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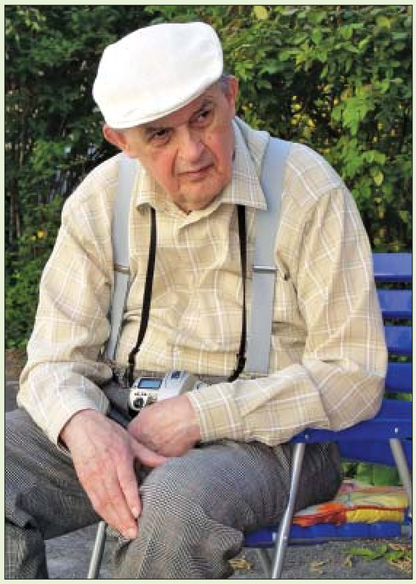
Dr. Lajos Diófási (1929–2012)



Lajos Diófási, Doctor of the Hungarian Academy of Sciences and retired director of the Pécs Research Institute for Viticulture and Oenology deceased on 10 August 2012.

Lajos Diófási was born on 21 September 1929 in the village of Harc in the Szekszárd Wine Region. Even at a young age, he admired and was interested in the work of his parents dealing with fruit production and he chose his schools in accordance with this. He obtained the General Certificate of Education at the Bereczki Máté Vocational Secondary School in Baja, where so many excellent horticulturists were educated. Afterwards, he attended and graduated from the College of Horticulture and Viticulture in Budapest, specialised in vine-growing. His professional life started in the Csopak Wine Region, where he was involved in production. He was offered a researcher job in 1956 in Pécs. In August that year he started his research work, taking over the position of the great ancestor, Ferenc Király. He worked at the Research Institute for 52 years, 28 as a director (until he retired in 2000), and afterwards he collaborated as a consultant until 2008.

Lajos Diófási professor went through the great challenges of the last century and lived to see the new tasks of the beginning of the new millennium. He was engaged in the theoretical and practical issues of quality viticulture throughout his career. He belonged to the generation that took part in the changing over of grape cultivation from manual labour to mechanized production, improving production technology, biological resources and technical elements.

The defence of his Doctoral Thesis titled ‘The effect of yield increase on the quality of the grape and on the biological characteristics of vine-stocks’ took place in 1982. By clarifying the technical and biological questions of modern vine-stock formations and pruning methods, he contributed significantly to the development of quality wine grape production. He defined the optimal load level during the examination of the correlation between quantity and quality. He revealed the effects of various vine-stock loads on their physiological behaviour. Professor Diófási demonstrated the advantageous outcomes of proper fertilization before plantation on the date of attaining full yield, yield stability, wine quality and the tolerance of vine-stocks. He was the first to draw the attention on the effects of global warming on grape and on how important the successful adaptability strategies are. He was an enthusiastic admirer of environment protection and environmentally conscious farming. He set affinity experiments in several wine regions (Pécs, Szekszárd, Badacsony, Villány), which are being assessed these days as well.

An exemplary melioration and reconstruction project was carried out under his guidance on the Szent Miklós hill.

Together with Márton Német he established, developed and maintained a grape variety collection of 1100 items, which is Hungary’s most valuable and the World’s sixth largest grape variety collection.

His other important achievement was restoring the role of viticulture and oenology research institutes in landscape research. Professor Diófási initiated and in 1993 restarted the research on viticulture and oenology in the Badacsony Wine Region. By establishing the Kéknyelű programme, improving environmentally friendly grape cultivation methods, examining the variety value of Olasz rizling, he laid the foundations of a research policy in Badacsony that was adapted to the local conditions and is still determining in the activity of the Research Institute for Viticulture and Oenology there. What made him capable of doing all this was his exceptional professional knowledge and his ability to combine the most important aspects of grape cultivation and his activity in representing the general interests of viticulture and oenology always and everywhere.

His work can be described by the careful designing and implementation of field experiments. It is no mere chance that interest was shown in the activity of the Pécs Institute not only by the wine regions of the area but also by other domestic and foreign wine regions.

Lajos Diófási has started a consultation programme to spread the results of research. For over 50 years, he actively participated in the trade shows held in spring and autumn, where vine-growers could get acquainted with the new findings.

The research results of Professor Lajos Diófási were announced in over 260 publications prepared individually or with co-authors. He carried out scientific public activity in eight committees. He received ‘Freeman of the City of Harc’ and ‘Freeman of the City of Szekszárd’ honours.

Continued on page 19.

Hare (Lepus europaeus)
Photo by Bleier Norbert

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Antal Szőke, Kitti Tóth-Lencsés, László Heszky, Erzsébet Kiss[1]

Red or white? Genetic basis of grape berry colour

Berry skin is a fundamental trait of grape varieties, basis of not only the variety categorization but also of wine classification, determining the vinification procedures and the consumer fashions. Over several thousand years of viticulture as a results of mutations, natural hybridization and – from the 19th century – deliberate crosses and selection numerous colour variants of grape berries have been developed black, blue, red, pink, grey and white.

Genetic basis of berry colour

The berry colour is determined by anthocyanin accumulation in the skin, which varies greatly in concentration and composition depending on the grape cultivar. The key enzyme of anthocyanin biosynthesis is the UDP-glucose-flavonoid 3-O-glucosyl-transferase (UFGT) (Figure 1). This enzyme does not express in the white berried cultivars, in spite of the fact that

there are no differences in both *VvUFGT* promoter and coding region between white and coloured cultivars. The anthocyanin biosynthesis is controlled by a transcription complex including the *Myb* genes, which activates the *UFGT* gene.

The ancient wild grape had coloured berries and the nowadays-cultivated varieties derive from the ancient form. The white cultivars arose mostly from red-berried parents by different mutations in two adjacent *Myb* genes, *VvMybA1* and *VvMybA2* (Kobayashi et al. 2004; Walker et al. 2007). Among these mutations, insertion of a retroelement *Gret1* retrotransposon into the promoter region of the *VvMybA1* gene was first identified in cultivars Italia and Muscat of Alexandria leading to transcriptional inactivation of *VvMybA1* (Kobayashi et al. 2004). This mutant allele was named *VvMybA1a*, while the functional allele of the colour cultivars is *VvMybA1c*. White berried cultivars are homozygous for *Gret1* insertion, whereas the colour-skinned varieties contain at least one functional allele. In some white cultivars deletion of *Gret1* from promoter region was observed resulting in a functional allele, *VvMybA1b*, containing only a short part, the 3'-LTR region of retrotransposon, thus these type of red cultivars derived from their white-skinned progenitor (Figure 2). Single nucleotide polymorphism (SNP) in *VvMybA2* coding region could result in white berries, too. These genetic observations suggested, that the white allele arose *only* once or a limited number of times and spread by sexual propagation.

In colour-berried varieties, the continuous range from pink to black is influenced by additional mutations in *VvMybA* genes, different expression

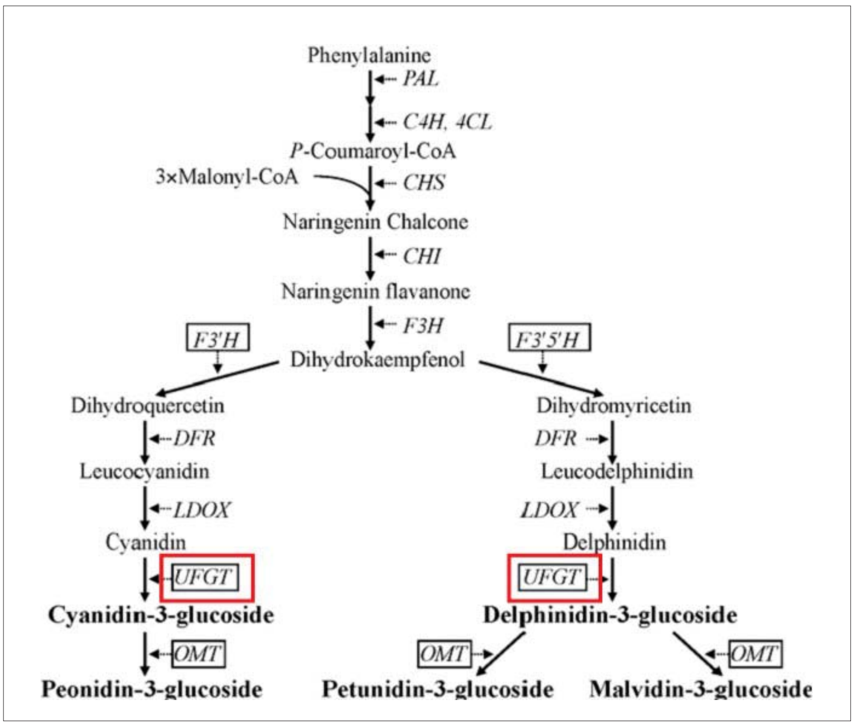

Figure 1: *The anthocyanin biosynthesis in grape berry skin (Azuma et al. 2009)*

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of genes in the anthocyanin biosynthesis pathway and cellular rearrangement in berry skin cell layer (Walker et al. 2006; This et al. 2007). During domestication, in the different grape growing areas distinct colour variants have been selected leading to a diversification process.

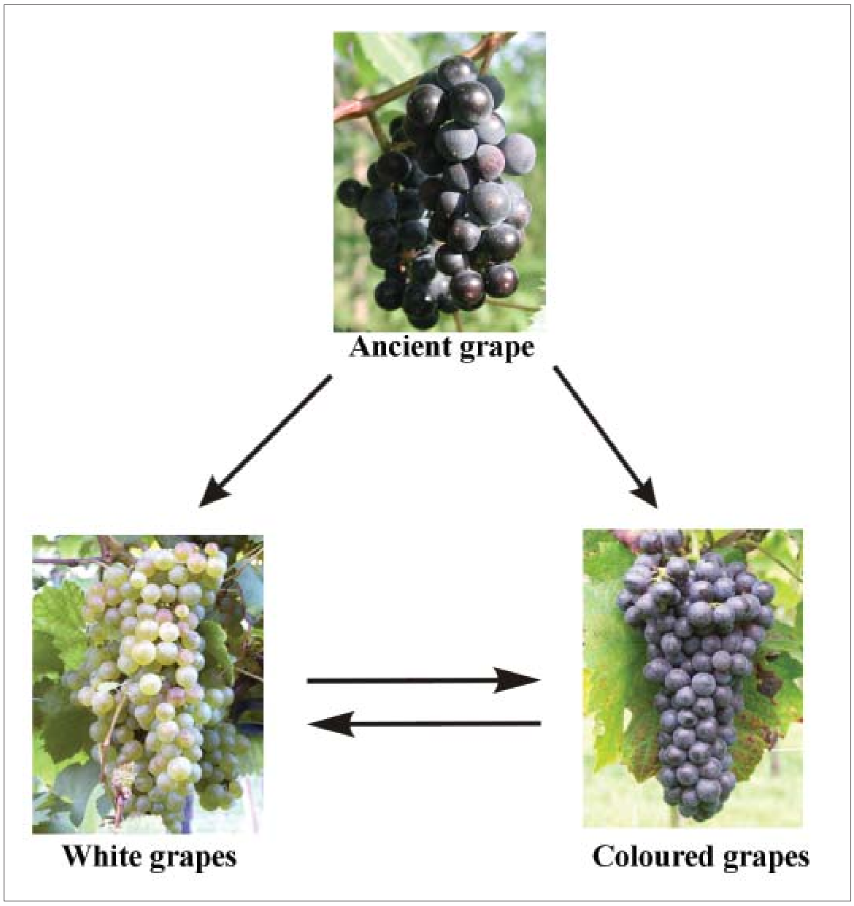

Figure 2: *Origin of the grape berry colour*

Application of colour alleles in genetic studies

Comparative analyses of *VvMybA1*a allele in *Vitis* family revealed, that the North-American and East-Asian species do not carry the *Gret1* retrotransposon. Consequently, Gret1 insertion in *VvMybA1* promoter must have occurred after the divergence of North-American and East-Asian species from the common ancestor (Mitani et al. 2009). Accordingly, the white-fruited *V. aestivalis* and *V. riparia* accessions, do not contain the *Gret1* either (Cadle-Davidson and Owens 2008).

Genetic investigation of *Myb* locus can contribute to distinguishing bud sports and to unravel the origin of varieties. In the case of Pinot family, Pinot blanc and Pinot gris arose from Pinot noir by independent somatic mutations. Pinot noir is heterozygous in the *VvMybA1* (*VvMybA1a, VvMybA1c*) locus. Deletion of functional *VvMybA1c* allele in Pinot noir resulted in the white-berried Pinot blanc (Vezzuli et al. 2012). Pinot gris is a periclinal chimera of Pinot noir. Berry skin consists of two cell layers. In Pinot gris and other grey-berried cultivars, L1 cell layer accumulates anthocyanins whereas the L2 cell layer does not because of the loss of the functional allele (Walker et al. 2006).

Bud sports and genetic conservation

Conservation of grape genetic resources requires the exact morphological descriptions and genetic characterization of cultivars. For this purpose two projects in EU, the GENRES CT96 and the GrapeGene 06 programmes have been established. In these projects, diversification analyses of grape bud sports proved - based on microsatellite fingerprinting – that they are indistinguishable. Additionally, they share identical morphological characters, the berry colour is only the difference.

Native bud sports in Carpathian Basin

Márton Németh who had collected the grape varieties autochthonous in the Carpathian Basin differentiated 30 berry colour variant groups named as concultа. The conculta consists of bud sports and - as it was mentioned above - they differ only in berry skin colour. In our earlier studies (in the frame of GrapeGene 06 project), based on genetic investigation of cultivars indigenious in the Carpathian Basin 6 concultas were differentiated: Lisztes (piros and fehér), Bakator (piros and tüdőszínű), Gohér (piros, fehér and változó), Muskotály (fekete, piros, sárga and csíkos), Furmint (piros, fehér, változó) and Barátcsuha (kék, szürke) (Figure 2.). Supposedly, old varieties autochthonous in the Carpathian Basin had different berry colour variants, but they could have disappeared during the viticulture or phylloxera (*Daktulosphaira vitifoliae*) epidemic and generally only one colour (in the most of case the white) was cultivated.

To differentiate the conculta members we analyzed the genetic variation of *VvMybA1*, major determinant of berry colour. As references, 3 cultivars were used: Barbera (no *Gret1* insertion), Pinot noir (heterozygous for *Gret1*) and Chardonnay (homozygous for *Gret1*).

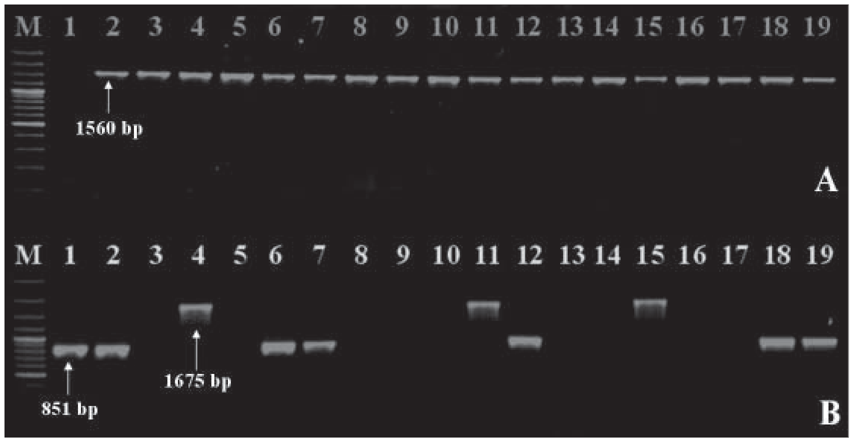

Figure 3: *Detecting of VvMybA1 alleles* ***A:*** *VvmybA1a (white allele)* ***B:*** *VvmybA1b and VvMybA1c (red alleles) M: DNA Ladder (Fermentas 100 bp Ladder Plus,100-3000 bp) 1. Barbera, 2. Pinot noir, 3. Chardonnay, 4. Lisztes piros, 5. Lisztes fehér, 6. Bakator piros, 7. Bakator tüdőszínű, 8. Gohér piros, 9. Gohér fehér, 10. Gohér változó, 11. Piros muskotály, 12. Fekete muskotály, 13. Sárga muskotály, 14. Csíkos muskotály, 15. Furmint piros, 16. Furmint fehér, 17. Furmint változó, 18. Kék barátcsuha, 19. Szürke barátcsuha*

Examination of the white allele (*VvMybA1a*) revealed, that except for the reference Barbera all cultivars contain the *Gret1* retrotransposon in the promoter region, as the 1560 bp DNA fragment demonstrated it (Figure 3/a). In Bakator, Fekete muskotály and Barátcsuha cultivars, application of the red allele (*VvMybA1c*) specific PCR primers amplified the same fragment size, as that of the reference Barbera and Pinot noir suggesting that they have functional Myb alleles. In the case of Lisztes piros, Piros muskotály and Furmint piros the PCR resulted in a 824 base pair longer fragment (*VvMybA1b* allele) indicating that due to the *Gret1* deletion these red-berried cultivars originated from its white-skinned progenitor (Figure 3/b). Following the deletion, the 3' LTR region of retrotransposon remained in the promoter region but the sequence did not interfere the gene expression, enabling the anthocyanin synthesis in berry skin.

Interestingly, however Gohér piros has coloured berries, functional red alleles can be not detected in this variety. The reason of this phenomenon remains at the moment unknown. Although Gohér változó and Furmint változó have white berries, they share specific characters. In the early stage of ripening anthocyanin accumulation can be observed in the berry skin, but this pink colouration – as maturation progresses - later disappears.

To sum it up, by means of investigation of *VvMybA1* alleles – major determinant of the grape berry colour, the Lisztes piros-fehér, Furmint piros-fehér and változó, the different coloured Muskotály cultivars were successfully distinguished based on the *Gret1* retrotransposon insertion. The reason for berry colour in the members of Bakator, Gohér, Barátcsuha and the Furmint fehér-változó, Sárga-Csíkos muskotály concultas requires further investigation.

Acknowledgement

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Tamás Németh[1]

What's next? Not next – further!

In the past decades the Research Network of the Hungarian Academy of Sciences was built up by two Research Centres (including 4 Institutes each) and 38 Research Institutes. While the size and structure of the institutes differed widely from each other, they had the same financial, economical and controlling obligations (prinarily, the ratio of the "attendant" departments, teams and the total number of employees was unfavourable).

Between 2008 and 2011, in our first term, we tried to work together with all three goverments (following each other in office during that period) to better the basic maintenance of the institutes. The governments did not support our efforts.

The recession of 2008, which shook the economical systems of our planet – the unreal, virtual European economy in particular – drew attention to the sustainable operability of the institutes. The thourough, prudent and adaptive execution of the reconstruction of the research units seemed expedient. Formerly, due to the lack of willpower, this renewal had only been materialized as various 'reform' ideas. With reconstruction should come renewal as well, since such occasion and pressure turns rarely up during the history of a research unit network.

The planning and consideration of the renewal had to be done along the lines of the values represented in the network. During the evaluation of the situation – beyond the research metric indicators seen by many as the only acceptable way – other values were taken into consideration, too. The future of the Research Network lies in its integration into the international research space and the winning and keeping of outstanding individual talents.

In line with the renewal, the chief officers of the HAS revised the companies owned or shared by the HAS and its institutes. Action plans were made regarding the future activities and public money use of these companies.

What helped, what could we rely on?

a) The average age of the researchers in the institutes of the HAS (except for some special cases) is favourable in international comparison as well. Primarily, this is due to the employment of young researchers (this program has been running for 20 years) and various grants, particularly the Bolyai-scholarship.

b) It became possible to form

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such units at every field of research, whose size enabled the number of researchers and the infrastructure to reach the critical amount where it can be competitive.

c) The recent internal changes, formation of new teams around leading researchers lead toward this direction.

d) Excessive funding, not for basic maintenance, but on a program level (in 2012, 1.5 billion HUF was given to the renewed network as a significant part of the annual budget).

Research financing system

In the past decades the research financing system has changed, too. Before 1989, and in the early 1990s the research institutes received almost full financial support. Although grant programs had been launched a few years before that, they were only taken into consideration as subsidiary sources of income. In our speciefic field of science (agriculture and environment) projects with portofolio-based funding were launched under different codes (G, SZ, etc.)

During the period of the Fall of the Communism (around 1989-1991) the sources were divided by the OTKA (Hungarian Scientific Research Fund) in case of basic research, the OMFB (National Engineering Innovation Committee) in case of applied research, and by portfolios and companies in case of innovative research. In the late 1990s high-rate consortium programs were launched by the NKTH (National Office of Research and Technology), which - under various names and on different grounds – ensured resources for the institutes until recently. These national resources were complemented by international research programs: the ESF (Europe), the PSTC, the NSF (USA) for example.

Due to the grants, the financing of the institutes changed, and as a result, the amount of money granted by the owner declined to less than 50%, even in case of the budgets of full-time research facilities. Meanwhile, almost all industrial and company-funded research facilities disappeared, and the number of those belonging to portfolios declined dramatically. In certain fields this resulted in irretrievable deficit; let's just mention the agony of the VITUKI or the MÁFI.

The chief officers of the HAS reached the conclusion that conversion from the current system to a more effective one needs changing of both structure and content. If the structural and content frame is developed, the launch of a calculable, intertemporal research financing system is crucial. In case of Hungary, the development of a three-level tender system is essential; its elements were the interdependent OTKA-OMFB-NKTH financing mentioned above. The fitting of this structure to the current conditions is the key point. (Out of these three, the OTKA is operating, it is transparent and merit-based, the NKFP should be revived so it could serve as the background for the social and economical value of the research, and the third pillar could be a National Technological Program for the fast-converting topics with tangible economical profit.)

The status and role of the agricultural research institutes of the HAS after the renewal (Quo vadis…)

The renewal of the Research Network affected the agricultural research institutes as well. In the past more than 60 years, four institutes with different research profiles worked in the frame of the Academy. The Institute for Veteniary Medical Research, the Agricultural Institute, and the Institute for Soil Science and Agricultural Chemistry worked in their current structure from the beginning; the Plant Protection Institute arrived in the network in the 1970s from ministerial control.

According to the decision made by the General Assembly of the HAS in the fall of 2011, from January 2012 the four institutes are to continue their work as the HAS Centre for Agrucultural Research (MTA ATK). The reconstruction changed the organizational economical structure primarily; the number of researchers did not change in the member institutes. Just like other newly founded centres, the success of the reconstruction will be measured by the results of the researchers, teams and member institutes.

The operation of the above mentioned companies (owned or shared by the HAS) affected the base institute of the MTA-ATK. The President of the HAS ordered the windup the the former conflicts of interests and initiated a more rigorous system of account and transaction control.

For the launch the HAS could provide – beyond the development of the organizational structure – significant (more than 400 thousand HUF) one-off funding for infrastructure and also budget resources.

The new Centre most probably can continue the successful work in the broad research field of agriculture and environment protection. This is achievable, based on the broadening stream of resources and with the development of proper organizastional and directorial practice.

Appointed to base institute, the former Institute for Agricultural Research can play an important role in this. With smart and reasoned science organizational policy the previous institutional advantages can be kept, while with misguided and autocrative principles the project is foredoomed to failure.

Norbert Bleier, László Szemethy, Judit Galló, Róbert Lehoczki and Sándor Csányi [1]

An overview of damages caused by big game to agriculture

One of the most serious problems of the Hungarian game management is the damage caused to forests and agriculture by big game species. Game damages are issues in forest management, agriculture and wildlife management, especially when these economic branches belong to different groups. These problems need long term solutions but in spite of all efforts of the past 60 years the debates regularly recurred about the unbearable consequences of game damages related to the overabundant big game populations.

In the last five years forest damage was about HUF 200 million/year on average, while the agricultural damage reached HUF 1.5 billions/year. Because of the large amount of money, agricultural damage has become the centre of attention for 10 years. Value of game damage notably changed in the last 50 years, from the end of the eighties the agricultural damage increased significantly in terms of nominal value of money (Figure 1).

In order to reduce agricultural game damages a reduction of deer populations was initiated in Hungary several times, but the expected result of declining game damages was not reached. Agricultural game damage continued increasing in nominal value after 2000.

Hares (Lepus europaeus) Photo by Norbert Bleier

During the last decades several studies were conducted to get a better understanding of factors affecting game damages. Mostly, overabundance of big game is considered as the main factor. As early as in 1940 it was described as follows: *The extremely overabundant deer population nibbled off forest sections, plantations as a gang of greedy marauders, and since animals are not full, they began to appear on agricultural lands every night and strip sown plants. The many deer hinds not only cause fatal damage in the forests and on agricultural lands, consequently people hate deer population, but deer population began to degenerate* (Nikolits, 1940).

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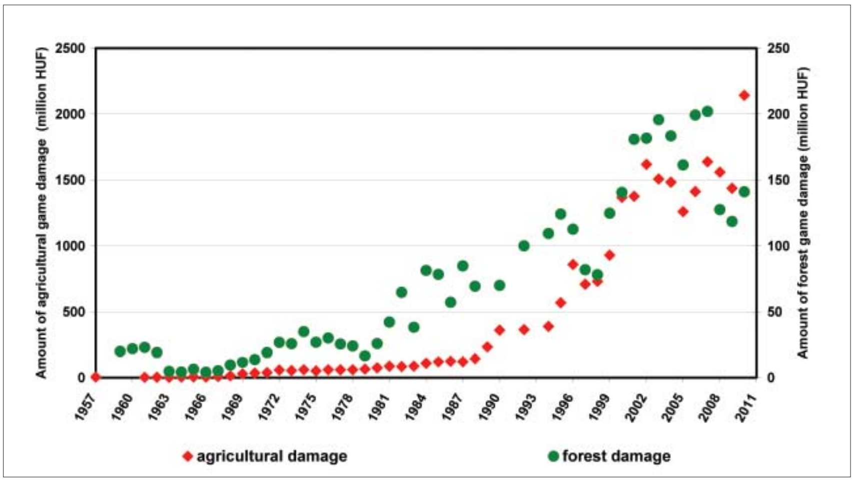


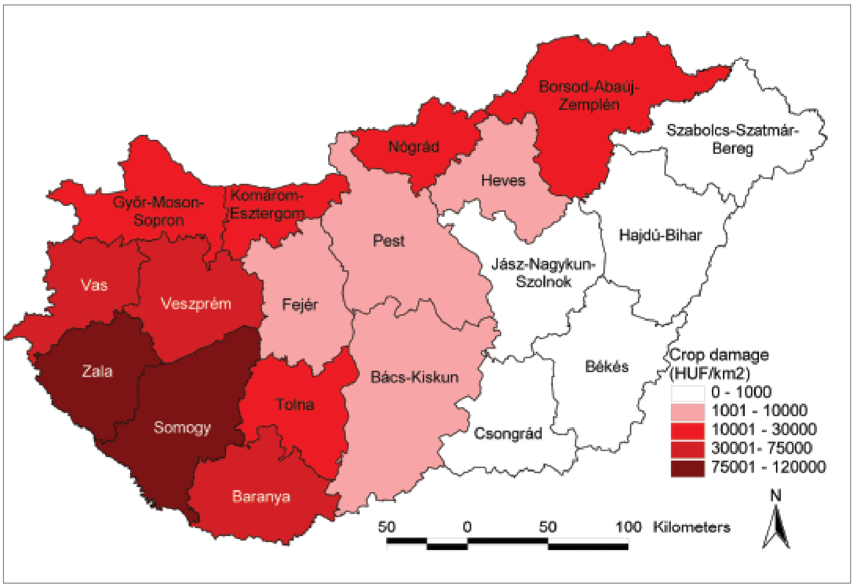
Figure 1: Change of big game damage in nominal value between 1957 and 2010 (data obtained from OVA)

Damage caused by big game

Deers. (Capriolus capriolus) Photo by Norbert Bleier.

In the next 50 years, the deer overabundance was considered as a fact, independently of the reported ("estimated") number of deer or number of deer bagged. For example, red deer population was estimated about at 20000 in 1940, at 36000 in 1971, at 54600 in 1985, at 77000 in 2000 and at 92000 in 2010, and it was always stated that red deer was "overabundant".

According to the most general opinion significant reduction in the number of deer is the obligate solution to the problem of increasing game damage. Of course there are different opinions. Many people thought that the situation should be studied in details in order to reveal another factors, which can influence the trend of game damages. At the end of the 1960s Professor Lajos Bencze called the attention to the fact that sylvicultural characteristics (e.g. transformation of stock of planted trees), as well as agricultural production at the edge of forests and on agricultural lands extended between forests, and the rate of the cultivated plants influence the tendency of big game damage.

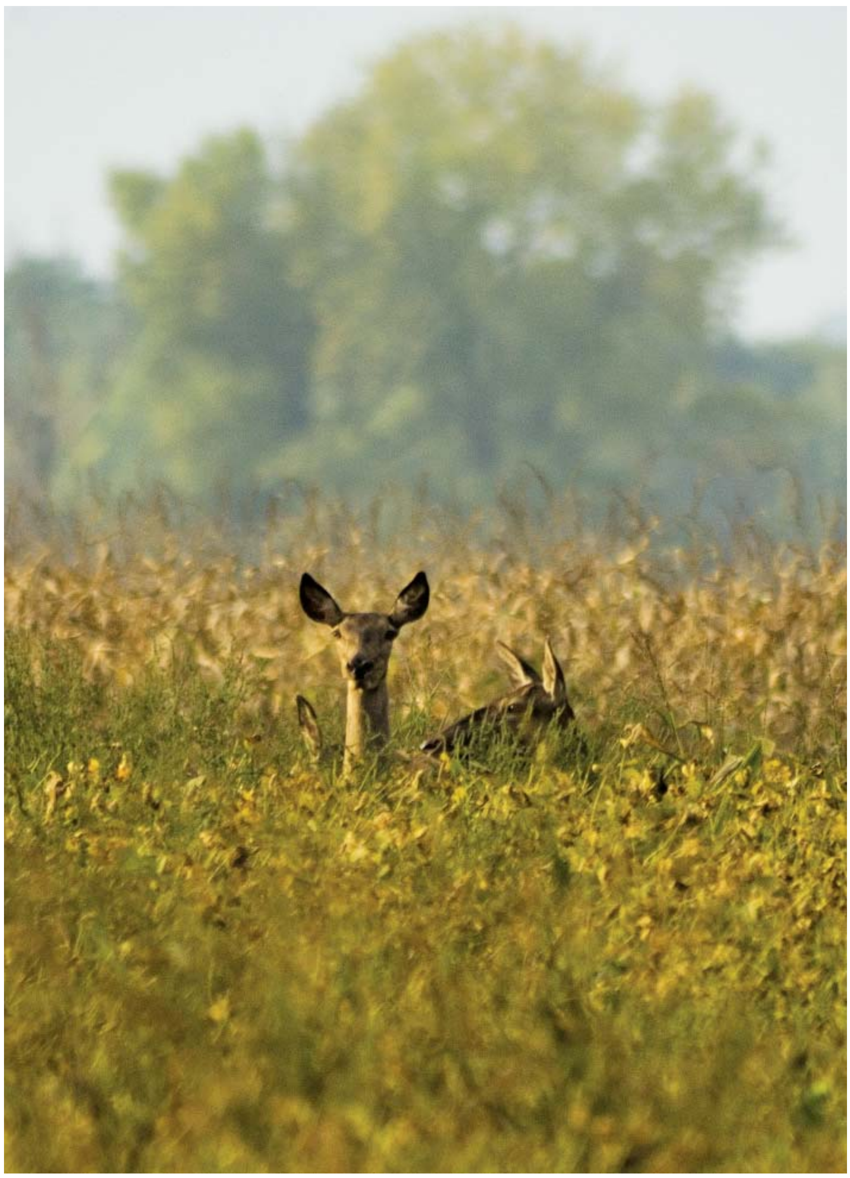


Map 1. The spatial distribution of agricultural game damage in Hungary

According to other authors big game damage probably increases parallel with increasing yield, even if deer numbers are constant. Changes of the market prices of agricultural products are considered as an important factor, because if the product is more expensive, the big game damage "costs" also more (Koller, 1971).

Statistical analysis of the data after 2000 revealed that agricultural game damage is not a countrywide problem. Large differences could be found between areas and the highest level of big game damage is observed in the Trans-danubian counties (Map 1). In those counties, the amount of money paid to the compensation of big game damage can reach or even exceed 20 % of game management expenses.

In this paper, we present the change of agricultural big game damage from 1994 to 2010. In this period, the amount of compensations has increased considerably and solving the situation of big game damage remained a hot issue. Our aim is to represent the situation of the amount of big game damage and its change in the last 17 years. Data were obtained from the National Game



Deers. (Capriolus capriolus) Photo by Norbert Bleier.

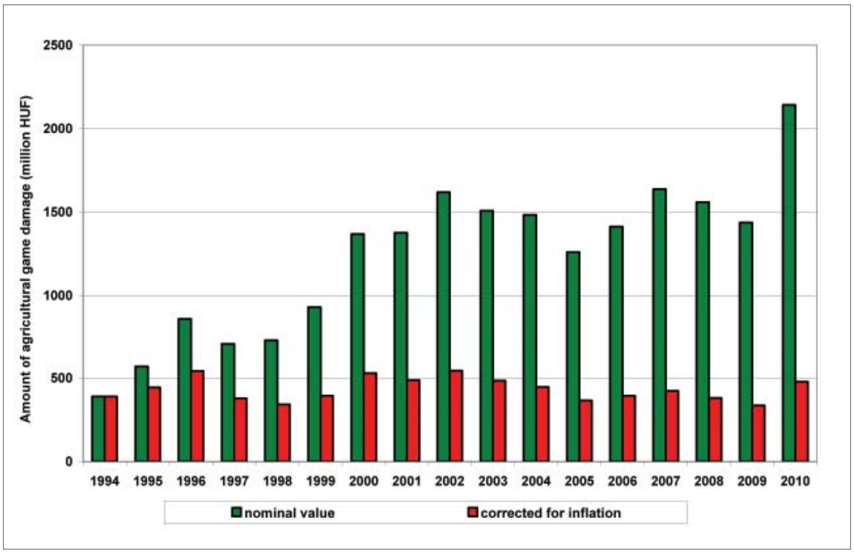


Figure 2: Change of agricultural big game damage on current value and on inflation-adjusted value

Red deer (Cervus elaphus) Photo by Norbert Bleier.

Management Database (OVA). We took the annual inflation rate into consideration based on data of the National Bank of Hungary (MNB). The base year of calculations was 1994. We determined the real value of damage after 1994 adjusted the nominal values of big game damage paid in the current year with removing the effects of the inflation annually. With the removal of the effects of inflation we expected to get a better approximation of the "real" amount of the damage.

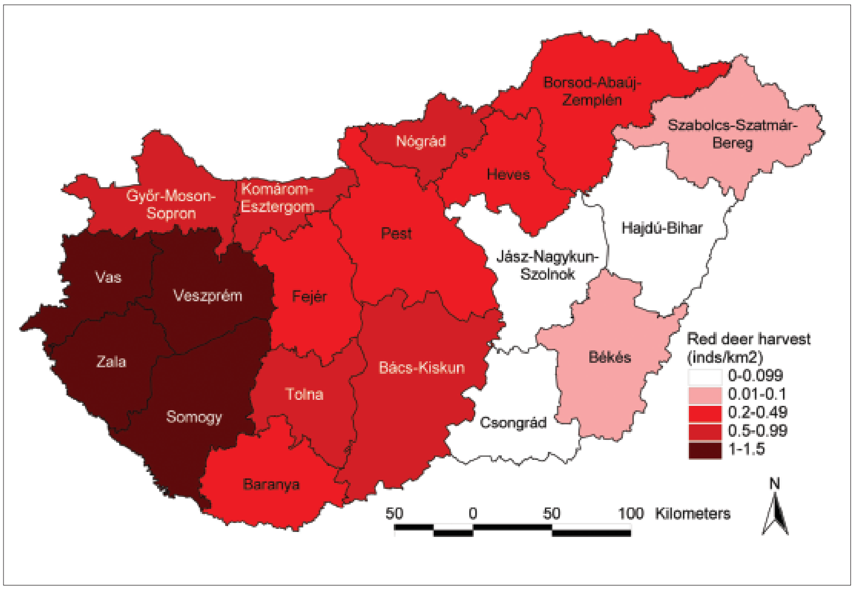
A significant difference was found between in the inflation-adjusted tendency of damage and tendency of damage presented in nominal value (Figure 2). Based on the nominal value an intensive increase was shown between 1994 and 2002. When we removed the effect of inflation the agricultural big game damage fluctuated gently, in the last five years the values were close to the value of the base year. So, the amount of game damage (determined in the biomass consumed) did not increase, although in this period the estimated number of big game increased significantly (both the number of wild boar and number of red deer roughly doubled).

After the political regime change of 1989/1990, the big game damage began to rise suddenly. It is explained as a probable consequence of the breakup of the agricultural cooperatives. Thereafter more and more land-owners began to appear. At the end of the eighties, the amount of big game damage did not increase drastically, although it is shown by data, it became known because of changing of proprietary construction and consequently, farmers' sensitivity to game damage was growing. Amount of damage caused by big game species increased in the nineties. Its reason may have been the general depreciation.

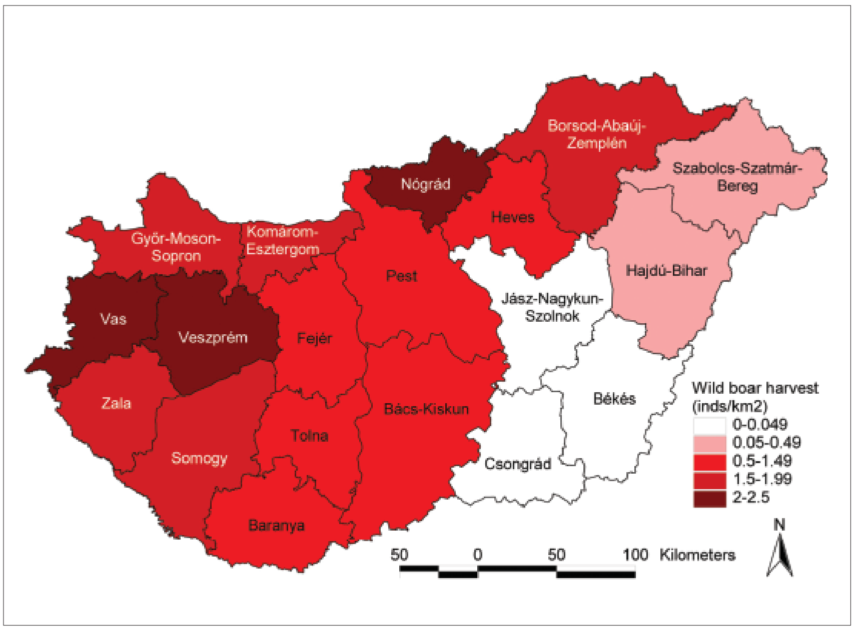
It is worth putting the importance of big game damage in another light. We used the data of the year 2010 in the next example (in this year was the biggest damage in current value), and we supposed that all the damage occurred on a maize-land:

- Agricultural game damage was 2.14 billion forints in 2010.
- This meant 57837 tons crop failure calculated with the prize: 37000 forints/ton
- Average yield was 6,57 tons/hectare in 2010, so it meant 8800 hectares maize area.
- That area (8800 hectares) is less, than 0.1% of agricultural land sown with maize in Hungary and it is less, than 10% of agricultural land sown with maize in Somogy county.

The problem exists, since people engaged in game management have to pay for damage yearly. According to our studies the problems of big



Map. 2. The spatial distribution of red deer harvest density in Hungary



Map. 3. The spatial distribution of wild boar harvest density in Hungary

game damage are the most serious in those counties where the number of big game is the greatest (e.g. Somogy, Zala). This fact by itself is shown by the relationships of big game harvest density and big game damage on Map 2 and 3. Efforts to reduce the big game populations failed and in the spring of 2010 the largest red deer population size was reported. To propose more sound solutions to the problem the tendency of factors playing a role in the changes of game damages should be modelled and this approach should be completed with economic calculations. These calculations can serve as a basis for adequate recommendations. The aim is to exploit big game population as a renewable natural resource and that process shall also be economically sustainable.

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László Tóth, János Beke, Péter Sembery, József Hajdú [1]

The role of biomass in Hungarian energy supply

The overall energy consumption in Hungary is about 1160-1200 PJ. This means the amount of primer energy sources, and real consumption is approximately 30-35% lower. The difference comes from conversion losses and the own consumption of energy converters. The major consumers include the inhabitants, traffic, industry and service industries.

Hungary has also joined the European Union's binding target of 20% renewable energy from final energy consumption by 2020, and aims at increasing the share of renewable energy sources from gross final energy consumption to 14.65% (Government Decision No 1002/2011 (I.14.)). By this, the gross quantity of renewable energy sources would add up to 165-170 PJ by 2020, which is to be used for electric power supply, traffic, heating and cooling purposes.

The increase in the generation of renewable electric power has increased primarily due to biomass utilization up to now. By 2010, the amount of renewable electric power reached 2600-2900 GWh/year, being equal to 7.1% of the net domestic electric power generation. The volume of biomass utilization became stable by 2009-2010, within which the amount of biogas consumption slightly increased, on the other hand, wind energy consumption raised to a significant extent, adding up to 620 GWh/year in 2010. Biomass was started to be utilized in greater quantities in 2004, the largest part of which was used to generate electric power. The reason for this was that user infrastructure did not require substantial investments, only traditional coal burning power stations had to be converted to multi-fuel power stations. The disadvantage of the technology is that the so-called waste heat produced during the generation of electric power in power stations can only be utilized to an insignificant extent, which causes a very low energy transformation efficiency of 20-30% (Figure 1).

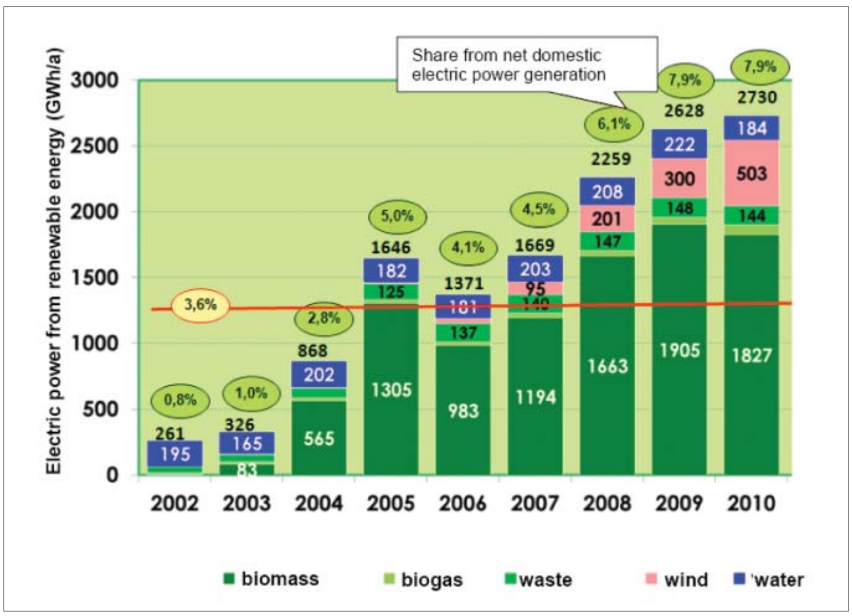

Figure 1 Generation of electric power from alternative energy sources

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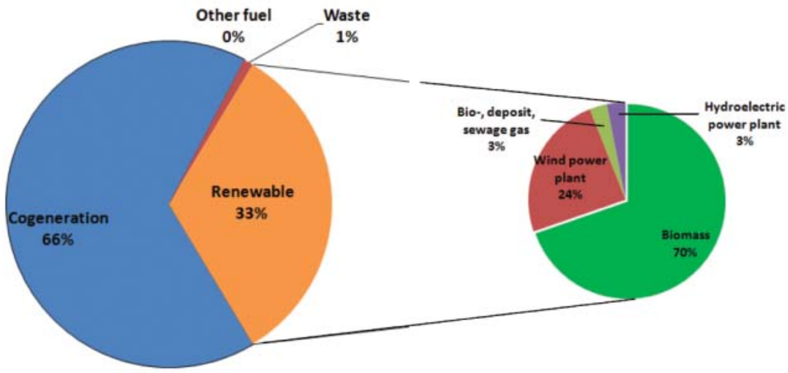

	Mill. HUF
Cogeneration	56680
Waste	827
Other fuel	0
Renewable	28007
Biomass	19520
Wind power plant	6812
Hydroelectric power plant	802
Bio-, deposit, sewage gas	873

Figure 2 The amount (in HUF) and rate of state subsidy in 2010

This quick rise was promoted by the support of the government given to the generation of electric power from biomass, irrespectively of the efficiency of production and utilization. Significant subsidies were provided to cogeneration (CHP) gas-fired power stations as well. Thus, 80-90 thousand million Hungarian forints were flown annually to cogeneration small power plants and renewable electric power suppliers as subsidy by 2010. From which 19-20 thousand million Hungarian forints were subsidy on electric power produced from biomass and 8-9 thousand million Hungarian forints were subsidy on other renewable sources like water, wind, geothermic, solar and other energy sources. The largest part of the subsidy was used to develop cogeneration power plants (Figure 2):

Even forestry experts agreed on that it was time to cut down and use the surplus, aged and sometimes ill trees although it occasionally led to misuse. The price of wood and consequently the income of forest managers considerably increased.

Seeing that deforestation was excessive in some places and the efficiency of transformation was low, the government withdrew the subsidy by 2011 from large non-cogeneration biomass-fired power plants and small amortised CHP gas-fired power plants. As a result, the amount of electric power output reduced to 1375 GWh in 2011, as against to the planned amount of 1870 GWh. Some 'worn-out' biomass-fired power plants were even closed down.

The government intends to implement a really ambitious plan on the utilization of renewable energy sources by 2020. The **National Action Plan** (NAP) specifies the production of electric power capacity of approximately 1530 MW by 2020 in the frame of a 14.65% renewable energy program (Figure 3).

The NAP continues to calculate with biomass as the major renewable energy source. Solid biomass primarily includes firewood produced by traditional sylviculture, agricultural by-products and plant-chips from energy plantations. Significant improvement is expected in the fields of biogas, agricultural wastes and residual materials from communal sewage purification plants. Wind energy utilization is of high volume, and is intended to be increased by 120%.

To reach the planned renewable electric power production of 5500-5600 GWh/year by 2020, **biomass** (including biogas) production and partially wind energy have to be increased significantly.

Biomass

From biomass we can produce heat energy, electric power and various gaseous, liquid or solid fuels (such as oil, alcohol, gas, biogas, chips, pellets, etc.).

Oil, alcohol and gas are used

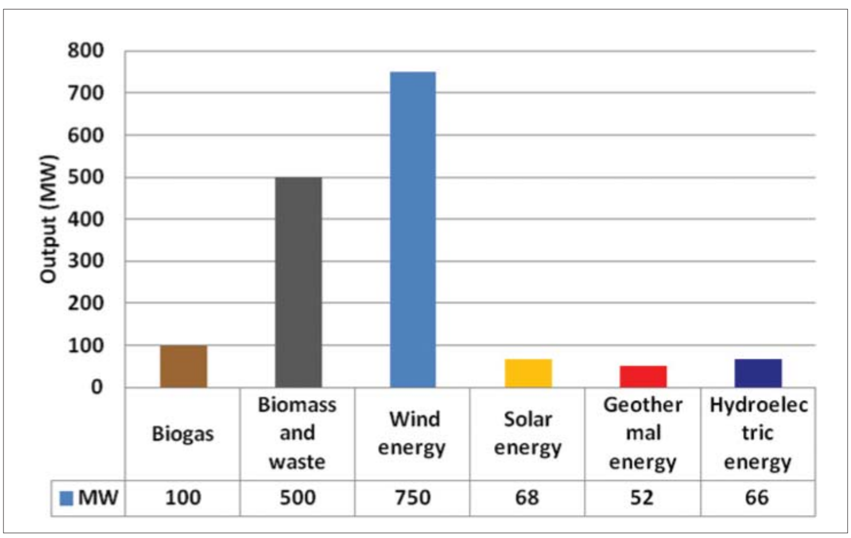

Figure 3 Expected electric power production capacity by 2020

(Source: National Energy Strategy (NEMZETI ENERGIASTRATÉGIA) 2010)

as fuels, while solid processed materials, for instance chips, pellets, briquettes are mainly utilized to produce heat.

It has to be acknowledged and should not be disregarded that the production of various biomasses requires substantial amount of energy (e.g. for converting herbaceous plant biomass into hard fuel pellet). Efficiency is demonstrated by the OUTPUT/INPUT (O/I) rate comparing the chemically bonded energy content of the end-product before use to the total energy content of all the energy sources used for production. In professional literature sometimes very beneficial rates are stated, for instance the O/I rate for hard stem energy plantation collected to the edge of fields is 15-20. It has to be noted that this rate is reduced by transportation, shopping and preparation, depending on the energy requirement of technologies, to O/I = 3-6 or even lower.

From the aspect of energetics, the amount of so-called **net energy gain** is to be examined, taking into consideration, in addition to the above, conversion losses as well. When only electric power is produced from biomass, the I/O rate does not exceed 3.0. When only thermal energy is generated (for heating) the O/I rate can be as many as 6, which is, of course, reduced by transportation.

These figures also indicate that biomass is not practical to be used only for generating electric energy. Combined production is much more advantageous when all the heat is utilized in addition to the generation of electric power. In this case, the efficiency rate is almost equivalent to heating (Figure 4).

There are a lot of estimations known on the total energetic biomass potential of Hungary. Some of which calculates with 200-300 PJ/year as the possible upper limits. It is estimated that the average biomass production from agriculture is approximately 100 PJ, while the maximum production is 170 PJ. The most important factor of uncertainty is the possible utilization of various biological by-products as the amount of cereal straw, corn-stalk, grape-shoot, etc. depends highly on weather.

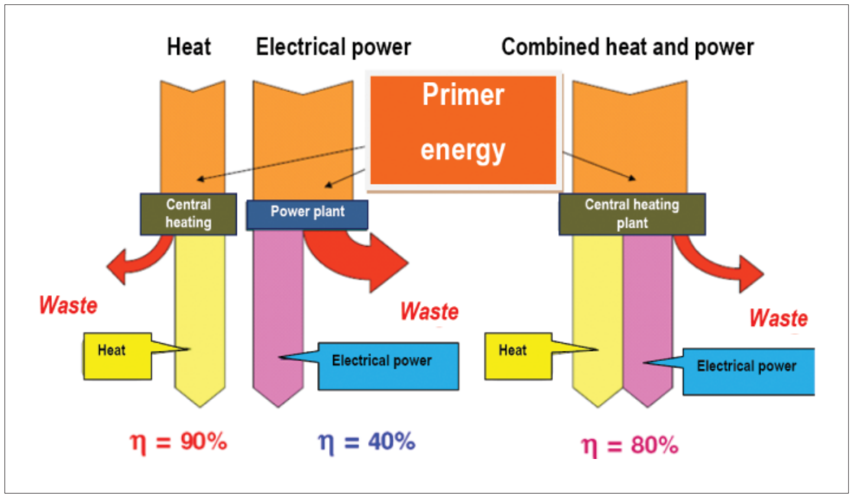

Figure 4 Efficiency of heat, electrical power and Combined heat and power generation

(Source: Stróbl A. 2011)

Biofuels

The amount of cereals and oil seed crops used for biofuels adds up to 4% of the annual raw material production of the world.

Biodiesel

In 2010, 21 million m³ biodiesel was produced in the world, 56% of which was produced in Europe. Biodiesel is mixed into diesel oil in the rate of 5%. This rate has to be doubled by 2020. The required production capacity (23 million m³) is practically available, which is now operated with a utilization rate of 56%. In several countries where biodiesel was offered as a separate fuel, it was withdrawn from the supply of filling stations as price differences dropped to the minimum in comparison to traditional diesel oil, significantly reducing its market advantage.

In Hungary, biodiesel is marketed as a component of traditional diesel oil mixed in at a rate of 4.7%, which is to be increased to 8% by 2020. The biodiesel production capacity established so far in the country (180 thousand tons) is capable of meeting the demand of fuel producers and distributors.

To achieve the mixing quota planned and undertaken by 2020, 240 thousand m³ biodiesel will be required. This can be obtained from the processing of oil-seed rape (95%) and a minimum amount of sunflower produced in Hungary at the present level of production. It is also possible to increase the production capacity. Biodiesel production and utilization in Europe may be influenced by the market prices of oil-seed crops which has shown continuous increase lately.

Bioethanol

Bioethanol is used as a component of petrol-driven motor vehicles mixed in the fuel E85 and partially as a separate fuel. Last year, 4.4 million m³ bioethanol was produced in the European Union, and 6.1 million m³ was mixed in petrol, 27.9% of which came from import. European bioethanol producing capacity adds up to 7 million m³, but it only operates with a utilization rate of 62.8 due to the high raw material (cereal) prices. In order to reach the targets by 2020, the EU has to increase bioethanol production to at least the double of the present amount, i.e. to 12-14 million m^3. Within the EU, only France, Spain and Hungary are capable of exporting bioethanol.

In Hungary, significant bioethanol production capacity has been established. In the near future, production capacity in the country will reach 810 thousand m^3/year. The majority of the product is exported as the amount used at present in Hungary is 75 thousand m^3/year, which will be increased to not more than 140 thousand m^3/year by 2020.

Biogas

Biogas production based on agricultural primary and secondary by-products and other biological wastes has increased substantially in the world. Europe is in the vanguard as more then 8500 biogas plants are operated here.

In Hungary, 46 biogas-producing plants are run at this time with an overall electric power generation capacity of 37 MW, from which 31 plants uses agricultural raw materials and the rest produces biogas from food and communal wastes or sewage sludge. The majority of the plants built in the vicinity of livestock farms and mainly using animal slurry and plant-based raw materials (silage, hay, residuals of cereal cleaning, etc) or food industry wastes have an output of 600-700 kW.

Using the biogas-producing capacity installed in the recent past, the country is able to produce 150-170 GWh/year electric power. This amount can be tripled or quadruplicated by 2020. It is important to ensure that waste heat is also utilized (for heating, drying, heating green-houses, warm-water fish-breeding) as this is required for the economic operation of plants. A solution could be the purification and concentrating of biogas (biomethane), enabling it to be fed into the natural gas network or used as fuel in motor vehicles.

Ecological sustainability

Experts involved in agriculture and soil management are right in criticising the utilization of cereal straw and corn-stalk for energy purposes and state that these materials are needed to maintain soil fertility and provide nutrition for the soil as a living organism. Accordingly, a substantial part of these materials has to be returned in the soil to maintain the original structure, water storage capacity of soil and to provide materials (carbon, minerals, microelements, etc.) required for plant growth. These experts claim that by continuously removing the yield from the field we degrade the soil, reducing its productivity as well as the nutritive value of the plants produced there.

The removing of some by-products such as grape-shoots, fruit trimmings does not mean significant ecological harm, however, they are not really important from energetic aspects either as their energy density is so insignificant in an unprocessed form that their transportation is not economic for distances above 20-25 km. Many people have reservations, with good reasons, about the utilization of wood produced in our forests in electric power plants, and the state subsidy provided for this.

Between 2004 and 2010, an annual amount of 6.4 PJ (400 thousand tons) wood was fired in Hungarian power plants, which requires over 500 thousand hectares of forests in addition to the usual timber felling. This was enough for 5% of the domestic electric power demand.

In the case of energy forests, much smaller areas are needed as much larger amounts of wood can be produced with 2- or 3-year turns. Professional literature contains very different data for this as well ranging from 2.0 to 14.0 tons of annual yield per hectare. Misinterpretations in evaluations are caused by that the moisture content of wood is not defined when yield is given. Firewood was traditionally used after a 3-year delay period in air-dry condition, which is not possible these days. Even if the wood is cut in winter with low moisture content and is used after a delay period in the next heating season, the moisture content will not be lower than 40-50% and the maximum net calorific value will only be 11-13 MJ/kg.

Calculating with the averages of values defined in literature for agricultural by-products, about 6500000 tons could be collected annually. Energy content is calculated in the next table:

By-product	Energy content	Energy content	Operational energy rate	Fossil requirement
Tons/year	GJ/tons	PJ/year	O/I	PJ/year
6 500 000	13	85	5/1	17

Thus, calculating with 50% transformation efficiency, the amount of utilized energy is 42.25 PJ/year, which does not reach 5% of total domestic energy need, and it requires a fossil usage of 17 PJ/year.

Biomass utilization for the purposes of electric power generation diminished considerable even in 2011 because the state subsidization of electric power was ceased. In accordance with the NAP, the restoration of the subsidy cannot be expected. Biomass utilization for heating can only be performed in larger village or city central heating plants (industrial, public utility, private sector). The majority of these will apply cogeneration systems favourable from the aspect of energy efficiency as only these types will obtain state subsidy in the future. Such facilities can be utilized for longer times and with higher effectiveness. The same applies to labour utilization, and the return of invested capital is of higher chance.

Alternative electric power programme

Figure 5 demonstrates the planned increases in electric power by 2020.

The plan shows that the present biomass production is intended to be increased by about 70%. Accordingly, the increase in biomass has to be doubled in comparison to the level of the year 2012 to achieve the target by 2020. However, the development requires substantial costs: 580-650 million euros (160-180 thousand million Hungarian forints) only for the power plants, which will give an overall amount of about 300-350 thousand million Hungarian forints together with infrastructural facilities.

Ecological sustainability also sets a limit to the plan as the expected increases in food production also have to be taken into consideration.

The concept of decentralized biomass-firing small power plants is reasonable especially when raw materials can be provided from the vicinity of the settlement. It also facilitates local employment, but their construction does not seem feasible in many cases under the present economic trends as they require significant resources.

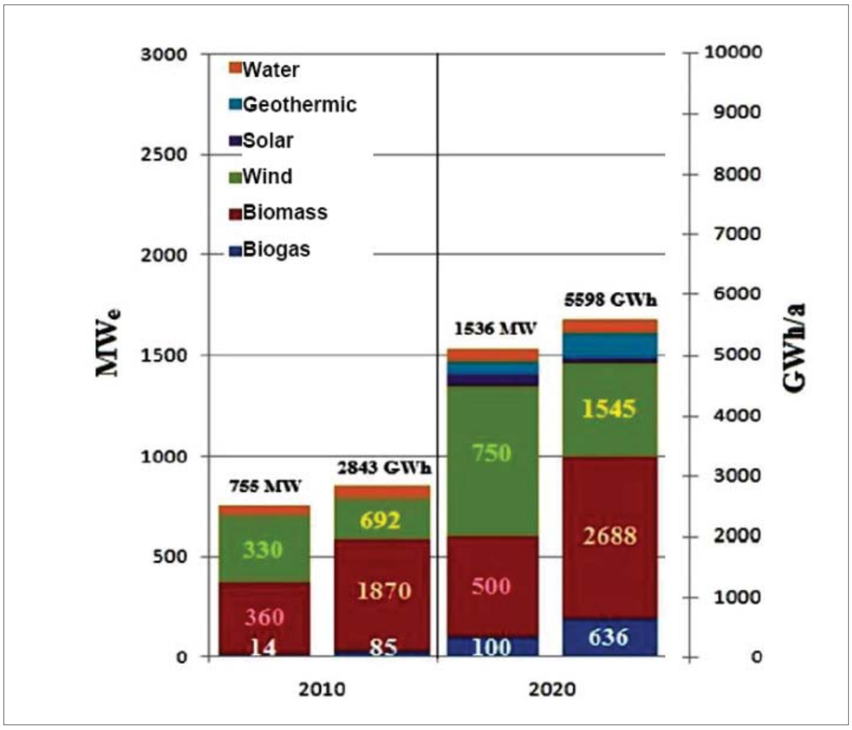

Figure 5 Planned quantity (MW) of various renewable energy sources and expected production (GWh)

(Source: National Energy Strategy (NEMZETI ENERGIASTRATÉGIA) 2010-2030)

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From page 2.

He was awarded with seven certificates of merit, from which he received the Order of Merit of the Hungarian Republic, Officer's Cross in 2011.

Professor Lajos Diófási was a determining person of viticulture and oenology for more than half a century. His greatness was shown not only by that he continuously worked to solve the tasks before his field of research and achieved excellent results but also by that he did his share in the organization of research and the spreading of the results of research and development in practice. In addition to the love of science, he also deeply respected his colleagues and practical experts. On the occasion of his 80th birthday, the professionals' day of viticulture was organized to greet him and praise his results, which is an honour not many people were given. He finished his last interview with the thought: 'if I see that farmers are open to innovations and we can help them solve their problems, it gives me a lot of strengths'.

By the death of Professor Lajos Diófási we lost an outstanding figure of viticulture and oenology. He set an example to be followed not only in his work but in his whole leading of life and family life as well. It will be hard to accept his absence and that we cannot rely on his calm opinion forming and advice. His life-work is appreciated and improved further by viticulturists and oenologists.

Csaba Gyuricza, Dean of the Faculty of Agricultural and Environmental Sciences, Szent István University

Dr. Csaba Gyuricza, former director of Pilot Farm for Crop Production and Biomass Utilisation and associate professor of Department of Soil Management, Szent István University has been elected dean of the Faculty of Agricultural and Environmental Sciences both by the senate of the faculty and that of the university. The new dean was appointed by the rector of Szent István University on 1 July 2012.

Dr. Gyuricza was born in 1973. He graduated as a certificated agricultural engineer for environmental management from the University of Agricultural Sciences in Gödöllő. In 2000 he became a doctor of philosophy (PhD) in Agricultural Sciences, in 2008 doctor habilitus. He has been working for Szent István University since 1999. In 2001 he became an assistant professor, then in 2004 an associate professor of the Department of Soil Management Szent István University. In 2004 he worked as a detached national expert of the Institute of Environment and Sustainability of the European Union in Italy. Between 2004 and 2008 he was vice-dean for foreign affairs of the Faculty of Agricultural and Environmental Sciences Szent István University.

Dr. Gyuricza was awarded the Darányi Ignác Prize in 1999, the For Science Prize in 2001, the Golden Delta Award of Delta Academy in 2006 and he became the Author of the Year in 2008.

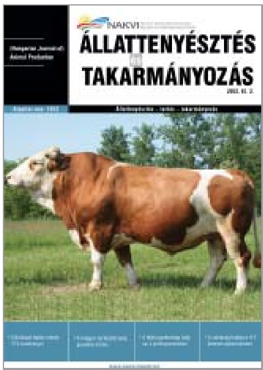
Dr. Gyuricza has been teaching several subjects on soil management and land use, crop production on low favoured areas, biomass production bases and utilization both in Hungarian and in English.

His research activity covers several areas in the field of crop production: land use and soil protection, interactions between climate threats and land use, utilisation of low favoured areas, production systems of soil conditioning green manure plants, cultivation systems of ligneous and herbal energy crops for energetic purposes, production of short rotation coppice woody energy plants, soil remediation on damaged areas.

Dean Gyuircza has authored and co-authored of 57 papers in foreign and domestic scientific journals, 85 reports in popular-scientific journals, several reports on scientific conference proceedings both in English and Hungarian and papers in institute publications.

He is actively engaged also in professional life as a member (1993) and secretary (2001) of Hungarian Soil Tillage Society, a member of ISTRO (1994), that of Society for Pro Scientia Gold Medal (1995), of International Biometrical Society (1999) and as a member of European Society for Soil Conservation (2000).

As the head of the faculty, Csaba Gyuricza intends to increase the role and level of practical training according to present-day requirements taking into account the opinion of students as well.



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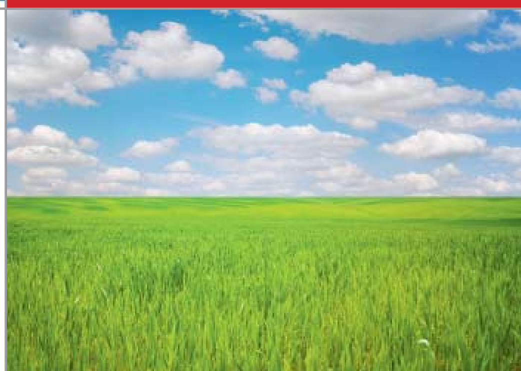

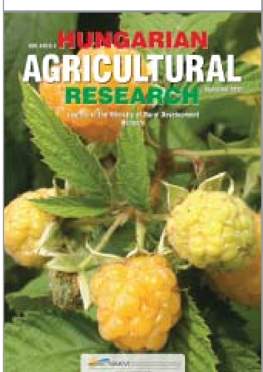

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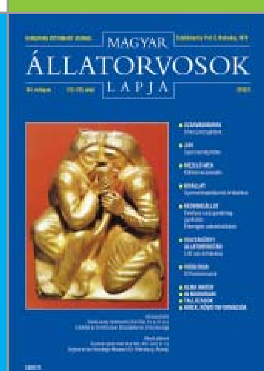

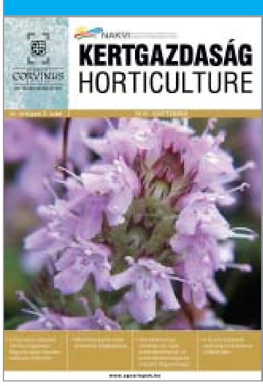

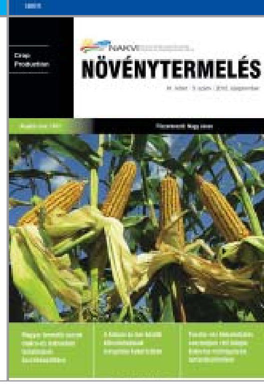

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