount of game meat was much less than 2000 tons, it reached 4000 tons by the mid-1980s. Fast increase of the total game meat production started in 1998 and this is still continues to these days. Analysing the proportions of the meat of the five big game species

Year	Big game harvested (individuals)						Big game meat (1000 kg)					
	Red deer	Fallow deer	Roe deer	Mouflon	Wild boar	Total	Red deer	Fallow deer	Roe deer	Mouflon	Wild boar	Total
1960	3,800		3,700		3,900	11,400	***128***		***105***		***88***	***321***
1961	4,700		4,700		4,200	13,600						
1962	5,400		5,300		5,212	15,912						
1963	5,431		9,442		5,602	20,475						
1964	5,394		7,668		4,707	17,769						
1965	6,500		7,931		5,192	19,623	***241***		***14***		***73***	***328***
1966	6,700		9,400		5,800	21,900						
1967	6,700		12,060		7,100	25,860						
1968	6,804		14,980		8,203	29,987						
1969	8,135	395	18,206	297	7,342	34,375						
1970	9,061	659	19,613	166	8,992	38,491	***630***		***204***	***4***	***291***	***1,129***
1971	11,869	470	25,910	130	12,076	50,455	***984***		***353***	***2***	***565***	***1,904***
1972	14,429	758	29,434	138	13,945	58,704	***1,100***		***385***	***2***	***665***	***2,152***
1973	15,993	1,185	45,122	328	14,288	76,916	***1,264***		***537***	***5***	***692***	***2,498***
1974	15,410	958	40,794	391	12,895	70,448	***1,228***		***531***	***7***	***614***	***2,380***
1975	16,642	1,420	54,337	583	14,050	87,032	***1,163***		***751***	***10***	***695***	***2,619***
1976	18,020	1,375	59,720	664	17,150	96,929	***1,409***		***778***	***11***	***851***	***3,049***
1977	19,157	2,143	62,424	1,043	18,906	103,673	***1,542***		***816***	***15***	***893***	***3,266***
1978	19,072	2,591	61,341	818	19,018	102,840	***1,559***		***765***	***12***	***882***	***3,218***
1979	22,710	2,221	72,251	1,119	20,729	119,030	***1,813***		***896***	***16***	***977***	***3,702***
1980	19,617	1,585	51,143	960	20,241	93,546	***1,589***		***585***	***13***	***986***	***3,173***
1981	19,216	1,326	46,171	886	23,242	90,841	***1,536***		***506***	***11***	***1,140***	***3,193***
1982	19,769	1,169	42,649	896	24,620	89,103	***1,557***		***462***	***12***	***1,154***	***3,185***
1983	22,275	1,683	43,672	854	33,780	102,264	***1,493***		***470***	***10***	***1,268***	***3,241***
1984	23,268	2,380	41,302	1,179	34,101	102,230	***1,766***		***426***	***18***	***1,472***	***3,682***

Table 2. *Number of big game harvested (individuals) and game meat produced (1000 kg) between 1960 and 2011*
Sources and notes*: National Game Management Database for number of animals harvested; Game meat data set in bold and italics were data published by Tóth (2005) as exports by MAVAD Inc., all other data were published in annual game managements statistics; between 1960 and 1990 red deer and fallow deer venison were pooled in the statistics; empty cells represent data not available;*

marked changes can be identified (**Figure 2**). In the 1970s >50% of the game meat was produced by red deer shooting and 20-30% was wild boar meat. Roe deer shared with 30% of the total game meat production. Although all of the big game species increased during the last half century, their contribution was not different to the game meat production. The share of red deer venison decreased to around 30% and wild boar increased >50%. The proportion of roe deer ranges between 15-20%.

By the end of the 1990s the export of the large amount of wild boar meat and red deer venison became difficult on international markets, especially that domestic markets did not exist and pricing of game meat was not adapted to the potential Hungarian consumers. However, the demand for healthy, affordable and available venison could be important (Anonymous, 2003). It may increase the revenues of game management, and it might contribute to the development of quality of life of rural populations and attractiveness of the country. Until 2011 the opportunities of the game management units to sell the game meat in small amounts on the domestic market was limited. Practically the domestic use consisted only the hunters' share. The wholesalers, the meat-processing and meat-packing companies were producing for the international markets. The more liberal rules introduced in 2011 diversified the market channels and allowed the direct connection of the game management units (producers) and the consumers (individuals). This has made possible to increase the Hungarian market and the increase of the domestic consumption of big game meat. In spite of the positive changes, the domestic market has not been assessed yet and the specific characteristics of this niche market is not known.

During the last half century the total amount of game meat produced showed >10-fold increase. One of the difficulties of the game meat market is the fluctuating production and the dependence on management efforts to control big game populations (**Figure 1**). As it was already mentioned the total amount sharply increased between 1997 and 2002, and after a decline it increased again between 2007 and 2010. This pattern is clearly connected to the introduction of a shooting quota system in order to

Year	Big game harvested (individuals)						Big game meat (1000 kg)					
	Red deer	Fallow deer	Roe deer	Mouflon	Wild boar	Total	Red deer	Fallow deer	Roe deer	Mouflon	Wild boar	Total
1985	29,831	3,394	41,535	1,469	35,774	112,003	***2,201***		***424***	***22***	***1,617***	***4,264***
1986	31,268	3,555	38,653	1,500	35,751	110,727	***2,270***		***399***	***23***	***1,428***	***4,120***
1987	27,186	2,880	34,000	1,654	34,675	100,395	*2,074*	*94*	*460*	*30*	*1,784*	*4,441*
1988	27,422	2,455	33,367	1,915	40,219	105,378	*2,092*	*80*	*451*	*35*	*2,069*	*4,726*
1989	30,515	3,367	36,313	2,353	40,908	113,456	***2,229***		***354***	***35***	***1,722***	***4,340***
1990	35,240	4,621	41,494	2,976	46,672	131,003	*2,688*	*150*	*561*	*54*	*2,401*	*5,854*
1991	36,749	6,205	44,005	2,812	43,768	133,539	***2,186***		***405***	***29***	***1,532***	***4,152***
1992	32,787	6,463	42,512	2,408	42,895	127,065	2,507	184	591	43	2,173	5,498
1993	29,959	7,456	37,606	2,568	42,851	120,440	2,201	201	503	49	2,065	5,020
1994	23,943	6,493	38,801	1,803	33,451	104,491	1,846	189	521	32	1,658	4,246
1995	21,825	5,462	37,890	2,344	34,979	102,500	1,690	154	511	42	1,777	4,174
1996	20,428	4,389	35,423	2,080	35,053	97,373	1,561	120	484	30	1,825	4,021
1997	19,692	4,652	34,481	1,464	38,126	98,415	1,508	131	473	25	1,956	4,093
1998	20,105	5,460	37,894	2,002	48,481	113,942	1,574	158	527	33	2,378	4,670
1999	24,184	5,480	44,437	2,615	58,368	135,084	1,867	162	604	44	3,047	5,724
2000	28,912	5,976	52,754	2,332	67,745	157,719	2,267	185	736	39	3,378	6,605
2001	34,048	6,652	61,851	2,674	88,297	193,522	2,603	207	856	44	4,251	7,961
2002	41,708	9,004	72,479	3,723	93,964	220,878	3,043	261	983	61	4,474	8,822
2003	41,640	6,553	76,599	2,536	72,109	199,437	3,083	247	1,024	50	3,741	8,145
2004	39,095	7,563	85,646	2,488	77,207	211,999	2,935	290	1,141	48	4,097	8,510
2005	35,178	7,252	89,567	2,377	70,325	204,699	2,657	261	1,193	49	3,880	8,039
2006	30,814	6,807	80,409	1,952	56,544	176,526	2,431	239	1,070	43	3,202	6,984
2007	32,734	7,768	79,264	2,246	83,776	205,788	2,317	278	1,035	46	4,103	7,779
2008	34,996	8,255	85,887	2,531	83,661	215,330	2,763	284	1,151	50	4,490	8,738
2009	37,809	9,646	89,532	2,710	99,444	239,141	2,888	293	1,204	52	5,134	9,572
2010	39,161	8,884	88,288	2,986	100,936	240,255	2,990	334	1,190	56	5,362	9,932
2011	45,759	9,702	92,880	3,001	116,258	267,600	3,482	363	1,249	58	5,957	11,109

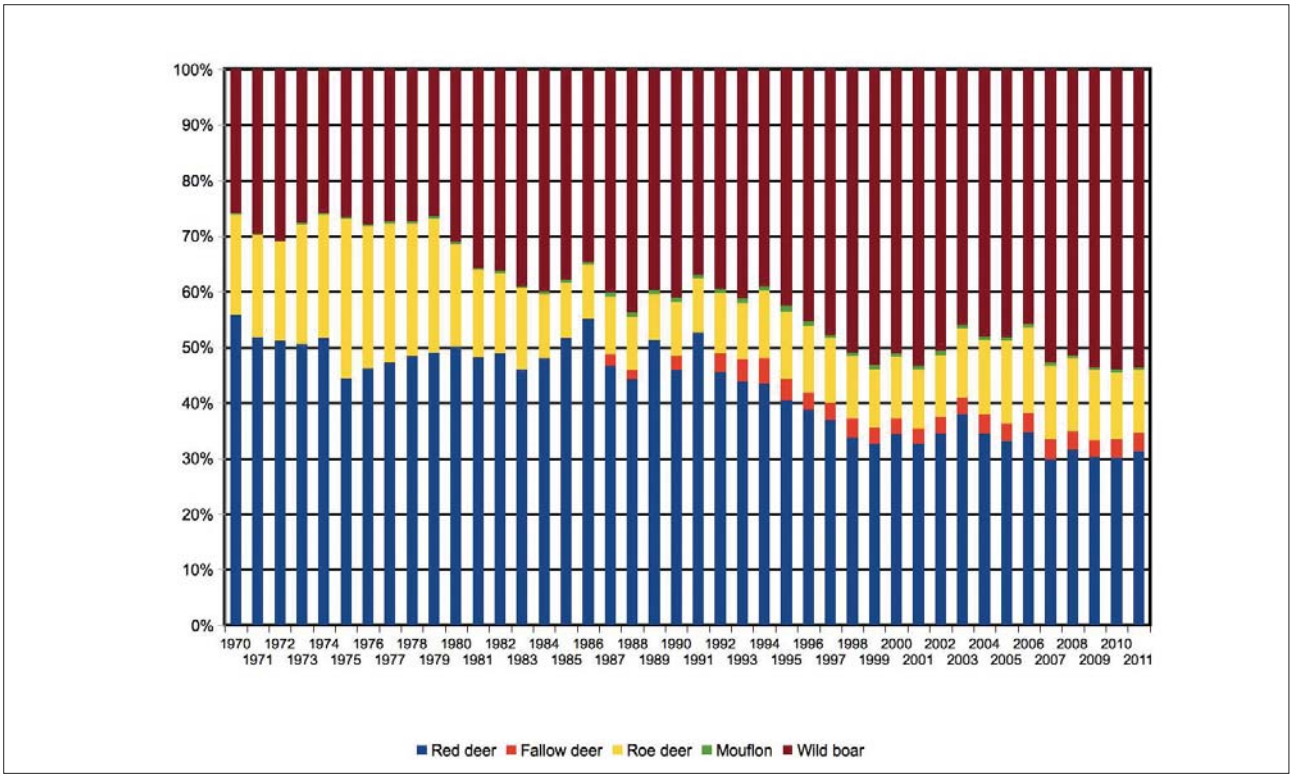


Figure 2. *The proportional share of the five big-game species in the total game meat produced between 1970 and 2011 (Source: National Game Management Database; until 1990 red deer and fallow deer venison were pooled in the statistics)*

reduce big game populations to more tolerable levels (and the damages attributed to them). At the same time the meat share of the five big game species shows considerable differences (**Figure 2**).

Game meat and venison are products of nature, healthy foods used primarily locally or delivered not too distant markets. Big game meats generally have a low fat content, although with a certain variability associated with sex, hunting season, age and physiological conditions, and a favourable fatty acid composition. In general, they are darker, less tender and characterised by a more intense and peculiar flavour than meats from domestic animals. However, these properties also show a great inter- and intra-specific variability (Ramanzin et al. 2010). Risks for the consumer associated with contaminants (heavy metals, radionuclides, organochlorine pesticides) and zoonoses are considered to be low. 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. The fat-content of roe-deer is almost one-tenth that of beef, while roe-deer meat contains 450 times more B_1 vitamin than beef (Vörös, 2009). Therefore, game meat can and should be promoted as an excellent component of almost any healthy nutrition plan (Lugasi, 2006).

Consumers rate venison as a special food and venison 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 one-third of the adult population in Hungary. However, the majority of consumers do not know the beneficial nutritional properties of venison.

The dominance of wild boar and red deer can clearly be attributed to their increasing populations and bags, and also there are the heaviest of the hunted species. It would be very important to direct the meat produced by red deer and wild boar hunting to the domestic market. Both big game species in Europe reached never seen peaks of population numbers and reduction of their populations requires sustained hunting pressures (Apollonio et al. 2010). Based on this fact, it can be predicted that the hunting bag of the wild boar and red deer will remain on high levels and the prices on the foreign markets stay depressed on the long-term.

The Institute for Wildlife Conservation (Szent István University) started a research program to assess the various aspects of game meat production, meat quality and markets in Hungary. In order to stabilize the Hungarian game meat market and the improve the food-chain security we propose the following actions:

- Monitoring of game meat production and the full channel of the food processing.
- Establishment of a system of game meat quality standards and assurance with special reference to the effects of habitat conditions and game feeding.
- Comparison of the game meat originating from the wild and produced on game farms and in fenced areas (hunting gardens)
- Monitoring of game diseases and zoonosis and the potential food safety issues related to game meats.
- Establishment of a network of accredited laboratories prepared for the analyses of the increased amount of game meat being sold on the domestic market.
- Set up of a gen bank in order to provide a basis for the protection of the wild origin/purity of game meats and their products on the market.

Acknowledgements

This research program is supported by TÁMOP-4.2.1.B-11/2/KMR (*Level up the education and research at Szent István University*) and the publication was supported by the "*Research Faculty Grant*" of the Hungarian Ministry of Human Resources" (registration no.: 7629-24/2013/TUDPOL).

References

Anonymous (2003): Vadhúspiac az EU-ban. GfK Hungária Piackutató Intézet tanulmánya. 52pp.

Apollonio M., Andersen R., Putman R. (eds.) (2010): European ungulates and their management in the 21st century. Cambridge University Press, Cambridge

Csányi, S. and Lehoczki, R. 2010. Ungulates and their management in Hungary. Pages 291-318 in: Apollonio, M., Andersen, R. and Putman, R. (Eds.) Ungulate management in Europe in the XXI century. Cambridge University Press, Cambridge

Lugasi, A. (2006): A vadhúsok szerepe a táplálkozásban tekintettel kémiai összetételükre és egyes élelmiszer-biztonsági szempontokra. A hús, 2006/2: 85-90.o.

Ramanzin, M., Amici, A., Casoli, C., Esposito, L., Lupi, P., Marsico, G., Mattiello, S., Olivieri, O., Ponzetta, M. P., Russo, C. és Marinucci, M. T. 2010. Meat from wild ungulates: ensuring quality and hygiene of an increasing resource. Italian Journal of Animal Science, 9: e61

Tóth, S. 2005. A hírnév kötelez. Vadászat és vadgazdálkodás Magyarországon 1945-1990. Nimród Alapítvány, Budapest, 359pp.

Vörös, G. (2009): Amit tudnunk kell a vadhúsról. In: Pechtol J. (szerk.) Vadászévkönyv 2009. 106-114.

Winkelmayer, R., Stangl, P.-V. and Paulsen, P. 2011. Assurance of food safety along the game meat production chain: inspection of meat from wild game and education of official veterinarians and 'trained persons' in Austria. Pages 245-258 in: P. Paulsen, A. Bauer, M. Vodnansky (Eds.) Game meat hygiene in focus. Wageningen Academic Publishers, Wageningen

Hunting is Culture at Large! Wildlife knows no borders!

The **Jubilee 60th General Assembly of the International Council for Game and Wildlife Conservation** (CIC) took place in the triangle of the Czech Republic, Slovakia and Hungary from the 26th – 30th April 2013. Renowned world experts gathered to discuss the topic of wildlife management under the motto Hunting: **Conserving Wildlife – Key to Global Cultural Heritage.**

Following CIC Council meetings in Prague and Bratislava, the core events took place in Budapest, Hungary. The highlight in Prague was a Hubertus mass in the St. Vitus Cathedral celebrating the 90th anniversary of the Czech Hunting Association and the Jubilee 60th General Assembly of the CIC with more than 2000 hunters from all parts of the Czech Republic, neighbouring countries and the Council members of the CIC.

In Slovakia, a delegation of the CIC Council was honoured to be received by H.E. the President of the Slovak Republic and the Slovak CIC Delegation gave an exquisite lunch, followed by an enlightening musical performance with a taste of a new hunting opera.

The opening ceremony of the Budapest programme was held in the magnificent and spectacular Hungarian Parliament. The Opening Ceremony was honoured by the presence of many distinguished guests and a series of prestigious keynote speakers, including Reinhold Messner, mountaineer, adventurer and explorer together with the Namibian John Kenena Kasaona. Both gave fascinating insights into the role of humans in nature. In a world where humans are becoming increasingly disconnected from nature, one of the most striking reminders of the importance of hunting in wildlife management was the enthusiastically applauded statement from Jon Hutton, Executive Director of UNEP-WCMC: "**Hunting is not part of conservation; it is conservation**". Hunting is a decisive wildlife conservation tool in today's managed environment! H.E. the Minister of Environment of Namibia, honourable guest of the assembly announced that Namibia was in the process to join the CIC as a State member.

The CIC is hugely grateful for the video message of Dr. Braulio Ferreira de Souza Dias, Executive Secretary of the Convention on Biological Diversity (CBD). The message served to further highlight the importance of the sustainable use of wildlife in the conservation biological diversity and preservation of rural livelihoods. At the same time it acknowledged the leading role which the CIC is playing in actively achieving this objective, in close collaboration with the CBD. The Collaborative Partnership on Sustainable Wildlife Management (CPW), a concept born from the CIC and in which the CIC, CBD and 10 other partner organisations are collaborating on the subject of wildlife management is just one excellent example of this.

Given the motto of the General Assembly it was most appropriate that the Division meetings started with that of the CIC Culture Division. The message from the CIC Culture Division discussions was clear: **hunting is an intangible part of human culture!**

Interesting new evidence is showing that the traditional harvesting of strong trophy males can lead to a degradation of genetic make-up of populations. In his presentation, Prof. Sándor Csányi showed that data obtained from hunting bag statistics, including trophies should be analysed, but also linked to other resource data e.g. from forest management. Detecting and understanding trends is essential for successfully adapting wildlife management schemes to a changing environment.

The participants of the meetings accepted that

there is a need to further develop the so-called "fly-way ideology" This includes the harmonization of species protection and hunting legislation and management procedures at regional and national levels, particularly in the European context.

One of today's greatest conservation challenges is the return of large carnivores to the highly fragmented and urbanised landscapes, especially in Europe. There was a general consensus that these magnificent animals are essential elements of a healthy and balanced ecosystem. It was highlighted that whereas Europe is trying to manage increasing populations, in Africa the issue is about how to mitigate human-wildlife conflicts with decreasing populations. Concerns were raised about non-range countries trying to influence the policies of range countries. Participants urged that locals be empowered to deal with their large carnivore management issues. Experience clearly shows that benefit sharing of income from sustainable hunting provides the incentives for local people to motivate and tolerate possibly life-threatening large carnivores in their neighbourhood.

A follow-up from the previous General Assembly was the presentation by Metsähallitus (Finnish State Forestry Enterprise) on the subject of the economics of hunting on state-owned lands in Finland. This was greeted with a great deal of interest from participants and seen as a topic which should be examined further and highlighted again at future General Assemblies.

The objective of the future could be a CIC library with data on the economics of hunting.

Already during the opening of the General Assembly, the announcement was made that the CIC wishes to establish a wildlife management reference library at its Headquarters in Budapest, thus contributing one more building block to a possible future **Global Wildlife Centre of Excellence in Hungary.**

Another groundbreaking event was a first meeting between the CIC and the Environmental Crime Programme of Interpol. The meeting resulted in the agreement to jointly map possible areas of collaboration between the CIC and Interpol in order to work towards a Memorandum of Understanding between the two organizations. A further meeting with representatives of the Food and Agriculture Organisation of the United Nations (FAO) confirmed the intent of both CIC and FAO to collaborate further, beyond the joint-work which has already been done.

As a further result of the 60th CIC General Assembly, two important recommendations were passed by the CIC. The first concerned **Age-Based Lion Hunting**, and the second the **Trade in Rhino Horn**. Both topics are of high importance for wildlife conservation internationally and in line with the sustainable use principles and scientifically based management of wildlife, which the CIC advocates.

The CIC extends its deep appreciation to Slovakia, the Czech Republic and Hungary for being such excellent hosts to these hugely successful events. The important support, especially of the Hungarian Government, was essential in making the 60th General Assembly a success. **Wildlife truly knows no borders!**

K. Rédei[1], Zs. Keserű[1], J. Rásó[1], B. Antal[2]

Juvenile growth of micropropagated black locust (Robinia pseudoacacia L.) clones under arid site conditions in Hungary

Black locust (*Robinia pseudoacacia* L.) was the first forest tree species introduced and acclimated from North America to Europe at the beginning of the 17th century. Hungary has a leading position in the field of black locust growing, as it has been grown for more than 250 years in the country. Being aware of the importance of black locust, forest research in Hungary has been engaged in resolving various problems of black locust management for a long time, and a lot of research results have already been implemented in the practice. It is a fast growing, nitrogen fixing, site tolerant, excellent coppicing species with frequent and abundant seed production and relatively high yielding potential. It has a durable and high quality wood, which is used for many purposes. Although native of North America, black locust is now naturalized and widely planted throughout the world from temperate to subtropical areas. In Hungary, this species has played a role of great importance in the forest management, covering approximately 23 % of the forested area and providing about 20 % of the annual timber output of the country. Black locust is native to the mountains of the eastern United States and naturalized throughout much of the North America as well as many parts of the world. Its rapid spread all over the world may be attributed to its adaptability to a wide range of conditions, favourable breeding properties, excellent coppicing, high survival rates, fast growth and high yield (Keresztesi, 1988).

Black locust timber can be used for industrial purposes (mining, construction, furniture, building industry and floor covering) for agriculture (post, pole wood and agricultural timber) and the black locust stands are to be considered the basis of the Hungarian apiculture and honey production. The black locust is also a promising tree species for setting up energy and environmental plantations. The development of an integrated landscape includes forests, agricultural fields and shelterbelts. In these cases afforestation with black locust is focused on improving the natural environment and the living conditions of the population as well (Führer and Rédei, 2003).

In Hungary, the range of sites optimal for black locust growing is rather limited. A successful black locust growing is highly influenced by ecological conditions and extremes (temperature and precipitation, water supply and unfavourable soil conditions). In the lowlands characterized with forest steppe climatic type, the annual precipitation is not more than 500 mm, most of which is outside the growing season. Thus drought is a frequent phenomenon in the summer period coupled with very high atmospheric temperatures

Photo1. *Promising black locust clone at age of 10 (Photo:ERTI)*

[1] Forest Research Institute, Department of Plantation Forestry, H-4150 Püspökladány, Farkassziget 3.
[2] Faculty of Agriculture, University of Debrecen, H-4032 Debrecen, Böszörrményi út 132.

Photo2. *Flowering black locust stand in Pusztavacs (Photo:ERTI)*

(30–35 °C). Relative air humidity in July is usually between 20–50 %. Due to the filling up of basin-like lowlands in Hungary, site conditions show a mosaic pattern. For this reason, there are no large, contiguous lands of homogenous site quality for black locust, and their growth and productivity may be very different across a large field. Due to these facts about 40% of the black locust stands in Hungary grow under marginal site conditions. Considering the above-mentioned circumstances a *new black locust selection work* has been started in 1996 to find and improve black locust clones and cultivars, which perform good stem form, provide good-quality wood material for industrial purposes, and which are able to tolerate the dry ecological conditions as well. As a result of the new selection programme eight black locust clones have been improved (Rédei, 2003).

Location of the trial and collection of data

Data used in this study came from a black locust clone trial established in the forest subcompartment Kecskemét 16CS (*N 46^{0}54'44", E 19^{0}41'51"*) in Central-Hungary between the Danube and Tisza rivers. The forest subcompartment has slightly humus sandy soil without ground-water influence. The annual precipitation amounts to only 500 mm in some years, of which only less than 300 mm comes in the dry summer period. It means that the water supply is a limiting factor. The trial at Kecskemét is not one of the best sites available in Hungary but can be considered as an average yield class site for black locust (Rédei and Gál,1983).

The main ecological conditions of the study area are as follows:

– relative air humidity below 50%,

– hydrology: free draining,

– genetic soil type: humus sand soil,

– annual precipitation is less than 550 mm (between April 1 and 26 September in 2011 the precipitation was 288 mm).

The trial was established at a spacing of 2.0 m × 1.0 m, with three repetitions and eight treatments representing different plant materials: common black locust and eight black locust clones *'PV201E2/4', 'PV201E2/1',*

'MB15A2/3', 'PV201E2/3', 'PV35B/2', 'MB17D3/10', 'MB17D3/4' and *'PV233A/1'*. Each treatment corresponds to a plot of 15 by 20 m. One-year-old micropropagated plants were used in the case of clones and one-year-old seedlings in the case of common black locust. *Plant tissue culture methods* provide us with new means to speed up vegetative propagation of recently selected clones and give us the opportunity to establish new clone trials (Rédei, Osváth-Bujtás and Balla, 2002).

The following parameters were measured and calculated: stem number, d.b.h., basal area, tree height, stem volume, stand volume and mean tree volume. The stem volume was calculated using the volume function based on the volume table for black locust (Sopp, 1974).

Tree quality classes used by us are as follows at the age of 10 (for calculating the stem- quality index on base of the arithmetic average of the set of observation):

1) Straight, cylindrical, healthy stems, reaching to the top of the crown. Crooks are tolerated in one dimension only, not more than twice the stem diameter.

2) The stem is straight, forks are tolerated, but only if they are in the uppermost third of the tree. Crooks are tolerated in one dimension only, not more than three times the stem diameter.

3) The stem is crooked and leaning. Crooks may reach five times the stem diameter in one dimension and minor crookedness in a second dimension is tolerated.

4) Very crooked in more than one dimension, low branching, forked trees with stem defects, broken crown or stem rot.

The collected data were analyzed by STATISTICA 8.0 (data analysis software system - StatSoft, Inc. 2008) programme including correlations and regression analysis. Analysis of variance was done for height (H) and diameter at breast height (DBH) since these parameters (particularly diameter) are highly correlated with the mean tree volume.

Conclusions

Some stand structure and stem-quality parameters concerning the trial with eight black locust clones and common black locust at the age of 10 years are provided in Table 1.The analysis of variance for mean height (H) and mean diameter at breast height (DBH) as well as the mean tree volume (v) at the end of the tenth growing season statistically significant differences ($SD_{5\%}$) between the clones. It is mostly due to genetic factors.

Comparison of clone means for H illustrated that the clone 'MD 17D3/4' achieved the higher value (10.7 m). The results of means' comparison for DBH indicated that the clones 'MB 17D3/4', 'MD'17D3/10' and 'PV 201E2/4' achieved the highest growth. The same result was obtained in case of means' for v ('MD 17D3/4', 'PV 201E2/4' and 'MB 17D3/10', respectively). According to the data of stem-quality-index the clones 'MB17D3/4' and 'PV 201E2/4' achieved the best values.

As the Table 1 shows at the end of the tenth growing season micropropagated plants attained a height of 6.7 to 10.7 m. Reasonable field survival rates were achieved. Clonal material regenerated from the same tree showed uniformity in the stem form. Higher variability occurred in height growth of individual trees planted in the field. It seems that nonuniformity in rooting and development as well as in number of roots can strongly affect the growth of micropropagated plants.

This study leads to the following conclusions:

1) The results at the end of the 10th growing season demonstrated that the growth of H, DBH differed significantly among the tested clones.

2) The investigations showed that clones 'MB17D3/4' and 'PV 201E2/4' achieved the highest mean

Clones	Mean height	%	Mean DBH	%	Mean tree volume	%	Stem - quality index (SQI)
	H (m)		$D_{1,3}$ (cm)		v (m^3)		(1-4)
PV 201 E 2/4	9.9	99.0	10.1	108.6	0.0641	131.9	1.32
PV 201 E 2/1	6.7	67.0	7.8	83.9	0.0324	66.7	1.58
MB 15 A 2/3	8.6	86.0	8.7	93.5	0.0472	97.1	1.83
PV 201 E 2/3	7.6	76.0	8.7	93.5	0.0406	83.5	1.47
PV 35 B/2	7.0	70.0	8.2	88.2	0.0357	73.5	1.50
MB 17 D 3/10	9.5	95.0	10.4	111.8	0.0618	127.2	1.78
MB 17 D 3/4	10.7	107.0	10.8	116.1	0.0691	142.2	1.31
PV 233 A/1	9.0	90.0	8.9	95.4	0.0469	96.5	1.64
Control	10.0	100.0	9.3	100.0	0.0486	100.0	1.75
$SD_{5\%}$	**2.4**		**1.5**		**0.0223**		**0.38**

Table 1. *Some parameters of planted-out micropropagated clonal material at age of 10 at Kecskemét*
100.0 % = control values.

Photo 3. *Black locust cultivars in Gödöllő ERTI Arboretum (Photo: ERTI)*

tree volume and stem – quality index values.

3) Micropropagation has proved as a suitable mean in the field of black locust improvement.

4) Some promising black locust clones (varieties) can be suitable for establishing new plantations under dry site conditions as well.

On global basis, the black locust has been extensively planted in some Asian countries (Korea, China, India) for various purposes, such as fuel, forage, honey production, soil erosion control, windbreak and landscape (Keresztesi, 1988). Recently, the usefulness of black locust in timber production and agriculture has been recognized by some European and South-American countries as well, which has promoted new introduction and research on black locust.

Acknowledgements

The project focused on black locust improvement has been partly financially supported by the Korea Forest Research Institute (Seoul) on base of the cooperating agreement between the Korea and the Hungarian Forest Research Institute (ERTI).

References

Führer, E., Rédei, K. (2003): The role of black locust (*Robinia pseudoacacia* L.) in the Great Hungarian Plain. Proceedings of Scientific Paper, 2. Sofia. 67-73.

Keresztesi, B. edit. (1988): The Black Locust. Academic Publishing House. Budapest.

Rédei, K. (1984): Yield of black locust stands in Hungary. Research Report. Forest Research Institute, Budapest.

Rédei, K., Osváth-Bujtás, Z., Balla, I. (2002): Clonal approaches to growing black locust (*Robinia pseudoacacia*) in Hungary: a review. Forestry, Vol. 75, 5: 547-552.

Rédei, K. edit. (2003): Black Locust (*Robinia pseudoacacia* L.) Growing in Hungary. Publications of the Hungarian Forest Research Institute, Budapest.

Sopp, L. (1974): Volume tables. Agricultural Publishing House. Budapest.

Gábor Dénes Award

This noble prize was established by Novofer Foundation to recognize professionals creating outstanding intellectual products, incorporating new knowledge into practice and successfully participating in innovation processes.

Tóth Magdolna

Dr. Magdolna Tóth, horticultural engineer, doctor of the Hungarian Academy of Sciences was awarded with Gábor Dénes Award in 2012 by the advisory board of the Foundation. As the head of department and university professor of the Department of Fruit-bearing Plants of the Budapest Corvinus University, she obtained this prize for her variety assessment research aimed at modernizing the usage of Hungarian apple varieties, adapting apple varieties having approximately 60% share in Hungarian large-scale apple production, participating in the establishment and development of apple resistance breeding in Hungary, breeding four state registered apple varieties which are under patenting procedure and seven applicant varieties. She established the complete laboratory and infrastructural background for apple multi-resistance breeding. The work of Magdolna Tóth has also been successful in directing the internationally recognized fruit biological bank activity of the department, and in the fields of educating professionals and PhD students. From her scientific results it can be highlighted that she was the first to point out the role of old apple varieties as gene sources for resistance against fire blight. Among old apple varieties from the Carpathian basin, she specified four breeding sources. Magdolna Tóth was among the first scientists to verify the complex feature of *Vf (Rvi6)* scab disease resistance, and the maintenance of resistance was supported by the gene pyramiding results and the generation of homozygous varieties. The identity and relations of several apple varieties were clarified using morphologic and genetic examinations. The health protection features of certain Hungarian fruit varieties were proved by instrumental analyses in cooperation with other institutions.

www.agrarlapok.hu