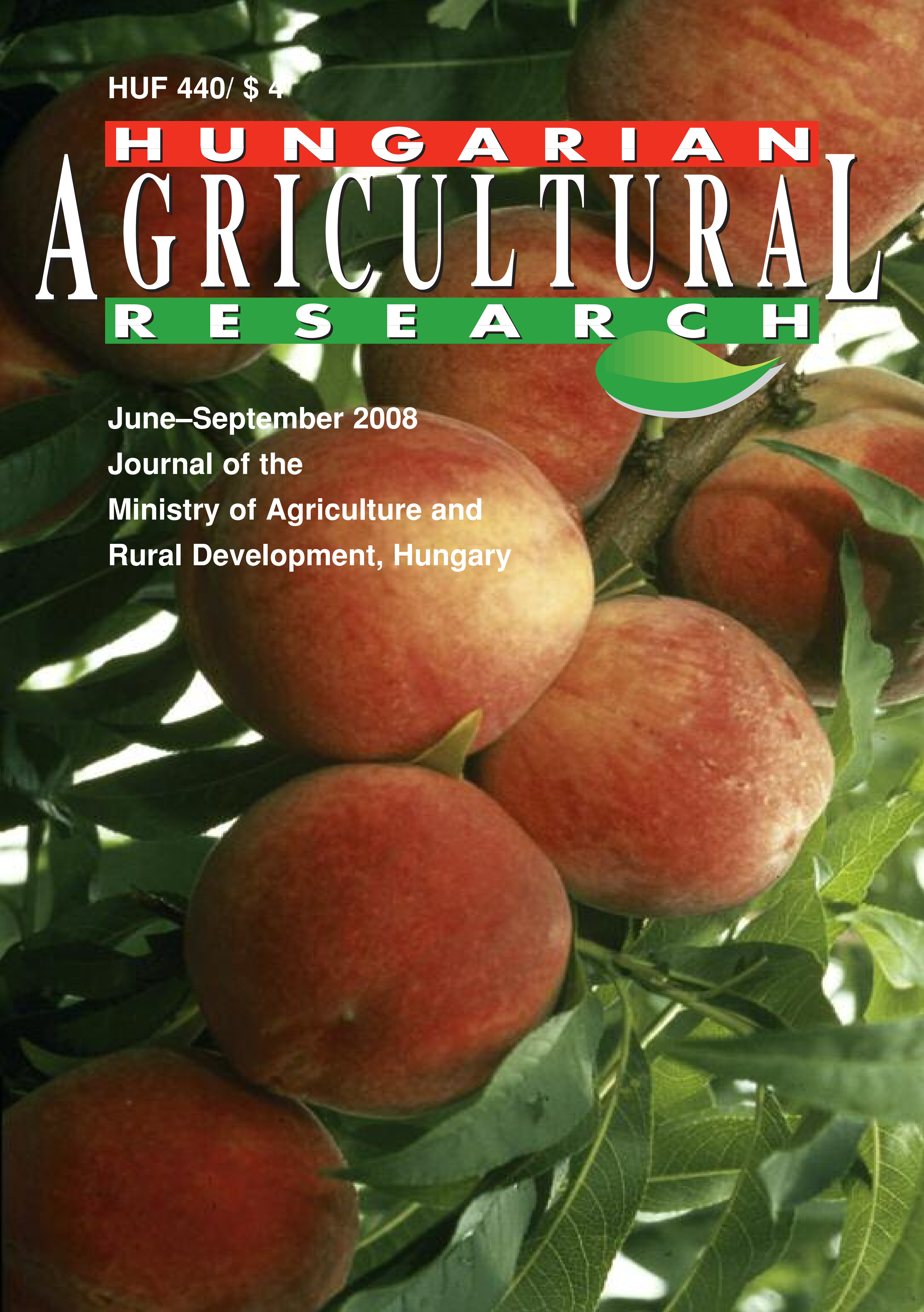

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HUNGARIAN AGRICULTURAL RESEARCH

June–September 2008

Journal of the
Ministry of Agriculture and
Rural Development, Hungary

53rd Plant Protection Scientific Days

20–21 February, 2007, Budapest, Hungary

Plant protection is a well-recognized discipline of Hungarian agriculture the world over. Plant protection activities in Hungary are extremely good as compared to other EU countries; no similar training in plant protection area are available in most countries.

The main activities of Plant and Soil Protection Services are the plant health control, examinations on permission and use of pesticides, observation of soil and ground water and to guarantee food safety.

There are 16–17 thousand tons of pesticides used in Hungary in a year, which is equal to 8–10 thousand tons active ingredient. The income of pesticide trade is consistently around 50–55 billion HUF per year, depending on meteorological factors, and suggests the market stability of this area.

The first plenary presentation of the Plant Protection Scientific Days was delivered by Prof. J. Horváth, ordinary member of the Hungarian Academy of Sciences, the president of the Plant Protection Society of Hungarian Agricultural Association, titled with ”Quo Vadis Agrarian Science”.

This was followed by the welcome ceremony of J. Gráf, the minister of the Minisry of Agriculture and Rural Development (MARD). An oral presentation was delivered by G. Gólya (Department of Food Chain Safety, Animal- and Plant Health, MARD), titled ”Changing in the plant protection administration department”.

Besides these the following presentations were delivered in the plenary session:

Genetical evaluation of the transgenic plants (L. Heszky); Environmental scientific results about DK-440 BTY genetical modified (MON 810) maize (B. Darvas, É. Lauber and A. L. Polgár); Transgenic plant and ecological farming (P. Roszik).

After the plenary session, some awards of the Plant Protection Society of Hungarian Agricultural Association were given, the most prominent from these was the golden degree of Life Tree delivered to Prof. Tibor Jermy, ordinary member of the Hungarian Academy of Sciences, by the minister of the Minisry of Agriculture and Rural Development.

After the plenary session, the presentations were continued in the different sections (Agrozoology, Plant pathology and Herbology). Altogether 60 oral presentations were delivered about the prominent scientific results of the sections. Oral presentations were completed with 30 posters.

Prof. J. Horváth
President of the Plant Protection Society of Hungarian Agricultural Association

Peaches

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Dezső Surányi[1]

National Peach Varieties and Growing Traditions

The Natural History of PLINY mentions an enigmatic tree species referred to as ’*Tuberes*’. This tree was introduced into Italy from Syria in the times of the Emperor AUGUSTUS. It is interesting to note that the tree ’*Tuberes*’ already existed in the times of NERO which meant nectarine: As a garden plant it was first encountered by PLINY. The scientific species name *Persica vulgaris (Prunus persica)* suggests that the region of origin of the peach would be Persia but in fact the latter is only the secondary gene centre of the peach. Perhaps, the Roman legionaries were the first in Europe to taste its fruit. Thus, the first written mention *of malum persicum*, also as Persian apple (e.g. THEOPHRASTUS), occurs in the roman age, though the exclusive roman mediation is not sure. The real gene centre is China where three species groups developed. The original homeland of the types that in our country are considered as very old may be the valley of the Yangtze where white fleshed cold and drought resistant peaches came from.

Picture 1: *Parasztbarack (Csongrád, 2006)*

Roman peaches in the Carpathian Basin

It is a fact that in his *Georgics* also VIRGIL deals with the honey sweet peach, but COLUMELLA likewise pays attention to praise the plant. The most pertinent attribute to describe the peach appears in the book of PLINY: *duracinus,* indicating firm fruit flesh and clingstone type, the word from which the Arabian *durakim* is derived and also which is related to the name of the Illyric (Albanese) city Durrësi. An almost perplexing variety: Chinese, Persian, Illyric, Roman and even Gallic. Which is the correct? It is known that one single fruit was sold at a price even as high as 30 sertertia in Imperial Rome, since it was a novelty.

At the same time, PLINY and COLUMELLA also make mention of the Gallic peach which is a proof that the peach might have already been present in Roman Gaul prior to the campaign of Julius Caesar. It is possible that the peach arrived to the Gallic people by the first route but the second route is an indication that also the Gallic sent various types from Southern France into the countries of the Roman Empire. In fact, peach was grown in Gaul already in the 1st century and in the 5th century the Benedictine monks learned the tricks from the Celtic inhabitants and produced several local varieties. The varieties known as ’Paraszt-barack’ *(Picture 1)* should be regarded as memorials less to the peach returned to the wild state but rather to the Roman-Celtic inheritance, similarly, in certain areas of the country, to nectarine

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also called as rubber-peach (in the neighbourhood of the town Cegléd) or to 'fügebarack' (fig) peaches *(Picture 2)*. On the other hand, it is possible that in the Carpathian Basin free-stone peaches are gifts only of the 18th and 19th centuries.

Having seen the historical background, it seems advisable to consider, one by one, the finds of fruit stones and the national written sources as it is not possible to rule out with certainty that the peach was introduced into Pannonia either by Celtics from the West or brought into the country by the Romans from the South via the Balkan.

Picture 2: *Fügebarack, alias Peento (Csemő, 1997)*

Four peach stones from the Roman period are known from the national archaeological finds. Three stones were recovered from a 1st–2nd century cremation grave in Győr-Homokgödör and one was excavated in the Roman period layer found at the corner of the streets Kiscelli and Pacsirta in the 3rd district of Budapest. Much later, a charred peach stone was unearthed from a Romanesque grave (next to an infant) at Esztergom-Kovácsi. Several stones were found at the Romanesque housing site at Fonyód-Bétatelep. A number of 12th–14th century peach stones were recovered from the fill of a well at 40 Úri Street in the 1st district of Budapest. A peach stone was also found in the 5th layer (16th century) of the court of the castle in Kőszeg. Of particular interest are the 39 peach stones in the coffins in the crypt of the church of Gyöngyöspata. It would be worthwhile to find out for what reasons they had been placed there in the same manner as into the Romanesque infant's grave (hope of eternal life?).

We had earlier mentioned that peach may have been introduced and brought under cultivation by the Celtics but the cultural effect of the Romans is beyond doubt in the provinces of Pannonia. Besides the stones found, the written sources can be considered as clear evidence. The glossary of Beszterce (around 1390–1410) contains two forms of occurrence: *psicus, barasc fa =persicum, baraczk* and *psicum, barassch = persicum, baraczk* and in the glossary of the Abbey of Schlägl (around 1400–1410) peach is denoted as persicum or *barazc* while in the Latin-Hungarian glossary as *bar(a)zcfa*. In charters some data also refers to peach and a document dating to 1528 mentions dried peach (*azw barazk*). In the glossary of Murmelius the meaning is persica pomus, i.e. *barazk fa* (peach tree) just like *barazk fa* (persica)in the Latin-Hungarian Glossary of Calepius, then the Glossary of Balázs Szikszai Fabriczius (1590) describes perhaps the typical trait of the earliest Hungarian peach variety (i.e. *duranczai*)

Picture 3: *Peach tree in bloom (Szatymaz, 2002)*

When the peach was born...

Based on a broad analysis of the national sources we can see that peach was started to be grown in Hungary without doubt as early as the 16th century *(Picture 3)*. The attribute 'őszi' (autumnal) began to be used only from the

18th century in order to distinguish peach ('őszibarack') from apricot ('sárga/nyári barack'). KELEMEN MIKES was the first to call peach, Persica vulgaris as 'őszibarack' in his work entitled Letters from Turkey (181st Letter). '*There are no pears, apples and plums, but a lot of peaches* (őszibarack)...

It is worthwhile to have a look at the Europe of the 15th–16th centuries even if peach production can already be encountered in the 8th–9th centuries. Accordingly, historical sources make mention of peaches in England, Holland and in areas north of Paris, situated, in particular, in sheltered gardens and along south-facing walls of houses. Later (e.g. in England) frost tolerant varieties were produced (till then the Belgian and Dutch gardeners had grown peaches mainly in glass houses), but due to the high costs they did not manage to become popular *(Picture 4)*. It is known from the Chronicles of ROGER of WENDOVER that in England peaches were already being planted around 1216 (the climate was warmer than today), then WOLF, Royal Gardener to Henry VIII started experiments with peach growing again, almost from the beginning. Over the following centuries, it was again the French that excelled with peaches. SERRES (1604) described already as many as 12 peach varieties while LECTIER (1628) 27 ones and 38 varieties were presented by MERLET (1667) in his book.

In the 16th century, according to GESNER, two peach varieties of Hungarian origin were growing in the garden of WOYSSEL in Wroclaw: 'Vérbarack' *(Picture 5)* and 'Woyssel sárga duráncija'. These were also described and classified by BAUHIN in his botanical work (*Pinax theatri botanici*). In his *Fructologia* KNOOP uses the denomination of 'Magyar barack' as the synonym of 'Vérbarack' and later 'Vérbarack' and 'Péche Hongroise' its equivalent name appear in a work of LEROY (1879), too. The variety 'Wossel sárga duráncija' survived under the name of 'Pavie alberge jaune'. According to LEROY the latter is identical to the peach referred to as 'Duracina' by PLINY.

Picture 4: *Cézanne: Fruit bowl with peaches*

The rapid increase in the number of the varieties is not only an indication of the development of the French peach production but also of the level of the national growing. In an archival document dated 1762 BOGDÁN – GEDAY (1971) discovered the variety list of the orchard of the Peklin estate. According to it 7 different peaches were grown, namely the varieties

Picture 5: *Vérbarack (Cegléd, 1995)*

’Korai mandulabarack’, ’Nagy duránci’, ’Nagy kemény húsú tivoli’, ’Nagy kopasz barack’, ’Nagy sárga mandulabarack’, ’Vérbarack’ and ’Vörös és Sárga tivoli’ (the name ‘mandulabarack’ used then is identical to the current botanical name ‘barack-mandula’).

LEIBITZER (1798) described 13 peach varieties and already 50 in a later edition (1836) of his book and COLIN (1802) presented 22 peach varieties. The *Kalauz* of JÓZSEF KOVÁCS (1861) described 32 free stone and only 3 cling stone varieties. FERENC ENTZ (1858), the founder of the national horticultural higher education, presented 4 French and 2 Hungarian varieties in the series of booklets entitled *Kertészeti füzetek*.

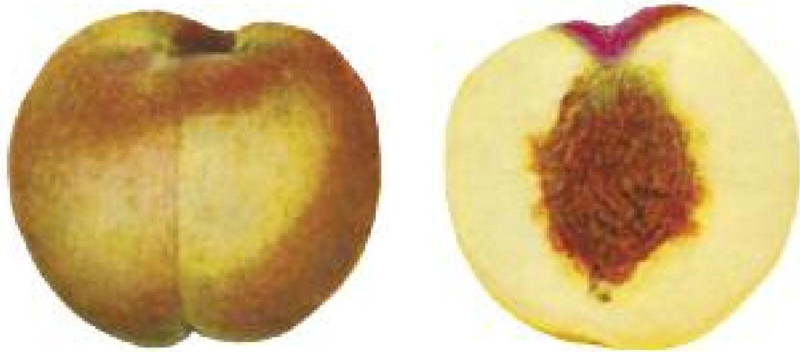
French peaches included usually light fleshed and free stone varieties. At that time the one most widespread in Hungary was ’Korai Chevreuse’ *(Picture 6)*, ripening at the end of August, similarly to ’Veres Magdolna’. ENTZ was the first to present the varieties ’Nagy kedvelt’, ’Kancellár’ and ’Szép Őrnő’ (Galande). The variety was so common that, according to ENTZ ‘*we had the opportunity to observe and admire it in the neighbourhood of Szeged, Eger and Lake Balaton, i.e. in our homeland*’. After the Austro-Hungarian Compromise of 1867 also free stone English varieties arrived in the country. The variety ’Rivers korai’ (nectarine) was recommended by VILLÁSI, on the other hand Hungarian varieties of such kind had already become popular, such as ’Metelka díjazott barackja’ (free stone), grown from seed by SOMA BARTHOLOMEIDÉSZ, the Lutheran pastor of the village Gyón and ’Zwikly barackja’ selected by ANDRÁS ZWICKLY on Gellért Hill.

Picture 6: *Jakab Bogdány: Still Life (detail) around 1700*

Picture 7: *Gallic peach, painted by a French artist (work of Cézanne)*

Hungarian local varieties and growing regions

Gallic (French) peaches *(Picture 7)* are mostly white or greenish white fleshed and free stone. The true Hungarian specimen of ‘Paraszbarack’ are also of this kind which confirms probably not only the successful maintenance of the Gaul peaches brought in via non-Balkan routes but demonstrates the successful horticultural activity of the military governor of the fortress of Szeged, at least in the county of Csongrád. The importance of the variety ’Vérbarack’ on the other hand is due to the fact that the yellow fleshed varieties, e.g. ’Sárga csodaszép’ and ’Elberta’ are considered to descend from it. The latter of the two became so popular that it is still present as a companion plant in vineyards in the Great Plain. ’Vérbarack’, on the other hand, has almost disappeared. ENTZ also considers the cling stone varieties as substantially Hungarian peaches writing this way: ‘*Any attempt to undermine the reputation of the French peach*, the term denoting the free stone cultivated varieties, *would be a futile effort, but I dare*



Picture 8: *Mezőkomáromi duránci (Brózik, 1962)*

and will attempt, though not promising in advance, to achieve that with time by the name of Hungarian peach foreign pomologists will understand the better ones of the cling stone peaches, should it cost some German theme'. In the second part of the 19th century several cling stone varieties were described by pomologists: 'Mezőkomáromi duránci' (grown from seed) *(Picture 8),* 'Vezerle duráncija' (variety of the parson of Badacsony), 'Kecskeméti duránci' (obtained by János Buzás from seed) *(Picture 9),* 'Szöghi duráncija' (seedling of the landowner in Szeged) and 'Bartha duráncija' (selected in 1887 by the author of the name).

As written by RAPAICS (1936), free stone varieties were mostly of western origin and over the last century several cling stone varieties were selected in the country. The varieties 'Mezőkomáromi duránci' of Entz, 'Vezerle duráncija' (Badacsony), 'Kecskeméti duránci' (Kecskemét), 'Szöghi duránci' (Szeged) and 'Bartha duráncija' (Tiszafüred) were grown as local varieties. These, besides being of the cling stone type, had the common characteristic of having been produced from seedlings obtained by open pollination via selection *(Table 1).*

The great Phylloxera epidemic brought about changes not only in the structure of viticulture, the techniques of cultivation, the geographical distribution of vineyards (allocation) and in the social position and initiated the migration of people, but had an influence also on the other sectors of agriculture. The peach production in the neighbourhood of Buda began at the devastation of the vineyards in Buda.

KÁLMÁN TÖRS (1889), based on his experiences gained in the region of Buda, wrote as follows: '*Peaches in mid-summer! How can we call 'őszibarack' (peach) as őszi (autumnal) when it ripens earlier than some of the varieties of the apricot ripening in summer!*' TÖRS describes 12 varieties in his article. That time the variety 'Legkorábbi' was widespread in the hills of Buda under the name of 'Hóbarack', but the most popular peaches were the ones of early July: 'Cőte d'Azur',

Picture 9: *Holy Mother of God with Peaches (Kecskemét, Roman Catholic Church)*

Table 1. Introduced and indigenous peaches in Hungarian growing regions

VARIETY	Character	Ripening	Note
Aranycsillag	cling	1st July	long dormancy
Hóbarack	cling	1st July	frost sensitive
Nektár H.	free	1st July	frost resistant
Cegléd szépe C. 425	free	2nd July	good transporting
Bársonypír	semi-free	2nd–3rd of July	good bearing
Mariska	semi-free	2nd–3rd July	drought resistant
Piroska C. 1629	free	2nd–3rd July	winter resistant
Bartha duráncija	cling	3rd July	good cap cv.
Csizmadia magonca	cling	3rd July–1st Aug	no transporting
Fehér korai	free	3rd July–1st Aug	no transporting
Csemői gumibarack	cling	1st Aug	excellent transporting
Homokgyöngye C. 427	semi-free	1st Aug	good transporting
Vezerle duráncija	cling	1st Aug	very bearing
Zwickly őszibarack	cling	1st Aug	good market cv.
Fügebarack	cling	2nd Aug	flat fruit
Laczy-féle barack	free	2nd Aug	tasty
Szatymazi Ford	free	2nd Aug	good cap cv.
Brugnon	free	2nd–3rd Aug	monilia sensitive
Parasztbarack	free	2nd–3rd Aug	diverse use
Cserhalmi szépe	free	3rd Aug	frost resistant
Elberta	free	3rd Aug	winter frost sensitive
Fodor-féle névtelen	free	3rd Aug	diverse fruit size
Proskaui	free	3rd Aug	seed-good cv.
Bourdin	free	3rd Aug-1st Sept	good table cv.
Metelka díjazottja	free	3rd Aug-1st Sept	greenish fresh
Szegedi arany	free	3rd Aug-1st Sept	frost resistant
Champion	free	1st Sept	for rootstock
Elberta	free	1st Sept	for rootstock
Kecskeméti duránci	cling	1st Sept	no sensitive
Nagy mignon	free	1st Sept	severe bearing
Paczelt magonca	free	1st Sept	very juicy
Württembergi király	free	1st Sept	good cap cv.
Gyümölcskertek királynője	free	2nd Sept	table cv.
Lord Palmerston	cling	2nd Sept	good transporting
Magyar aranyduráncija	cling	2nd Sept	big fruit
Mezőkomáromi duránci	cling	2nd Sept	good transporting
Shipley	free	2nd-3rd Sept	for rootstock
Szöghy duráncija	cling	2nd-3rd Sept	excellent cap
Kései bronzos Elberta	free	3rd Sept	drougth resistant
Vénusz emlője	free	3rd Sept	good table cv.
Vérbarack	free	3rd Sept	blood fresh
Salwey	free	3rd Oct	late ripening

'Korai Alexander' and 'Amsden'.

Phylloxera (1875) appeared in Hungary in a time when the peaches from America were becoming more and more popular. The destructed vineyards were replaced with peaches. The orchard of KÁROLY KERKÁPOLY was set up on Gellért Hill, then in the 1930s the market was dominated by peaches from Nagytétény. In Nagytétény also hillsides had been planted with grapevines before the Phylloxera epidemic, which were then replaced with peaches. The teacher VILMOS LEHNER made his home there, who nevertheless tried to grow table grapes as well, but soon changed over to the production of peaches. He procured the best varieties and with them he conquered the market of Budapest, contemporarily teaching farmers the method of modern production, though it is true that JÓZSEF TÖRLEY and his family managed to establish their famous vineyard and Champaign factory in Budafok. The region of Buda extended in peach growing: the example of Budafok and Nagytétény was followed by Érd, Diósd and Törökbálint. The experiences were summed up by ÖDÖN LEHNER in a very popular catechism which had several editions.

Peaches spread not only in place and at the expense of grapevines. HUSZ (1940) in his book entitled as *Diseased Plant and Its Cure* describes his experience demonstrating the harmful nature of deforestation in the peach plantations planted in place of the forests. I can add, that the present author was told similar experiences at Vértesalja and in the region of Gyöngyös by elderly farmers: '*In the region of Érd in five years hardly any surviving trees has remained of the peach plantation planted in place of the* *exchange forest cleared. The trees after the initial development stop in growth, languish with smaller yellowish leaves and gradually perish*' (p 87). Thus, replant diseases can occur in peach plantations also after Austrian oaks (SURÁNYI 1998). This isolated phenomenon, on the other hand, had no affect on the flourishing of the growing region around Buda. The 296 thousand peach trees of 12 settlements had increased to 1,101 thousand by 1959.

Epoch of changes in variety use

The region of Szatymaz also constitutes a traditional growing region and is important because it is here where most of the traditions have survived. The first data demonstrating a large scale peach production in this area are from the turn of the 18th and 19th centuries. Therefore BÁLINT (1976) is cautious in saying: '*Little is known about the previous past of the peach in Szeged. However, the fact that the peach not tied up with either idioms or beliefs seem to be a proof of the relatively recent presence of the peach in Szeged. Its production is parallel to the development of viticulture on sandy soil*'. (A szögedin nemzet, Col. I, pp 597–598). The oldest local variety was 'Vedres-féle duránci' then records occur relative to a nectarine. JOSEPH, the Prince of Lotharingia, the military governor of the fortress of Szeged, introduced several French peach varieties into cultivation in the regions around Szeged. The efforts of the Prince, unfortunately, have fallen in oblivion, even though the so-called 'Parasztbarack' varieties developed from the French varieties imported by him, thus being the youngest Hungarian varieties.

One can mention, as breeder, the name of RICHÁRD ZAUER and his subsequent followers JÓZSEF BÓDI, ISTVÁN FOKI and PÁL TÓTH. The result of their work includes 'Aranycsillag' *(Picure 10),* 'Bársonypír', Szatymazi Ford', 'Szegedi arany' and 'Szegedi óriás'. The region of Szatymaz had only 48 thousand peach trees in 1935, but in 1968 already 685 thousand trees were bearing fruit in the neighbourhood of Balástya, Bordány, Csengele Forráskút, Szatymaz, Szeged, Üllés, Zákány and Zsombó (BÁLINT 1976).

On the other hand, peach had a considerably wider growing region in the decades following the Second World War. The growing region in the Danube Bend was also established in the last century after the Phylloxeara epidemic, though the origins of peach production in the neighbourhood of Szentendre and Óbuda go back to Roman times. Similarly, cultivation in the neighbourhood of Győr has 'classical roots', too. Also, in the vicinity of Lake Balaton and the city Pécs the existence of a peach culture in the 4th–5th century seems probable. It was some of the mother trees selected in the vineyards of the Great Plain that proved favourable also as a

Picture 10: *Aranycsillag (Gyöngyös, 2001)*

Table 2. *Rootstock peach and peach alomond cultivars at Cegléd*

VARIETY	Self-fertility %	Frost resistance	Ratio, seedling/seed no./kg
'C. 932'	12,2	weak	94
'C. 2629'	19,1	moderate	114
'C. 2630'	15,4	enough good	80
'Öttömösi nagyvirágú'	17,4	good	80
'Öttömösi kisvirágú'	19,3	good	95
'Shipley'	6,2	moderate	110
14/54 'Elberta'	15,6	enough good	78
50/54 'Champion'	29,6	good	83
'C. 410' almondpeach	9,7	very good	131

***Picture 11:** Pits of C. 932 peach rootstock (Cegléd, 1998)*

rootstock variety *(Picture 11)* because of the small size of pit, of the favourable germination and the high resistance to ecological stresses and diseases *(Picture 12) (Table 2)*.

Also, a smaller growing area was formed at the feet of the hills of Mátra–Bükk–Tokaj and, even if in a manner less marked than that of the abovementioned regions, peach production became typical as a companion crop in vineyards on sandy soil in the region between the rivers Danube and Tisza. This old form of cultivation, on smaller patches of land, was observable in other parts of the country, constituting 6.75 million trees (62.8%) on the level of the whole country. In contrast, the tree inventory listed 2.2 million peach trees in home gardens (20.5%) and 930 thousand (8.6%) as scattered.

***Picture 12:** Petals of virus infected flower (1998)*

Thus, only 3,808,901 trees were in cultivation in 1935 while 1959 already 10,734,767 peach trees were included in the inventory (the growth is 281%).

As written by TIMON (2004), from 1961 ‘Champion’ became the leading variety in the country. Peach production had a good position and in 1972 the total yield amounted to 131 800 tons and 10–18 thousand tons went for exports. 87% of the fruiting areas were concentrated on ecologically suitable areas. From the 1980s the nectarines started to have an ever greater role, nevertheless the proportion of the early maturing varieties remained around 30%. Still, the economical, social-political situation is a hindrance to changes in variety use which should not be neglected both from the point of the development of the national fruit production and because of the new phytosanitary problems.

Nectarines (*Prunus persica* var. *nucipersica*), on the other hand, had long been known in Hungary, as already LIPPAY (1667) knew them: ‘*There are hairless, smooth peaches which are usually cling stone*’. Later, ISTVÁN MÁTYUS calls the ‘smooth skinned nut, plum and lemon peaches’ as ‘bastard (=deformed) peaches’. They are most fully discussed by COLIN at the beginning of the 19th century. FERENC ENTZ (1858) recommended the cling stone ’Vérpiros kopasz muskotály’ or ’Római violány’ (Brugnon violet musqué), DEZSŐ ANGYAL (1908), on the other hand, praised the nectarine ’Lord Napier’.

References

Faust, M. – Timon, B. 1995. Origin and dissemination of peach. Hort. Rev. New York 17: 331–379.

Mohácsy M. – Maliga P. – ifj. Mohácsi M. 1967. Őszibarack. Mezőgazdasági Kiadó, Bp.

Rapaics R. 1936. Őszibarack-jaink. Term. tud. Közl. 68: 385–396.

Rapaics R. 1940. A magyar gyümölcs. KMTT, Bp.

Roach, F. A. 1985. Cultivated fruits of Britain. Their origin and history. B, Blackwill, New York.

Surányi D. 1985. Kerti növények regénye. Mezőgazdasági Kiadó, Bp.

Surányi, D. 1998. Data to the history of replant disease and soil sickness in Hungary. Acta Hort. Hague 474: 162–169.

Surányi D. 1999. Csonthéjas alanyfajták botanikai leírása. GYDKFI, Cegléd.

Surányi D. 2002. Gyümölcsöző sokféleség. Biodiverzitás a gyümölcstermesztésben. Akcident, Cegléd.

Timon B. 2004. Őszibarack. Mezőgazda Kiadó, Bp.

Tomcsányi P. (szerk.) 1979. Gyümölcsfajtáink. Gyakorlati pomológia. Mezőgazdasági Kiadó, Bp.

Péter Sembery, Gábor Géczi[1]

Microwave treatment of food

Behaviour of foods in an electromagnetic field is highly dependant on the dielectric constant of the material. In the beginning of the investigation we had a wave guide apparatus which was suitable for the measurement of solid phase permittivity. A measuring system utilizing a cavity resonator *(Figure 1)* was developed which allowed usto determine the dielectric properties of liquid foods (e.g. milk) as well.

Based on the results of our measurements and calculations we defined an algorithm permitting a quick and simple assessment of the complex permittivity of cereals with different moisture content and bulk density. In the first step we calculated the complex dielectric constant of the 'single kernel' in the knowledge of the moisture content (w, %). In the equation (1) ***k*** is a complex constant characteristic of wheat (k=0.053–0.053j) and ε_a is a theoretical set value corresponding to the dielectric constant of the 'perfectly dry' wheat seed (ε_a=4.132–0.151j).

$$\varepsilon_{mag} = k \cdot w + \varepsilon_a \qquad (1)$$

By use of the equation (1) and also of the Landau-Lifshitz, Looyenga mixture expression (2) we are able to make a quick and simple assessment of the complex permittivity of wheat with different moisture content and bulk density

In the equation (2) $\varepsilon_{mixture}$ denotes the complex permittivity of the wheat of the given moisture content and bulk density v_{air} is the complex permittivity of air, in our case always 1–0j (no loss) and v_{seed} is the complex permittivity of the wheat seed calculated by the equation (1). Furthermore, v_{air} and v_{seed} are the partial quantities represented by the components (air and seed) relative to which it is always true that $v_{air} + v_{seed} = 1$.

When the above described algorithm was applied to the wheat samples tested, at a frequency of 2.45 GHz, to samples with different bulk density and moisture content, the estimation

$$(\varepsilon_{halmaz})^{1/3} = v_{levegő} \cdot (\varepsilon_{levegő})^{1/3} + v_{mag} \cdot (\varepsilon_{mag})^{1/3} \qquad (2)$$

Figure 1: *A measuring system utilizing a cavity resonator*

Figure 2: *Cavity resonator and sample holder*

[1]Szent István University, Faculty of Mechanical Engineering.

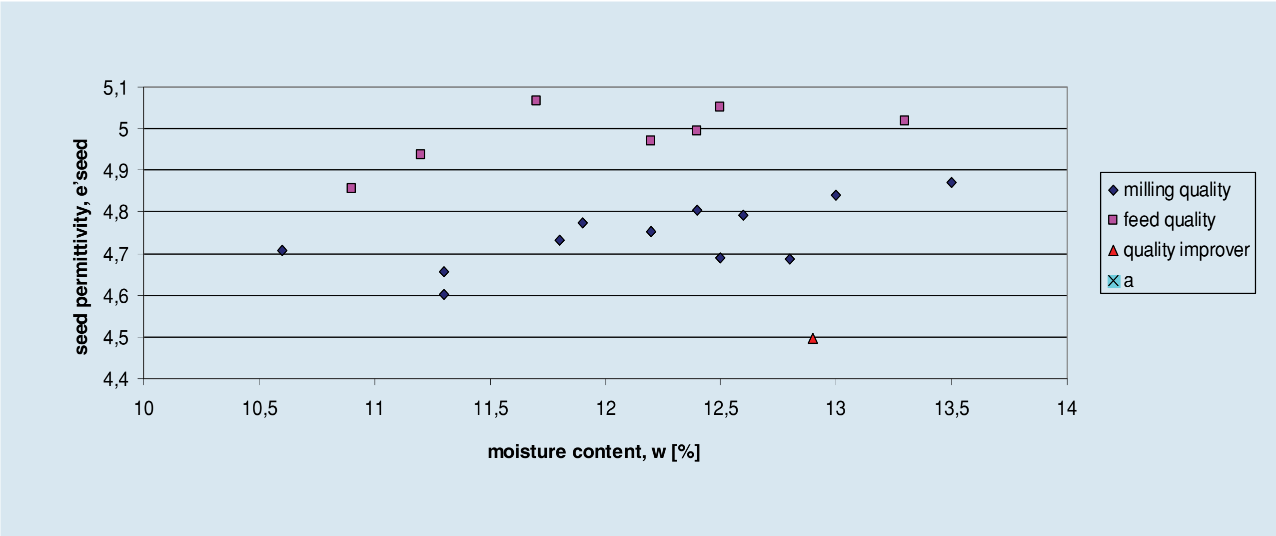


Figure 3: *Seed permittivity expressed as a function of moisture content*

error in the real dielectric constant compared to the measured values was 2% and in the case of the loss factor less than 4%.

Our investigations revealed a relationship between the dielectric properties of wheat and the parameters decisive for its quality. The basis for the classification of wheat into quality categories (milling, feed and 'quality improver') is the standard MSZ 6383:1998. The determining parameters are hectolitre weight (bulk density) of the aggregate, its moisture, wet gluten and crude protein contents and the falling number. The first two have a substantial influence on the permittivity of wheat and on the loss factor.

The dielectric constant of an aggregate of grain or seed crops, by calculation using the Landau-Lifshitz, Looyenga mixture expression, permits to determine the dielectric properties of seeds with a specific moisture content. When the permittivity of the seeds is represented as a function of the moisture content, the results of the samples belonging to different quality classes will clearly separate from each other *(Figure 3)*. This finding will help us in the accomplishment and control of wheat quality evaluation.

Tests of liquid foods (milk, beer) indicated that the dielectric properties could not be cumulated with a method similar to that of grain and seed crops. We failed to demonstrate the possibility to determine the dielectric properties of the mix in the knowledge of the dry matter content of the liquids and the dielectric constant of the water. On the other hand, we considered that the real dielectric properties of the milk samples provided clear information on milk fat content as a positive result. It can be seen from *Figure 4*

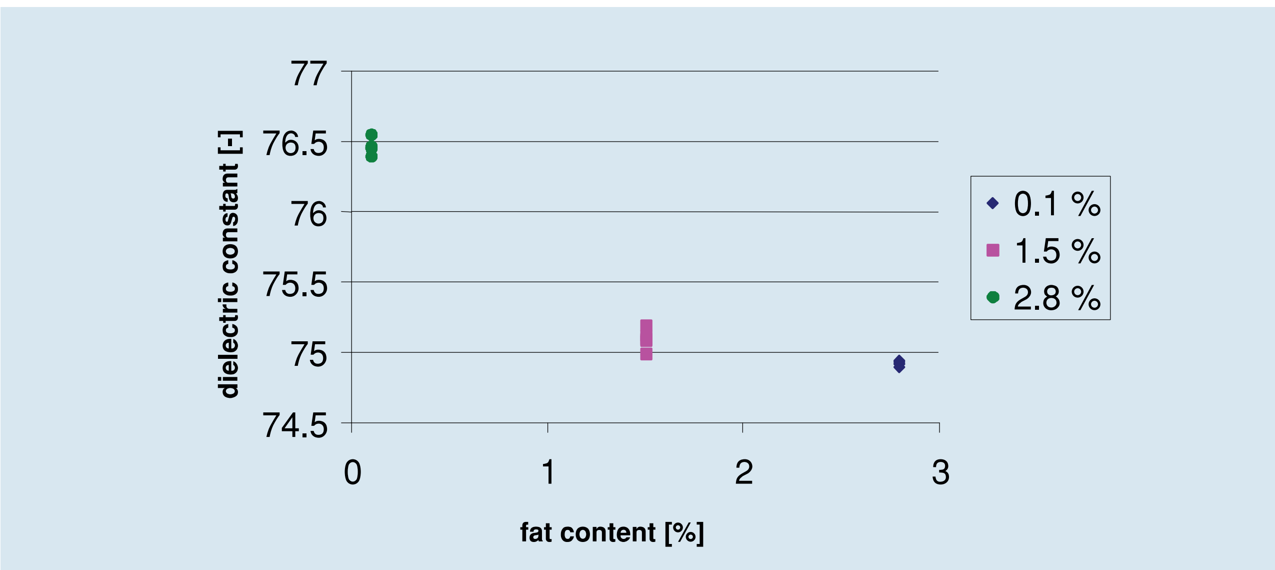


Figure 4: *Dielectric constant of milk expressed as a function of fat content*

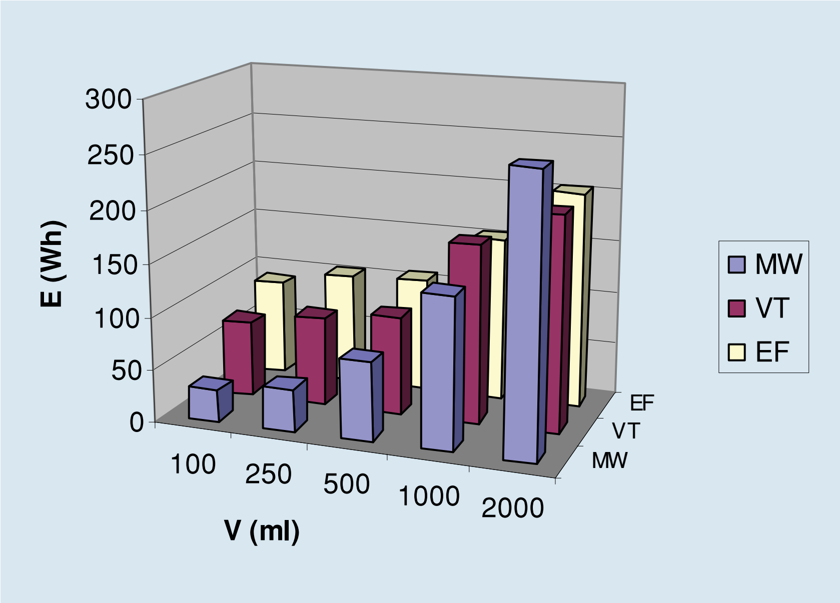


Figure 5: *Energy consumption*

that the value of the real dielectric property decreases with the increase in fat content.

Using our earlier results, we continued our investigations with the study of food technologies suitable for use in electromagnetic field. We set ourselves the objective to find a solution for the **pasteurization of liquid foods by the application of microwave energy**. The particular character of the thermal application of microwave energy is given by the fact that the thermal energy is produced inside the material to be heated, thereby making heating faster. Known applications of dielectric heating include the drying of seeds and food products, the pre-sowing seed treatment in order to improve germination and growth, heating of agricultural products in order to improve their nutritional and other properties, pest control, enzyme inactivation (pre-cooking), pasteurization and sterilization. Microwaves are electric waves having frequencies from 300 MHz to 300 GHz. However, for safety reasons, only a few frequencies are allowed in the food industry: 915 MHz, 2.45 GHz, 5.8 GHz and 24.124 GHz.

The purpose of the initial experiments, besides the feasibility of pasteurization, was to determine energy consumption. Microwave heating was compared to other electric heating methods, such as electric cooking plate and constant temperature water bath. Heating was carried out using a domestic microwave oven (Whirlpool AT314), an electric cooking plate (ETK 5508) and a constant temperature water bath (PHYWE S07022). All three methods had a nominal electric capacity of 1000 W and energy consumption was measured using an Actaris SL 7000 energy meter. Sample temperatures were continuously monitored at eight points with the help of CU-CuNi thermocouples, using an ALMEMO 2590-9 device.

Our investigations confirmed the quickness of microwave heating (MW) for milk, distilled water and beer. Based on the analysis of energy consumption *(Figure 5)* we can see that the heating up of quantities over 1 litre using the domestic microwave oven required higher energy inputs than that using the constant temperature water bath (CTWB) or the electric cooking plate (ECP). A similar conclusion can be drawn from the results for the efficiency of energy use (ratio of heat output and electrical output). On the other hand, it can be seen that when dealing with lower quantities it is the microwave method that produces better results.

Based on these we set ourselves the objective to develop a continuous operation apparatus having a lower quantity in the microwave field at a given moment during its operation, thereby a better energy consumption was achieved even when heating greater quantities. One of the possibilities is the apparatus provided with a flow-through system carrying out the pasteurization prior to packaging. The other possibility is the placement of the already packed product (boxed milk, bottled beer) into the microwave field and its pasteurization. The latter is an energy efficient technology based on internal heat generation in which process the pasteurization of products already packed or bottled can be accomplished, capable to substitute the costly aseptic techniques.

A **heat treatment apparatus for laboratory use** was developed for the purpose of the microwave treatment (pasteurization) of fluid foods prior to packaging. The apparatus was constructed from a commercial microwave oven for the purpose of, initially, **batch** and then **continuous** operation pasteurization. Continuous operation was achieved with the help of a glass spiral placed in the microwave oven. Treatment time is controllable by the flow speed and by the modification of the length of the spiral tube. The design of the continuous operation microwave pasteurizer of laboratory dimensions is illustrated in *Figure 6*. 2 holes of 7 mm in diameter were drilled, spaced at 8 cm apart, on the side of a

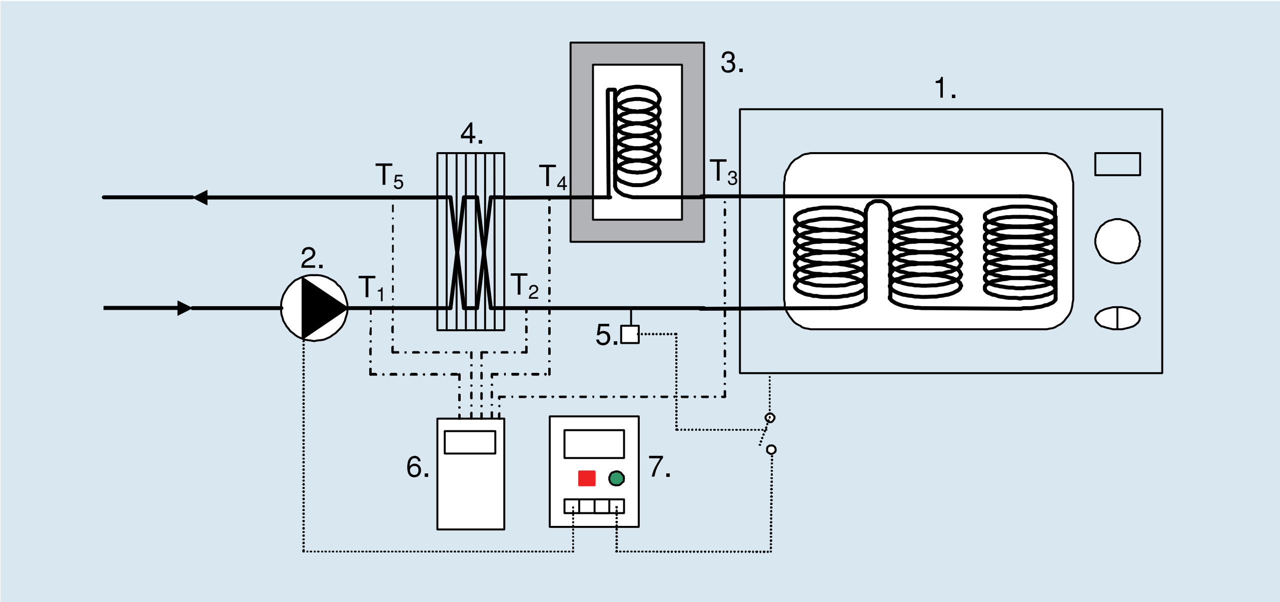


Figure 6: *Continuous operation pasteurizer of laboratory type*
1 – Whirpool AT 314 microwave oven with spiral accessories, 2 – STENNER 85M5 controllable flow rate pump, 3 – temperature maintenance section, 4 – Alfa-Laval CB14-14 heat recovery unit, 5 – flow sensor 6 – ALMEMO 2590-9 temperature sensor, 7 – ACTARIS SL7000 electric power meter

domestic microwave oven (Whirpool AT 314 MW) in order to provide an inlet and outlet for the liquid. The size and spacing of the holes were chosen to permit safe operation of the apparatus. A pump having a controllable flow rate (STENNER 85M5), as well as instruments for the measurement of weight (XP-3000), volume, time and temperature (ALMEMO 2590-9) were connected to the apparatus supplemented with the special glass spirals. The measuring circuit was also equipped with a plate heat exchanger (Alfa-Laval), a temperature maintenance section, as well as with a flow sensor and with an electric power meter (ACTARIS SL7000).

Based on *Figure 6* individual points of temperature measurement are as follows: T_1-initial material temperature T_2- temperature of preheated material T_3-product temperature on leaving the microwave oven T_4-product temperature after the temperature maintenance section and finally T_5-pre-cooled product temperature.

The arrangement illustrated in the figure permits the modification of the volume flow rate Q (cm^3/s) of the pump as well as the exchange of the glass spirals fit for inclusion in the microwave oven thereby permitting the choice of the length of the spirals l_{spiral} (cm). Both embodiments allow us to modify the time the liquid spends in the cavity resonator t_t (s) which has an influence the level of heating.

The effectiveness of the microwave heat treatments was checked by the analysis of **chemical composition** and by **microbiological** and **sensorial** tests. We carried out the Coliform

Figure 7: *Spiral coil placed in the microwave oven*

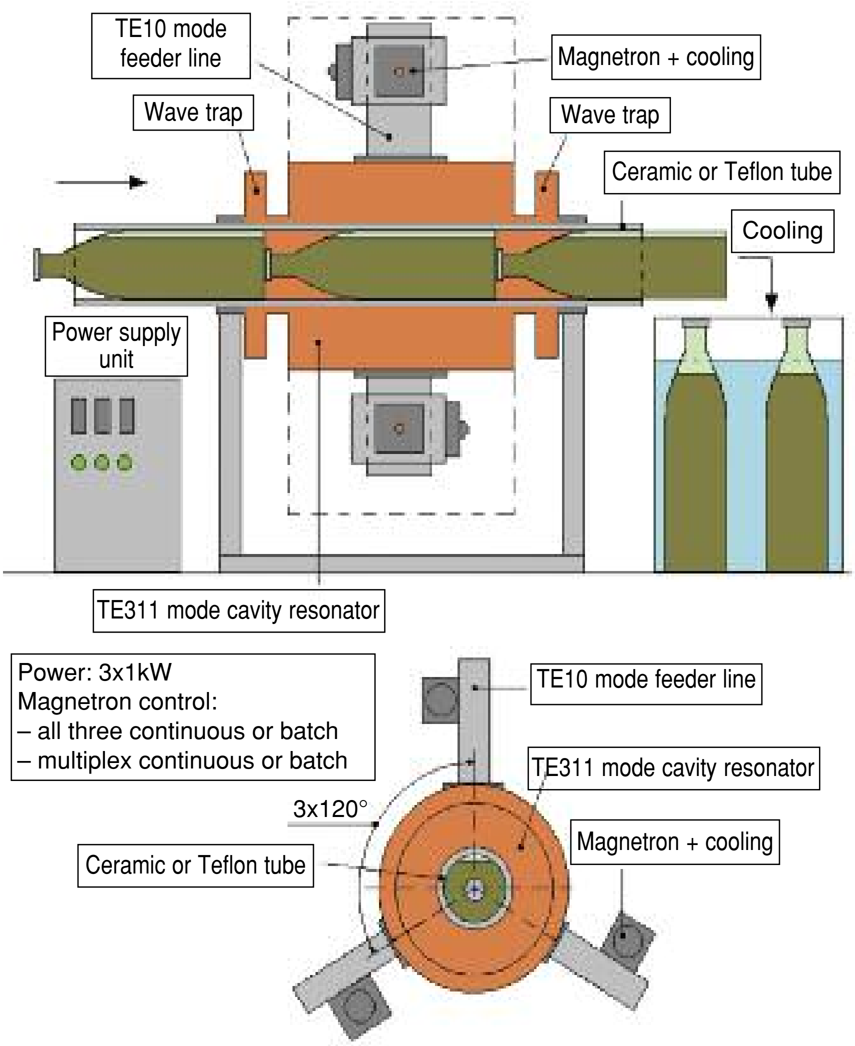


Figure 8:** Basic structure of continuous operation apparatus suitable for microwave heat treatment of **bottled beer

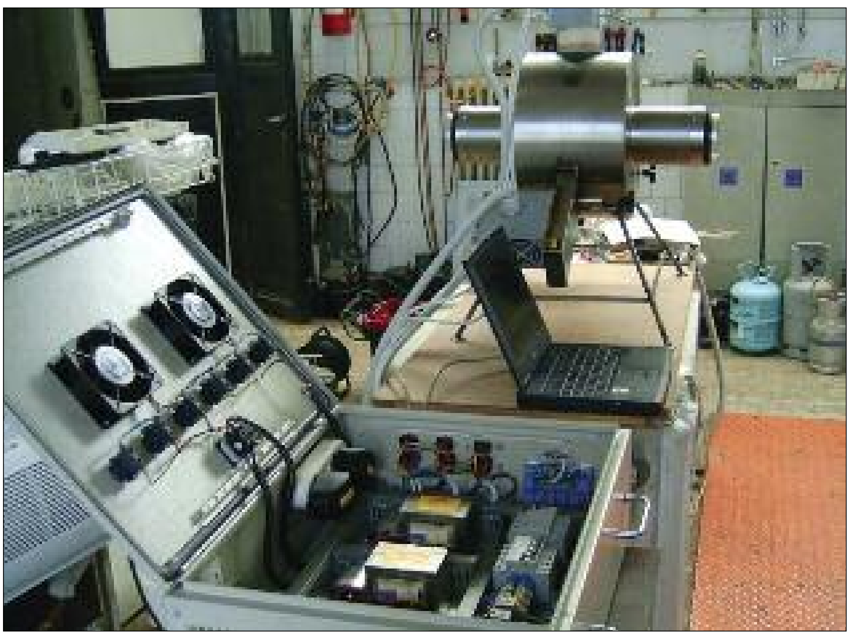


***Figure 9:** Continuous operation apparatus suitable for microwave heat treatment of bottled beer*

and Pseudomonas aeruginosa tests for the beer and also sent it for an alcohol content check. The effects of heat treatment on milk was checked thorough pH measurements, count of dead bacteria, phosphatase and peroxidase test and by the determination of milk fat, milk protein, lactose and non-fat milk solid content (SNF). Neither the sensorial analysis nor the analysis of chemical composition and microbiological quality revealed any difference between the products pasteurized by us and those subjected to traditional heat treatment. The tests were carried out by the Animal Health and Food Control Station (ÁÉEÁ) in Gödöllő.

As a result of the investigation it can be concluded that **the microwave heat treatment apparatus comprising spiral tubes is suitable for pasteurization**. After subsequent development its model could be competitive with the traditional methods, both in terms of quality and energy efficiency.

In the course of our research, we made an attempt to develop a continuous operation apparatus suitable for the microwave heat treatment of **bottled beer**. In the apparatus the beer bottle passes through a tubular wave guide the energy supply of which is ensured by three magnetrons spaced at 120 degrees apart. On the other hand, the background radiation of the model developed exceeds the threshold limit value of workplace environment therefore the present embodiment is unsuitable for testing. The basic structure of the apparatus is shown in Figure 8 and the apparatus already existing but under modification for safety reasons can be seen in *Figure 9*.

In the terminal stage of the research we started to investigate about the microwave pasteurization of egg juice. Results and implementation of further developments are under way.

József Popp[1]

The future of GM crops

Introduction

For science, biotechnology has already created opportunities and opened up prospects which ordinary people and consumers can barely comprehend. Since 1996, when the first genetically modified or GM soybean was harvested, biotechnology and its adaptations by the food industry have become one of the most controversial and most disputed topics.

The adoption of genetically modified (GM) crops is occurring at a rapid pace. The global area planted with GM crops in 1996 was approximately 1.7 million hectares. GM crop production has increased each year since 1996, with an estimated 114 million hectares of GM crops planted in 2007. The United States is the leading producer of GM crops accounting for 58 million hectares of the total GM crop area. Argentina is second, producing GM crops on about 19 million hectares. Brazil had an estimated 15 million hectares of GMO area in 2007 (*Table 1*). Virtually 100% of the world's GMO area is planted to varieties of maize, soybeans, canola or cotton which are either herbicide tolerant, or contain a Bt gene for insect resistance, or combine both of these events.

Table 1. *Global area of biotech crops by country (2006–2007)*

Country	2006	2007	Biotech crops
	Million hectares		
USA	54.6	57.7	Soybean, maize, cotton, canola, squash, papaya, alfalfa
Argentina	18.0	19.1	Soybean, maize, cotton
Brazil	11.5	15.0	Soybean, cotton
Canada	6.1	7.0	Canola, maize, soybean
India	3.8	6.2	Cotton
China	3.5	3.8	Cotton, tomato, poplar, papaya, sweet pepper
Paraguay	2.0	2.6	Soybean
South Africa	1.4	1.8	Maize, soybean, cotton

Source: ISAAA

In 2007, GM crops were cultivated on about 12 million farms in 23 countries all over the world. The main producers of GM crops are, with the exception of the United States and Canada, are all developing countries, i.e. Argentina, Brazil, India, China, Paraguay and South Africa. Over the next decade, the most significant investments can be expected in China where, as a consequence, almost half of the crop production could be GM.

In 2007, soybean had the largest area among GM crops with 58.6 million hectares (accounting for 51 % of global biotech area). It was followed by GM maize with 35.2 million hectares (31 % of global biotech area), then by GM cotton and rapeseed with 15.0 and 5.5 million hectares, respectively. In 2007, 73% of the US maize crop was GM, as was 70% of the Argentinean crop. In the case of soy, the proportion was 91% in the US, 98% in Argentina and 57% in Brazil (ISAAA 2008). The marketing of GM soybean, soybean oil and meal, maize, cotton and rapeseed has already been allowed in several countries all over the world. According to the experiences gained so far, due to the spreading of transgenic plants, a decrease in global herbicides and pesticides use and a rise in farm incomes can be noticed because of the improved productivity and efficiency of GM plants. The accumulative reduction in pesticides for the period 1996 to 2004 was

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estimated at 173,000 metric tons of active ingredient, which is equivalent to a 6% reduction in the associated environmental impact of pesticide use on these crops (Popp–Potori 2007). In 2007, the global value of the biotech crops was projected at approximately US$6.9 billion representing 16% of the global crop protection market, and 20% of the global commercial seed market.

GM feed use in the European Union

The EU is unable to satisfy its need for high protein feed by itself. Most of the protein feed is imported from North and South America where the exporting countries produce GM soybean, maize and rapeseed in large quantities In total, 56.5 million tons of protein-rich feedstuffs were used in the EU in the 2006/07 marketing year. Of this, soybean meal alone accounted for 34.6 million tons, or a good 61 %. Around 22 million tons of usage were imported directly as soybean meal, while approx. 12.6 million tons came from the processing of soybeans into soybean meal and soy oil in the EU.

The EU imports soybeans and soybean meal from the three large soybean producing countries. Of total imports in 2006/07 in the amount of 14.8 million tons of soybeans, 8.9 million tons came from Brazil (60%), 3.9 million tons from the USA (26%) and just under 200,000 tons from Argentina (a good 1%). The remaining 1.8 million tons were imported from other South American countries, Paraguay, Uruguay and Bolivia, as well as from Canada. Dominating soybean meal imports into the EU was Argentina. Of total imports of 22 million tons, 13.8 million tons (63%) came from Argentina and 7.9 million tons (36%) from Brazil. The USA supplied only just under 100,000 tons. The USA, Brazil and Argentina dominated soybean cultivation worldwide (*Table 2*).

Besides China and India, all the other main soybean and soybean meal producing and exporting countries have for the most part switched the cultivation of soybeans to the GMO varieties. Thus, GMO varieties had a share of 91 % of total soybean acreage in 2007 in the USA, while it was 98 % in Argentina and approx. 65 % in Brazil. In the other South American countries, GMO varieties are likely to have the same share or higher than in Brazil, while it is approx. 90 % in Canada (Toepfer International 2008).

This situation has an effect on the supply of „GM-free“ soybean meal. This refers to soybean meal that is not required to be labeled in the EU because it contains less than 0.9 % GMO. Brazil is the only supplier on the world market offering this and, besides Norway and Switzerland, the EU is the only one with any demand. According to the surveys and in-depth discussions with a number of market participants in the EU, around 3 million tons of soybean meal is currently being used that is not subject to required labeling (Toepfer International, 2008). Soybean meal not requiring labeling thus has a share of approx. 8.5% of total soybean meal consumption in the EU, so that this can still be referred to as a niche market. This soybean meal is used almost exclusively in the broiler sector. Demand is concentrated in France, the United Kingdom, Austria and Scandinavia. Furthermore, demand has been seen in Switzerland. While the sales contracts in Switzerland and to a large extent also in France limit the GMO content to a maximum of 0.1%, in the other countries mentioned above it is sufficient to furnish proof that the GMO content is below the labeling threshold of 0.9%.

Supplying the market with soybean meal not subject to labeling is associated with higher costs because the marketing chains have to be separated. In addition, having decided not to plant GMO soy, the farmers in Brazil have had the economic disadvantage of higher production costs. These costs have to be offset by premiums.

The premium, however, has increased sharply in the last few years as a result of the increasing plantings of GMO soybeans in Brazil. While the premium was under 5 USD/t in 2004, it was around 10 USD/t in 2005 and 2006. In 2007 the premium for soybean meal not requiring labeling rose to 60 to 80 USD/t. It can therefore be expected that demand for soybean meal not subject to labeling requirements will decline at least in several Member States of the EU since the premiums will not be paid by the market.

Consequences for the livestock sector

The EU livestock sector faces significant problems if the EU does not urgently review its policy of zero tolerance for imports of non-authorised genetically modified products. It topically takes twice as long to approve new biotech strains in the EU than in the US. This means that products which were being widely grown in North and South America were unavailable to EU importers because they had not completed the authorisation process in the EU, and because of the high costs of ensuring strict segregation of authorised and non-authorised strains.

***Table 2.** EU-27: Imports and consumption of soybeans, soybean meal and corn gluten feed*

			EU-27	
	2006/07	2005/06	2006/07	2005/06
			in%	
		Imports		
Soybeans	**14,860**	**14,087**	**100%**	**100%**
thereof USA	3,550	2,510	24%	18%
Argentina	270	76	2%	1%
Brasil	9,200	9,826	62%	70%
Soybeanmeal	**23,691**	**23,746**	**100%**	**100%**
thereof USA	98	72	0%	0%
Argentina	13,809	13,608	58%	57%
Brasil	7,922	8,567	33%	36%
Cornglutenfeed	**950**	**2,833**	**100%**	**100%**
thereof USA	905	2,804	95%	99%
		Domestic use		
Protein Feedingstuff	**56,480**	**56,973**	**100%**	**100%**
thereof Soybeanmeal	34,633	33,810	61%	59%
Rapemeal	9,280	8,592	16%	15%
Palmkern Expeller	2,890	2,916	5%	5%
Sunflowermeal	4,577	4,538	8%	8%
Cornglutenfeed	2,500	4,517	4%	8%
		Compound Feed Production		
Total	148 103	146 956	100%	100%
Cattle	40 071	39 418	27%	27%
Hog	50 321	49 440	34%	34%
Poultry	47 271	47 562	32%	32%
Others	10 441	10 535	7%	7%

Source: Eurostat, Oilword, ACTI

While the absence of corn gluten feed could be absorbed by rapeseed meal, palm kernel meal and grain (at a higher price, however), soybean meal can only be substituted to a very small extent by other protein feedstuffs. The availability of other protein sources on the world market is nowhere near enough to substitute to an appreciable extent for soybean meal. This is true for the animal protein feedstuffs, fishmeal and meat and bone meal, as well as for the alternative plant protein feedstuffs, such as feed peas, field beans, lupines and also rapeseed meal. Also from a nutritional perspective, soybean meal can be substituted only to a small extent because of the optimal composition of essential amino acids.

Moreover, it cannot be expected that other countries will be able to provide the substitute for the exports from the South American countries. First of all, the necessary climatic conditions for soybeans limit the number of countries where soybeans can be cultivated. Secondly, it can be assumed that because of the increasing competition between grain and oilseeds (especially soybeans) for acreage worldwide, soybean acreage will grow only relatively moderately. This makes it all the more important to achieve higher yields on existing acreage. This, too, makes it seem improbable that Brazil and Argentina will make allowances for the EU when it grants the approvals for the second generation of transgenic soybeans.

Without a sufficient volume of soybean meal, livestock production in the EU could suffer serious damage. If the current rate of authorizations of new GMO traits is maintained, especially with regard to soybeans and corn, and if the strict zero tolerance is adhered to for traits not yet authorized in the EU but already subjected to a risk assessment in the exporting countries and approved for planting there, then the livestock industry is in danger of losing an extensive part of its protein feed basis. Thus, the livestock industry would also quickly become less competitive. Consequently, an increasing share of animal products in demand in the EU will no longer be produced in the EU, only in other countries. Especially the production of poultry meat and pork will move to Brazil and Argentina, which would be detrimental to local farming and the entire livestock sector.

At the same time, the EU will have to rely to an ever greater extent on imports of animal products from these countries. The self-sufficiency rate in the EU for poultry meat and pork will decline. Without a doubt, the imported meat will have been produced using feedstuffs that contain GMO traits that will not yet have been approved in the EU. As a result of the growing dependence on imports and higher feed costs, the livestock production remaining in the EU will result in significantly higher consumer prices for meat in the EU (European Commission, 2007).

Conclusion and consequences

On the world market, a very strong competition for cereals has started between the bioethanol, food and feed industry. Traditional maize importers (e.g. Japan, Egypt and Mexico) are getting more and more anxious over the likely decrease of US maize exports because the shortage of feed grains may set back their livestock sectors. Furthermore, maize is not only a feed grain but also a primary source of food in some developing regions (e.g. in Africa or Mexico), thus the increase of world market prices can be felt by the people directly. In the coming years, the quest between the approximately 800 million car owners and the 2 billion poor of the world who fight for survival every day will become stronger. This may lead to unrests and political instability in low-income countries which are dependent on grain imports, and could obviously have a negative effect on global economic growth and food security. This economic and political constellation favours the further expansion of the area of GM crops.

In the next few years, a multitude of new GMO traits will be introduced into the market. With this in mind, a substantial role will be played by a doubling in the next 20 years in demand for food and feedstuffs and the rapidly increasing demand for agricultural raw materials used for the production of renewable energy, in particular biofuels. Agricultural production therefore has to be boosted in those areas already used for production. All available advances in productivity need to be used for this. This includes GM crops. More and more countries will plant genetically modified plants regardless of the length of time necessary for the approval process in the EU. The dependence of the agricultural and food industries in the EU on imported agricultural raw materials will also not become less.

The EU is therefore facing the choice of accepting a reduction in the production of food and thus importing more, especially meat, or acknowledging the develop .ment on the international markets and ensuring that the approval process for GMO is freed of politically motivated delays and is thus accelerated. This does not mean that the risk assessment will be any less stringent. It is far more the necessity to abide by the time periods stipulated in Regulation 1829/2003 so that the EU can catch up with international developments. No GM crops are produced in Hungary due to the introduction of a moratorium on the production of GMOs in 2005. The moratorium should be lifted as soon as possible, encouraging the uptake of GM maize in the light of increasing bioethanol production.

In addition, threshold levels are needed for those GMO traits that are in the midst of the authorization process but are already being cultivated in other producing and exporting countries. Of course, a prere .quisite for this would be that this GMO trait would have been subjected to a scientific risk assessment in the producing country exporting to the EU and would have been found to be safe. So it is vital that the EU rapidly implemented a code of practice being drawn by the Codex Alimentarius, which would set out rules for authorizing the low-level importation of GM products which had already been safety-assessed in another country.

Referencies

European Commission DG AGRI (2007): Economic Impacts of Genetically Modified Crops on the Agri-Food Sector. EC Directorate-General for Agriculture, Brussels

ISAAA (2008): International Service for the Acquisition of Agri-biotech Applications: www.isaaa.org

Popp, J. – Potori, N. [2007]: ‘A GM-növények (elsősorban kukorica) termesztésének és ipari felhasználásának közgazdasági kérdései Magyarországon’, Magyar Tudomány, 167. évf., 2007/4: 451– 461.

Toepfer International (2008): The Feedstuffs Market in the EU. Toepfer International, Hamburg

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Application of food quality methods in case bakery products

Quality is defined as the group of those product characteristics that satisfy explicit and implicit customer requirements. Food quality is an important food manufacturing requirement, because food *consumers* are susceptible to any form of contamination that may occur during the manufacturing process. Many consumers also rely on manufacturing and processing standards, particularly to know what ingredients are present, due to dietary, nutritional requirements *(kosher, vegetarian),* or medical conditions (e.g., *diabetes,* or *allergies*). For the safety of these manufacturing processes various quality safety systems have been developed. In the food industry two different aspects of product quality can be identified: on one hand, food safety and sanitary integrity, compulsory requirements for selling a food; on the other hand all those components, such as exterior aspect, functionality, nutritional characteristics, etc., that attract the customer (Scipioni et al., 2002).

According to the point 8.5. of the ISO 9001:2000 standard the failure mode analyses has effect on the right work of quantification systems (Dr. Nádasi Józsefné, 2005). In our study the failure mode and effect analyses (FMEA) were modelled in case of a medium size companies which use the HACCP appropriate for many years ago. In this work the FMEA method is to provide the quality and traceability of products, but it would be suitable for the controling of the practical usages of the voluntary quality systems as GAP, GHP, GLP; ISO-9001, ISO-22000.

A tool for failure prevention: The method of FMEA

A ***Failure mode and effects analysis*** (FMEA) is a *procedure* for analysis of potential failure modes within a system for the classification by severity or determination of the failures' effect upon production technology. It is widely used in the manufacturing industries in various phases of the product life cycle and is now increasingly finding use in the service industry as well. Failure causes are any errors or defects in process, design, or item especially ones that affect the customer, and can be potential or actual (Scipioni et al., 2005).

FMEA methodology was developed and implemented for the first time in 1949 by the United States Army. Later it was used for aerospace/rocket development to avoid errors in small sample sizes of costly rocket technology. An example of this is the Apollo Space program. The primary push came during the 1960s, while developing the means to put man on the moon and safely get him back. In the 1970s, thanks to its characteristics of strength and validity, its application field extended first to aerospace and automotive industry, then to general manufacturing (SVRP, 1997). Although initially developed by the military, the FMEA methodology is now extensively used in a variety of industries including semiconductor processing, food service, plastics, software, and healthcare.

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It is integrated into Advanced Product Quality planning (APQP) to provide primary risk mitigation tools and timing in the preventing strategy, in both design and process formats. Each potential cause must be considered for its effect on the product or process and, based on the risk, actions are determined and risks revisited after actions are complete (Bertolini et al., 2006).

The manufacturing process monitoring, standard for large corporations, is usually not implemented in the production cycle by small and medium size companies. It is interesting to observe how these difficulties have been solved through the adaptation of conceptual FMEA, as described in the reference manuals, in the analysed case. Applying an FMEA to a production cycle means following a series of successive steps: analysis of the process or product in every single part, list of identified potential failures, evaluation of their frequency, severity (in terms of effects of the failure to the process and to the surroundings) and detection technique, global evaluation of the problem and identification of the corrective actions and control plans that could eliminate or reduce the chance of the potential failures. This task cannot be achieved on an individual basis because FMEA is a team function (Neville, 1993).

The most important aspect of FMEA is the evaluation of the risk level of potential failures identified for every sub-system or component.

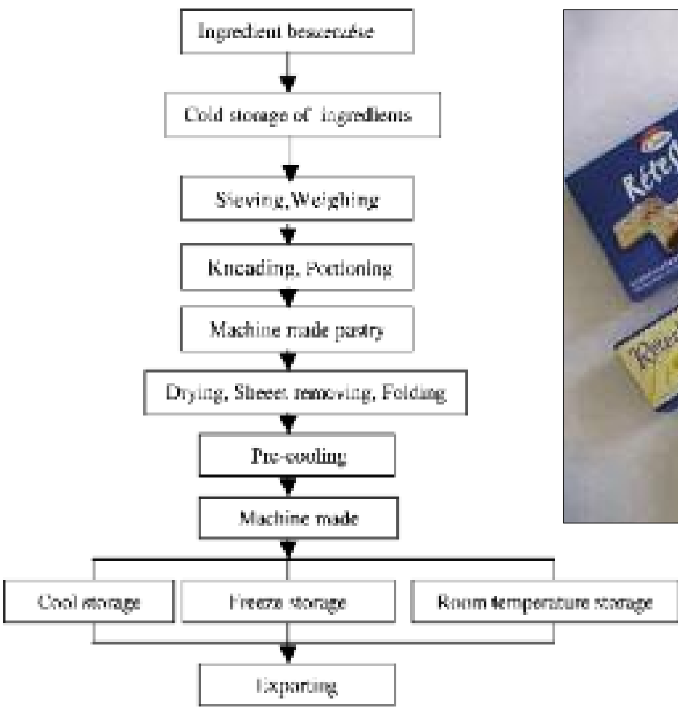
The global value of the damages caused on the function or on the surroundings by every failure is indicated with the risk priority number (RPN). This number (from 1 to 1000) is an index obtained from the multiplication of three risk parameters, which are:

- Severity of the worst potential resulting outcome due to the failure in terms of safety and system functionality (***Severity***). The severity number (S) is from 1 (no danger) to 10 (important).
- Relative probability that the failure will occur (***Occurrence***). A failure mode is given a **probability number** (O), again 1–10. Actions need to be determined if the occurrence is high (meaning >4 for non safety failure modes and >1 when the severity-number from step 1 is 9 or 10).
- Probability that the failure mode will be detected and/ or corrected by the applicable controls installed on the production lines (***Detection***). The detection number is 1, if the efficiency of quality control suitable and 10 if it is not correct.

There is no standard for the choice of scale ranking, but, generally, FMEA teams prefer a ranking of 1 to 10, because it provides ease of interpretation, and, at the same time, accuracy and precision (Stamatis, 1995).

After these 3 basic steps, Risk Priority Numbers (RPN) can be easily calculated by multiplying these 3 numbers: RPN = S x O x D

Once the actions have been implemented in the design/ process, the new RPN should be checked, to confirm the improvements. Whenever a design or a process changes, an FMEA should be updated.



FMEA in strudel production

FMEA was used by Hesi Kft., which is a leading producer of baked goods and sweets in Heves County. The company provides employment for 160 people achieved an annual sales-related income of 725 million HUF in 2004. The firm produces over 150 types of products including 45 kinds of breads and over 100 types of baked goods, pastries, ready-made biscuits, quick-frozen ready made dough and crumb-based goods.

The firm's most important product is fresh deep frozen pastry (strudel) dough primarily sold in Western Europe. In addition to Austria, Germany, and Switzerland, the firm's chief domestic clients include the TESCO, METRO, and Penny Market retail chains.

The most important phases of the strudel production technology are the follows.

By using the FMEA method the potential failure sources, causes and its possible results were determined, then for all of steps of the production technology the severity, occurrence and detection numbers were obtained and RPN numbers were calculated. After determining the RPN values an order of rank was specified, via potential failure factors.

After the determination of the RPN values by the Pareto method the most important parameters could be chosen.

1. The critical movements will be taking into consideration that must have been modified or neglected.
2. In case of risk parameters having risk parameters over 120, correction method should be elaborated.

It is very important part of the analyses that in practice the chief and the time-limit of these modifying procedures should be selected.

The effects of the new or/and corrected steps should be observed and after a process changes, an FMEA must have been updated, new RPN values should be determined.

According to this FMEA method the risk priority numbers were more than 120, which mean real failure in cases of these movements of the technology:

1. Polluted flour as ingredients;
2. Microbiological pollution under portioning, machine pastry making, sheet removing, folding and machine made packing. (This failures are originated from the aspergillus pollution of the flour which ingredients are present all the production technology.);
3. Pastry pollution during the drying technology by the damaged cook taps.
4. One of the most important parts of the quality control is to guarantee the quality of the food and its ingredients from the yield to the table. So the last failure point is not depending on the food industry, but on the exporting company, because the exporting and storage conditions are also very important.

In our study differences were observed between the failure points of the tried and tested HACCP and FMEA methods. It does not mean the imperfection of one or another but that the efficiency of the food quality methods are complements each other.

References

A. Scipioni, G. Saccarola, A. Centazzo, F. Arena (2002): FMEA methodology design, implementation and integration with HACCP system in a food company. Food control 13: (2002) 495–501.

A. Scipioni, G. Saccarola, F. Arena, S. Alberto, (2005): Strategies to assure the absence of GMO in food products application process in a confectionery firm. Food Control 16: (2005) 569–578.

M. Bertolini, M. Bevilacqua, R. Massini (2006): FMECA approach to product traceability in the food industry. Food Control 17: (2006) 137–145.

S. Neville (1993.): Failure analyses of mechanical components. Maintance technology magazine, September FMEA- a valószínűsíthető hibák és okainak feltárása. Magyar Minőség 12: (2004) 27–28.

Dr. Nádasi Józsefné (2005): Az FMEA mint helyesbítő és megelőzési módszer alkalmazása a zöldség-gyümölcs feldolgozásban. Rendszerek, Modellek, Módszerek 6: (2005) 327–330.

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Chromosome mediated gene transfer via classical hybridization techniques into wheat and detection of the alien chromosomes using up-to-date molecular cytogenetic and genetic methods

Introduction

The wild and cultivated species related to wheat represent a valuable gene source (reservoir) for breeding, as a large number of accessions have good resistance against various biotic (diseases, insects) and abiotic (drought, frost) stresses. A large proportion of the related species can be sexually crossed with wheat, so favourable traits can be transferred from the hybrids via traditional crossing. The transfer of the agronomically useful characters of barley, rye, and some *Aegilops* and *Agropyron* species into wheat via classical genetic methods is in progress at the Agricultural Research Institute of the Hungarian Academy of Sciences in Martonvásár. The most up-to-date molecular genetic and cytogenetic (*in situ* hybridization) methods are used for the detection of alien gene transfer and the analysis of the hybrids and their derivatives. It is planned to transfer salt and drought tolerance, earliness and favourable nutritional quality parameters from barley, disease resistance from rye and *Agropyron* species and drought tolerance from *Aegilops* species into wheat.

The alien chromosomes in the hybrids and their derivatives are identified using *in situ* hybridization.Genomic *in situ* hybridization (GISH) is an excellent technique for distinguishing between chromosomes of different origin in the hybrids and their derivatives. GISH allows the detection of the translocation breakpoints in rearrangements arising between chromosomes of different genomic origin. The identification of alien chromosomes is based on the hybridization pattern achieved using fluorescence *in situ* hybridization with the help of repetitive DNA probes. Cytogenetic identification is confirmed with the help of molecular markers mapped on various chromosomes.

Wheat × barley hybridization

The first wheat-barley hybrid was produced by Kruse in Denmark in 1973. Some years later a set of wheat/barley addition lines was developed in Australia from a cross between a genetic model spring wheat cultivar and a spring barley cultivar. Due to the great incompatibility between the two genera, it has proved difficult to include agronomically adaptable barley cultivars in the hybridization process in order to promote the transfer of useful genes. The work underway in Martonvásár is thus aimed at producing new winter wheat × winter barley hybrids using barley cultivars possessing good agronomical traits.

New winter wheat × winter barley hybrids were produced using the embryo rescue technique after treating pollinated flowers with hormones under controlled environmental conditions. More than 10 000 flowers were pollinated over several years, as a result of which three wheat × barley hybrid plants were developed (Molnár–Láng et al.. 2000a). Fertilization was achieved with three of the sixteen barley cultivars tested (Igri, Manas, Osnova), all three of which are cultivated winter genptypes. Igri is a German two-rowed winter barley cultivar, while Manas and Osnova are Ukrainan six-rowed winter barley cultivars well adapted to Hungarian environmental conditions. In two combinations the maternal parent was the Martonvásári 9 kr1 line developed from the wheat cultivar Martonvásári 9 and containing the *kr1* crossability gene transferred from a Chinese wheat variety. Hungarian wheat, like the majority of European cultivars, has very low crossability with alien species, making it very difficult to hybridize them with related species. A Mv9 kr1 genotype has good crossability

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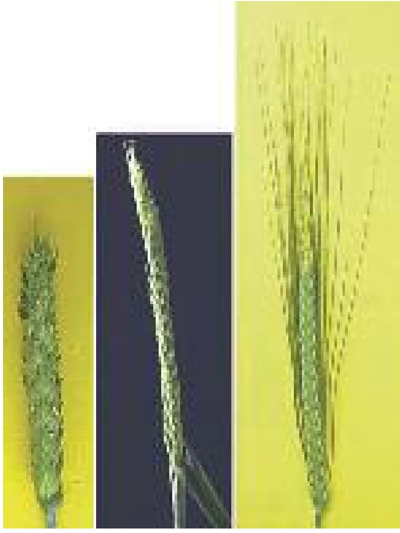

Figure 1. *From left to right, spikes of wheat (Mv9 kr1), the wheat × barley hybrid (Mv9 kr1 × Igri) and barley (Igri)*

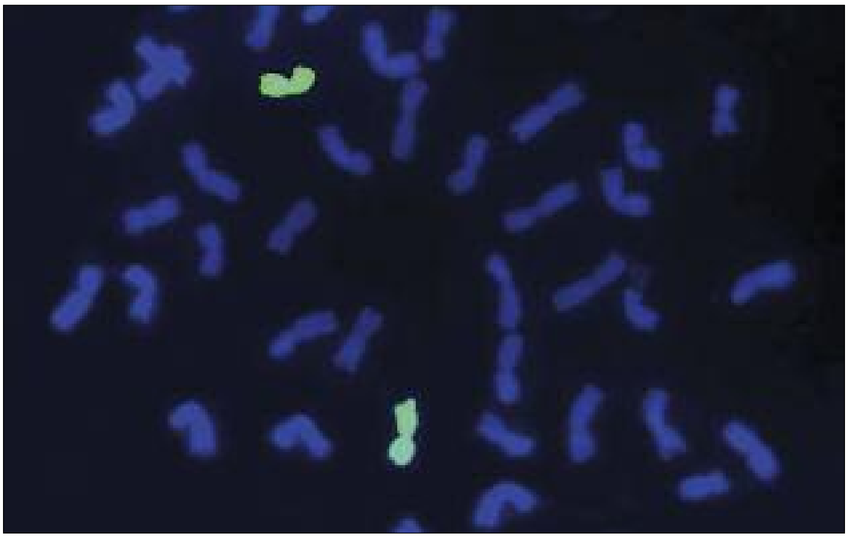

Figure 2. *Detection of barley chromosomes in a wheat/barley disomic addition line (Asakaze komugi/Manas 7H addition) using GISH. Total barley DNA was labelled with Fluorogreen and thus barley chromosomes show up bright yellowish-green. The wheat chromosomes are blue as a result of counterstaining with DAPI.*

with related species (rye, Aegilops, Agropyron, barley) and is well adapted to Hungarian environmental conditions, so it is a good recipient for interspecific hybridization aimed at alien gene transfer.

The hybrids (Mv9 kr1 × Igri, Asakaze komugi × Manas, Mv9 kr1 × Osnova) were vigorous and had good tillering ability. The spikes were intermediate between wheat and barley, but bore more resemblance to wheat *(Figure 1)*. The hybrids exhibited complete male and female sterility, giving no seed set at all when pollinated with wheat, so they were multiplied from young inflorescences in tissue culture. Hundreds of regenerants were developed from the two initial hybrid plants for two combinations (Mv9 kr1 × Igri, Asakaze komugi × Manas). The large number of regenerant hybrid plants enabled us to pollinate several thousand flowers with wheat, resulting in 7 backcross progeny (BC_1 plants – the first generation after backcrossing with wheat). Out of the 41 BC_2 plants developed after the second backcross with wheat, 25 plants were fertile, making it possible to select lines containing various barley chromosomes.

Wheat/barley addition lines

Disomic addition lines containing the 2H, 3H, 4H, 7H and 1HS barley chromosomes were produced from the Mv9 kr1 × Igri combination (Szakács and Molnár–Láng, 2007). Detection of the barley chromosome pair in the wheat genome was carried out using GISH *(Figure 2)*. The barley chromosomes were identified with FISH using a combination of DNA probes (GAA, HvT01 and pTa71). The morphology of lines containing the various barley chromosomes was analysed and the seeds were multiplied. The effect of different barley chromosomes on drought and salt tolerance is being studied with the help of an international grant. It is also planned to study other important agronomical traits (earliness, quality). Wheat/barley disomic addition lines were also produced from a hybrid developed using the six-rowed barley cultivar, Manas (Molnár–Láng et al. 2005). The 4H, 6H and 7H Asakaze komugi/Manas disomic addition lines have been produced so far and the selection of 2H and 3H disomic additions is in progress from monosomic addition lines carrying only one alien chromosome in addition to the wheat genome. The identification of the chromosomes in the progenies was carried out with a combination of molecular markers and fluorescence *in situ* hybridization (GISH, FISH).

Wheat/barley translocation and substitution lines

The multiplication of the hybrids was carried out in tissue culture, a result of which intergenomic rearrangements between the wheat and barley chromosomes were observed in some progeny. The detection of wheat/barley translocations was carried out using GISH *(Figure 3)* and plants containing homozygous translocations were selected from selfed seeds in the next generation (Molnár–Láng et al., 2000b). Wheat chromosome segments in the translocated

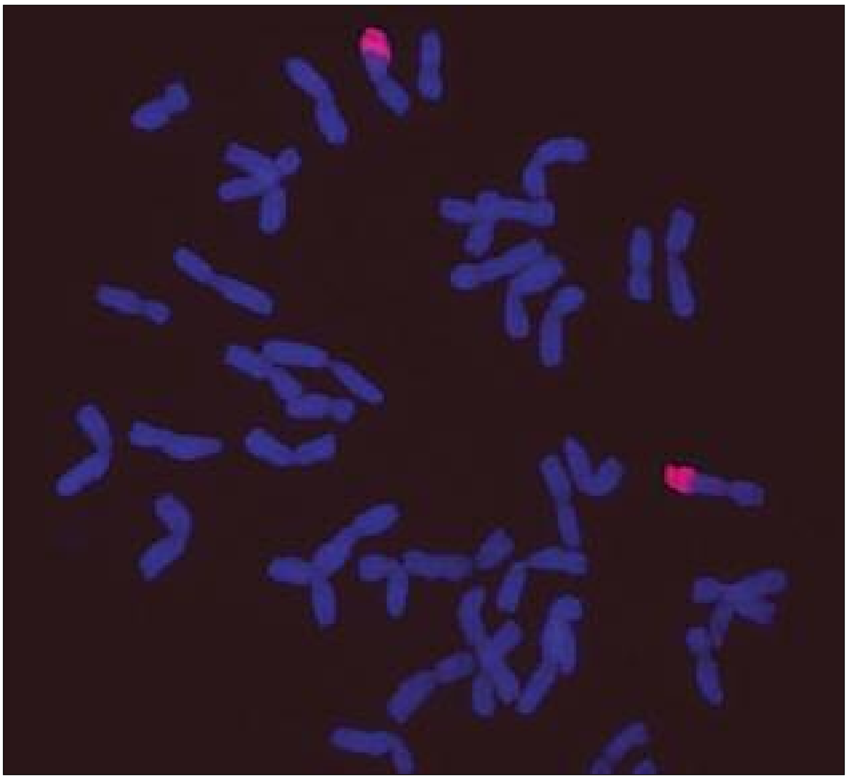

Figure 3. The somatic chromosomes of a wheat/barley translocation line after GISH. The barley chromosome segments are bright red as a result of labelling with Fluorored, and wheat chromosomes are blue as a result of counterstaining with DAPI. A distal segment of barley (Igri) chromosome 5HS can be seen to be incorporated into the 7D chromosome of wheat (Mv9 kr1).

chromosomes were identified using FISH with the help of repetitive DNA probes (pSc119.2, pAs1), while the barley chromosome segments were determined with the help of molecular markers *(Figure 4)*. The following wheat/barley translocation lines were produced: 2DL.2DS-1HS, 3BL.3HS, 6BS.6BL-4HL, 4D-5HS, 7DL.7DS-5HS, where H designates the barley chromosomes, A, B and D the wheat chromosomes, S the short arm and L the long arm. In other words, 3BL.3HS means that the translocated chromosome was developed from a fusion between the long arm of wheat chromosome 3B and the short arm of barley chromosome 3H. Lines carrying different wheat/barley translocations were multiplied in the nursery and the effect of the incorporated barley chromosome segments on various agronomical traits in now being studied in the field *(Figure 5)*. Wheat/barley translocation lines can also be used for the physical mapping of the chromosomes (D.Nagy et al., 2002). Molecular markers genetically mapped close to the centromere on chromosome 5HS were found to be physically located in a distal position on the chromosome arm, towards the telomere. This confirmed the difference between genetic and physical chromosome map. The development of new wheat/barley translocation lines is in progress, which will further help the more precise physical mapping of wheat and barley chromosomes.

One substitution line was also selected from the progenies of the wheat × barley hybrids, in which wheat chromosome 4D is replaced by barley chromosome 4H. The morphological parameters of this substitution line were analysed in detail. It was concluded that the tillering ability, parameters connected to drought tolerance (WUE, CO_2 assimilation rate) and the amylose content exceeded those of the wheat parent (Molnár et al., 2007). Future work will focus on analysing the agronomical traits of the available wheat/barley addition and translocation lines to determine how the introgression of barley chromosome segments into the wheat genome influences earliness, nutritional quality and drought tolerance. This work is expected to clarify which barley chromosomes carry genes responsible for drought tolerance, earliness and various quality parameters. It should be possible to select genotypes with drought and salt tolerance, early heading and good nutritional quality parameters.

Production of wheat × rye and wheat × Aegilops hybrids, additions and recombinants

In further experiments it is hoped to transfer the disease resistance of rye and the drought tolerance of a goatgrass species (*Aegilops biuncialis*) into wheat. Wheat lines carrying new wheat-rye recombinant chromosomes were produced using rye genotypes with good leaf rust resistance. Hybrids, amphidiploids, addition and translocation lines were produced from the wheat × *Aegilops biuncialis* crosses. The disease resistance and drought tolerance of genetic materials developed are studied in the field. A wheat line containing a chromosome segment from the old Hungarian rye cultivar Lovászpatonai is promising, judging from the results of field experiments

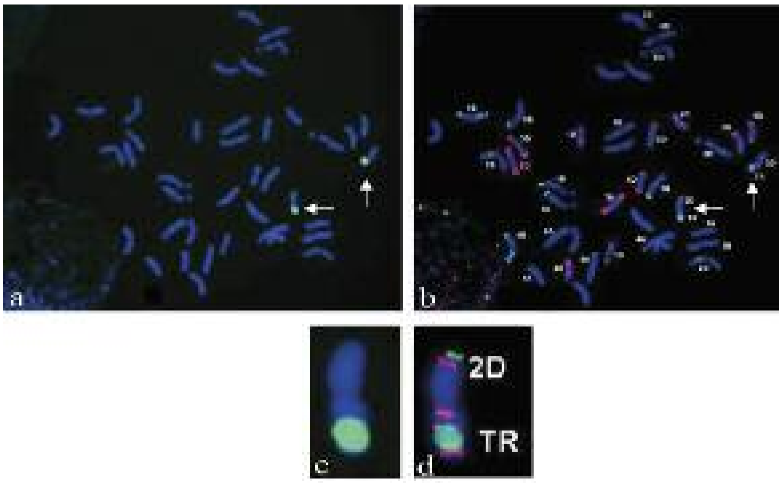

Figure 4. *Identification of a wheat/barley translocation using sequential GISH and FISH with the help of repetitive DNA probes (pSc119.2, pAs1).*
a) Detection of wheat/barley translocation using GISH. Total genomic barley DNA was labelled with Fluorogreen, so the barley chromosome segment is yellowish green. The unlabelled wheat chromosomes are blue.
b) Identification of wheat chromosomes using FISH with the help of repetitive DNA probes, pSc119.2 was labelled with Fluorogreen and pAs1 with Fluorored.
c) The wheat/barley translocated chromosome after GISH.
d) The translocated chromosome can be identified as the wheat 2D chromosome on the basis of the FISH signals given by the two repetitive DNA probes

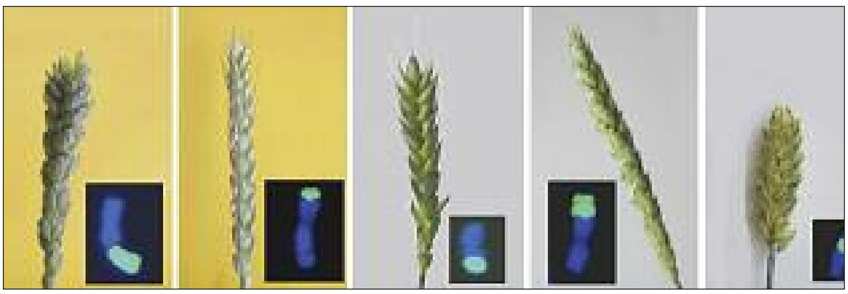

Figure 5. *Spikes of various wheat/barley translocation lines.*
he translocated chromosomes can be seen in the right corner of each picture after GISH. The barley chromosome segments are yellowish-green and the wheat chromosome segments blue

References

D. Nagy, E., Molnár–Láng, M., Linc, G., Láng, L. (2002): Identification of wheat-barley translocations by sequential GISH and two-colour FISH in combination with the use of genetically mapped barley SSR markers. Genome, 45: 1238–1247.

Molnár–Láng, M., Linc, G., Logojan, A., Sutka, J. (2000a): Production and meiotic pairing behaviour of new hybrids of winter wheat (*Triticum aestivum*) × winter barley (*Hordeum vulgare*). Genome, 43: 1045–1054.

Molnár–Láng, M., Linc, G., Friebe, B. R., Sutka, J. (2000b): Detection of wheat-barley translocations by genomic *in situ* hybridization in derivatives of hybrids multiplied *in vitro*. Euphytica, 112: 117–123.

Molnár–Láng, M., Novotny, C., Linc, G., D. Nagy, E. (2005): Changes in the meiotic pairing behaviour of a winter wheat-winter barley hybrid maintained for a long term in tissue culture, and tracing the barley chromatin in the progenies using GISH and SSR markers. Plant Breeding, 124: 247–252.

Molnár, I., Linc, G., Dulai, S., D. Nagy, E., Molnár–Láng, M. (2007): Ability of chromosome 4H to compensate for 4D in response to drought stress in a newly developed and identified wheat-barley 4H(4D) disomic substitution line. Plant Breeding, 126: 369–374.

Szakács, É., Molnár–Láng, M. (2007): Development and molecular cytogenetic identification of new winter wheat/winter barley (Martonvásári 9 kr1/Igri) disomic addition lines. Genome, 50: 43–50.

József Stefler, Sándor Makray[1]

Grassland utilization by draft horse

Farming on grassland has been going on since the Hungarians settled in the Carpathian Basin.

The role of grass as a natural source of energy has changed over the course history; it has decreased. Recently 11% of the country and 18% of the agricultural land was covered by grass. This means altogether 1015 million ha grassland. The vast majority of this is poor-medium quality, which is suitable for extensive way of grazing. (Vinczeffy, 1993). Beyond this, our expectation is that grasslands contribute to erosion protection, conservation of water supply, preservation of biodiversity and develop an attractive landscape, which serves the life quality (Nagy et al. 2003).

Grasslands can achieve the mentioned goals only in the case of rational utilization. On non-utilized areas deterioration will start. The risk level of this is extremely high, because the number of ruminants has decreased to approximately half in the last 15 years. To counter balance this spread of new, non traditional species (domesticated wild animals, horse) may arise (Horn, 2000).

Breeding and keeping meat horses on pasture is motivated mostly by the demand of good quality slaughter horses (France, Italy, Belgium) and to widen the range of the so called Hungaricum. The special traits of horses, like good weight gain, excellent grazing ability (Ócsag, 19992; Bodó and Hecker, 1992; Mihók, 1993; Dér et al. 1992, Makray et al. 1993) provide a reliable base to develop a technology process. According to these argues a several years lasting series of experiments were carried out on the Experimental Farm of the Kaposvár University, to determine the ability of meat production of draft horses among grazing conditions to get experiences to an effective production process, which can work also among farm conditions.

Material and methods

Environment

For this lengthy experiment a grassland of 41 ha was designate, using a New Zealand type fence on the experimental farm. This field has represented well the Hungarian grasslands, yield was 3.1–3.5 t/ha dry matter or 3.4–3.8 t/ha hay annually. Although change in yield was not important during the long lasting experiment (table1.)but dry periods occurred often in July and August. On average the experimental stock had 40 mares . They were kept in two harem groups during the mating season from between May 15 and June 15. the grazing season lasted from the end of April to the middle of October or November, depending on weather conditions. The average number of the days spent on pasture was 216 days. Calculated area for 1 mare and her foal was 1.1 ha. Controlled grazing was carried out. Change of paddock happened every 2–3 weeks, depending on the condi-

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tion of grass. To ensure continuous and safe water supply automatic drinkers were employed. During the grazing period the basis of the forage supply was the pasture, additional feed was given only in dry periods in July–August. This time animals may consume ad. lib forage straw and 2–3 kg hay. At the end of the grazing period foals were weaned. For mares an open shed like building was available. During winter daily feeding consisted of 2–4 kg oats (and corn), 5–10 kg corn silage and 5–8 kg grass hay.

Data collection

Data collection was carried out to ensure the precise recording of reproduction traits and live weight changes of mares, weight gain and slaughter value of foals, considering that farm conditions have limited.

Reproductive and live weight data are originated from the whole population, while slaughter data could be collected only from a sample test (n=47).

Recorded data:

– Time of foaling, foaling ease, abortion, foal loss

Table 1. Grass yield of the pastures (t/ha) during the experiment

Yield/Year	1991	1992	1993	1994	1995	1996	1997	1998	Average
Hay	3.4	3.5	3.6	3.6	3.7	3.8	3.4	3.5	**3.6**
Dry matter	3.1	3.2	3.2	3.2	3.3	3.4	3.1	3.2	**3.2**

– Weight of mares at start and at the end of the grazing period
– Weight of foals at birth and weaning
– Fattened foals:
    initial and final weight
    dressing percentage
    carcass weight
    dry matter, protein,
    N-free extract content
    mineral elements
    fatty acid content

Primary data procession was made using the Microsoft Excel for Windows 95, Version 8.0 program package, evaluation of results happened by SPSS for Windows Version 8.0 software. Recurrent

Data (reproduction of mares) were evaluated via Chi^2 test. To detect trait effects t-test, ANOVA and MANOVA were used. To compare averages Student-Keuls test was employed.

Results

Since in meat horse production-similar to beef cattle- the only yield is weaned offspring, good reproduction of the population is essential. Mares were mated in harems. As *Figure 1* shows there were considerable differences in the major parameters year by year. Conception rate was 75.1% in average. Best results were close to 90%, but an inexperienced stallion or other disadvantageous may cause really poor conception. Losses composed by abortion, dead foaling and death of foals. Reason of abortion was mostly because of feeding failures and not efficient prevention. Lack of exercise and overfeeding caused too fat mares and big foals, which appeared in dead foaling. Death of foals occurred mostly because of poor vitality. Ratio of weaned foals was above 60%, but in best

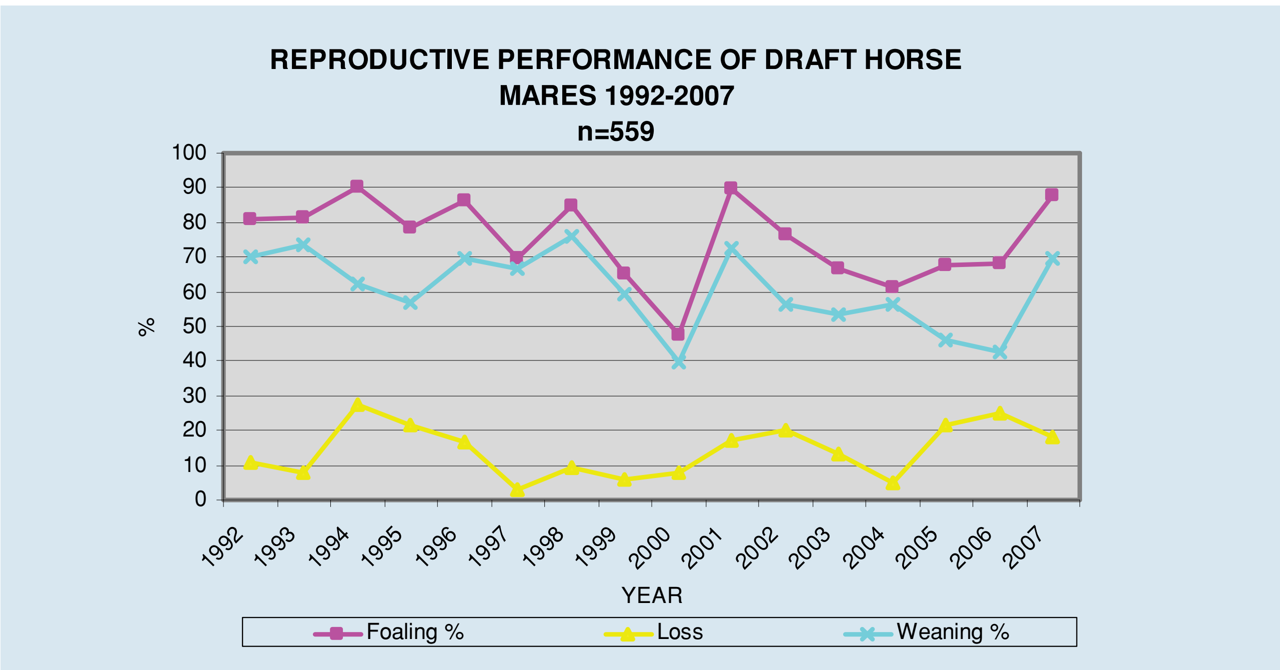

Table 2. Weaning weight of foals

Denomination	1992	1993	1994	1995	1996	1997	1998	x̄
n	22	26	25	16	21	18	29	**24**
Age at weaning (day)	152[b]	196[d]	203[d]	172[c]	207[d]	175[c]	109[a]	**171**
Weaning weight (kg)	261.6[b]	319.9[cd]	330.2[d]	298.9[c]	297.2[c]	265.2[b]	225.8[a]	**284.5**
Weaning weight adjusted for 185 days (kg)	289.9[ab]	310.4[b]	3152[b]	310.2[b]	278.6[a]	273.8[a]	291.2[ab]	**296.3**
Weaning weight/age (g/day)	1760[c]	1664[abc]	1642[abc]	1753[c]	1445[a]	1521[ab]	2092[d]	**1711**
Gain (g/day)	1330[b]	1332[b]	1321[b]	1372[b]	1139[a]	1156[a]	1496[b]	**1318**

Different letters mean a significant difference (P < 0,05)

years more than 70% of mated mares produced marketable offspring.

In *Table 2*. gain of foals can be seen till weaning. No concentrate was fed when mothers and their young were together on pasture.

Rearing ability data of mares is shown in *Table 2*. As it can be seen draft horse foals had remarkable gain during the suckling period on pasture at minimal additional (only hay and straw) feeding. Their daily gain exceeds 1300 g in average.

Table 3. Slaughter value of draft horse foals n=47

Nomination	Average
Age at weaning (day)	**200.7**
Slaughter weight (kg)	**316.3**
Carcass (kg)	**170.2**
Dressing %	**54.4**

Calculations prove, that adjusting weaning weight for 185 days is much more appropriate in case of foals, than adopt to 205 days, which is accepted at beef calves. This statement is based not only by gain of foals but during the pregnancy of mares at seasonal mating. Moreover foals have been weaned at age of 185 days without any problem.

Age of foals at slaughter was 200 days at 316 kg weight in average. Dressing percentage was almost 55%. This parameter is close to that of medium quality beef cattle and indicates the specific traits of draft horses. Moreover hay was available till the last moment before the slaughter.

Conclusions

Draft horses, similar to beef cattle can be kept effectively in extensive management system (groups, harem-like mating, controlled grazing, spring foaling-autumn weaning).

Good milk production of mares resulted in high growing rate at foals, which cases excellent rearing ability. Consequently foals are weaned by approx. 300 kg live weight at the end of the grazing period. There is significant variation in reproductive parameters by years and further improvement is needed. First of all well-planned nutrition and better management at foaling are the main tools to achieve this goal.

Weaned foals produce excellent slaughter value after a short fattening period and can be sold well by appropriate marketing strategy.

Meat horse is a promising alternative in utilization of extensive pastures.

Erik Tarczal, Zoltán Varga, László Kocsis[1]

Grapevine Rootstock Use: Physiological and Cultivation Technology

History of Use of Grapevine Rootstock

There is reliable information on grapevine grafting from times long before the appearance of phylloxera, the grape root louse (*Daktulosphaira vitifoliae* FITCH). at that time both graft partners belonged to a form of *Vitis vinifera L.* On the other hand, grapevine grafting and its propagation by grafts became common only in the battle against phylloxera on heavy soils. Since then for the purpose of rootstock we use phylloxera resistant (wild) varieties of American origin (*Vitis riparia*, *Vitis rupestris*, *Vitis berlandieri*) and their hybrids. As a consequence, the search for grapevine rootstock varieties began for the European vine-growers starting in 1872, the appearance of phylloxera in Europe. It took a long time before the technology of graft production was elaborated and began to be practiced widely. The breeding and the utilization of the rootstock varieties were even slower as the principal method of breeding was selection. In the beginning, besides the French, Hungarians and Austrians took an active part in this fundamental work. Based on an intensive research work, it was the biological and cultivation values of the North-American *Vitis* species that were discovered in the first place.

Phylloxera invaded Hungary in 1875 causing significant harm within twenty years in the wine regions with heavy soils. The enormous job of vineyard replanting was headed by Zsigmond Teleky the vine-grower from the region of Villány who did great services. Zsigmond Teleky set up an experimental rootstock vineyard in 1881 in Villány in order to produce a grapevine rootstock that could be grown with the greatest success in all types of soil. The Berlandieri x Ripária Teleki rootstock varieties bred by him and bearing his name permitted the renewal of calcareous hillsides with poor, thin soil which were the most difficult to replant but giving the best wines and besides they thrive better in our best soils giving grafts with a more uniform callus formation that are this way more vigorous than the stock varieties known so far *(Figure 1)*. Zsigmond Teleky ordered 10 kg of Berlandieri seeds from France in 1896 from which he raised 40,000 seedlings. Through carrying out selection over three years he separated 10 types from the 40,000 seedlings, which he considered worth propagating. He judged the types 5 and 8 to be the best and in fact it was the rootstock varieties of his Berlandieri x Ripária cross that became popular all over the world.

Figure 1.

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Figure 2.

In the course of continued research efforts it was discovered that *Vitis riparia* prefers the deep alluvial soils of the temperate climate zone, having a profusely branching root system sensitive to soil lime levels, is characterized by an early bud break and ripening.

Vitis rupestris originates from the southern part of North-America, from the temperate climate zone. It sends its roots deep down into the soil, develops few and fleshy thick roots and is able to support even the sandy and rocky soils, is relatively drought tolerant and shows an excellent tolerance.

Vitis berlandieri originates from the hot, dry western region of North-America. It is tolerant to lime and to soil characteristics, but roots poorly. Possibly, it was to improve this latter characteristic that it was crossed with *V. riparia*. Also this rootstock is resistant to phylloxera and has good cold tolerance.

By now it is commonly known that the rootstock varieties also play an important role in creating the delicate harmony between grape yield and quality as they influence the productivity of grafted grapevines through their differing morphological and physiological properties.

In viticulture the targeted study of cultivation with grafted plants started only with the application of the American rootstocks, first in France. Damage by phylloxera was successfully prevented with grafted grapevines, at the same time, the European grapevine variety maintains its character even after grafting and this character will not change either in the case of the table or the dried or the wine grape. There is no difference in the taste or chemical composition of the wine from grafted and ungrafted vines. It was the same time when the difference in the behaviour of the different rootstocks towards the scion and towards the ecological effects was noted, which on the one hand determined the necessity and objectives of rootstock breeding and, on the other, the investigation into the issues of rootstock (scion) ecological effects and interactions. Relative to this, two concepts became common in viticulture: 'affinity' (Coudrec 1887) and 'adaptation'.

The choice of the rootstock has been the central issue in viticulture since the phylloxera plague. The immunity to phylloxera is a fundamental precondition and the grapevine scion cultivar must be compatible with the rootstock in a lasting manner for the whole life span of the plantation. Further requirements are: the rootstock should have good tolerance to the soil and that as high a percentage of usable grafts should be obtained as possible and that strong, long-living, high yielding and high-quality producing grapevine plants should be obtained from the grafts.

The possibility of grafting is permitted by the stable existence of compatibility between rootstock and scion, i.e. there is a certain level of physiological and histological kinship or similitude.

Figure 3.

This determines the callus formation and rooting ability of the rootstock and the callus formation ability of the scion and is primarily dependent on the quality of the cane used. The symbiotic ability of the rootstock and the scion variety is an important factor which is based on the mutual interaction between rootstock and scion. In the course of grafting an artificial symbiosis is created between the rootstock and scion in which the rootstock supplies the minerals absorbed from the soil and the scion the assimilates produced by the leaves. Both partners receive materials from the other which are to a certain extent alien to them, leading to a certain level of change in their living processes. In the case of grafted plants a further hindering factor is that the formation of callus makes somewhat more difficult the transport of materials between the rootstock and scion.

The failures reported more frequently in the older literature were often ascribed to affinity. Nowadays, however, it is already evident that the mutual influence between rootstock and scion can only be understood with methodological experiments set up under identical ecological and agro-technical conditions. As the expression of the symbiotic affinity is greatly influenced by the adaptation and the data obtained are valid only for the given soil class. Nowadays experiments in this direction are being carried out in all major grape producing countries.

In the case of all the plants where grafts are used in cultivation, the research of rootstock characteristics is continuous, as well as the breeding of rootstock. This applies to the grapevine too, though compared to the cultivated grapevine *Vitis vinifera* much lower expenditures are spent on rootstock qualification and breeding. Based on a very high number of observations and scientific works, CURRLE-BAUER et al. (1983) qualified rootstock according to 4 important characteristics, namely affinity or compatibility, growth vigour, lime tolerance and drought tolerance.

Naturally, the relative quality score permitting the ranking of rootstock varieties is unsuitable for describing the absolute value of the variety, since in this qualification relies on only 4 characteristics. Variety characteristics on the other hand cannot be limited to 4 aspects, further ones could be listed, the knowledge of which could reflect the value of the rootstock variety in an ever better and more realistic manner. These quality indicating characteristics are generally suggested by life and special trials should be organised in order to estimate their values. For instance, the experiments of BAVARESCO et al. (1991) were aimed at finding out about the nature and essence of the differing chlorosis sensitivity of the individual grapevine varieties.

In the experiment bud cuttings of 3 rootstock varieties and the very sensitive 'Pinot blanc' were induced to root. According to the results of the experiment, the iron uptake by the roots, the reduction of EDTA (iron complex) and the capacity of the reaction showed close correlation with root diameter and root hair number. It is somewhat surprising, but is a significant result, widening our knowledge in this field.

The variety specific function of the root system, namely the uptake and accumulation of a nutrient or another, can determine at least significantly and can unfortunately modify, according to the characteristic of the variety, the composition of the main product, i.e. of the must in our case. The demonstration of this hypothesis might play an enormous role relative to the quality of the grape.

In the case of grafts, however, the scion also plays an active part in concentrating the elements in the must, as the varieties 'Hárslevelű' and 'Furmint' on the same rootstock concentrates certain elements to different extents (POLYÁK et al. 1992).

According to the researchers, as far as the uptake of the essential nutrients is considered, there is little difference between the rootstock, and both the rootstock and the scion have a great role in the accumulation of partly toxic materials in the must.

Certain researchers accord to conclude that the rootstock has an influence chiefly on the growth vigour of the grafted grapevine and on yield quantities and has less effect on must quality parameters, sugar content and titrable acid content. Changes in yield quantities can be attributed to changes in cluster number per plant or in average cluster weight and the role of the factors can change almost from graft combination to graft combination. Decisive differences between the rootstock varieties were measured in the shoot growth and leaf area of the scion which manifested themselves in the intensity of the assimilation and eventually in the must sugar levels.

Utility of Rootstock Experiments

Certain school books and manuals publish those general findings according to which, for example, the varieties grafted on *Riparia portalis,* an early ripener quality rootstock or on *Rupestris* and on *Rupestris* hybrids require a longer pruning. On the other hand, the rootstock suitable for a given growing area cannot be chosen on the basis of general findings.

The importance of the rootstock experiments is underlined in the lecture notes of CSEPREGI published in 1951 which highlight the particularities of the setting up of rootstock experiments.

The study of the nature of grafted plants is interesting from a scientific viewpoint and useful from the viewpoint of the economy. Increasing economic importance is also suggested by the great number of experimental works. Certain researchers studied the effect of the rootstock on the yield potential and condition of the scion in the first place and to a lesser extent on its physiological reaction. Nowadays, the primary objective of graft experiments consists not in the protection from phylloxera, but in the improvement of yield potential and yield quality, as well as in the enhancement of the conditions of the grapevine plants and life span of the vineyard under the most various ecological conditions. It is this economical objective that should be followed in each wine region in carrying out the experiments on rootstock effect using the scion varieties which are common to those places, because the results of the individual growing regions cannot or can only be partially adapted to other wine regions. A number of experimental data also demonstrate that yields can be increased by the proper choice of rootstock without any loss in quality. Now the use of grafts for the establishment of vineyards should not be considered purely as a compelled solution against phylloxera but as a possibility or means of yield potential control.

Furthermore, the application of rootstock can be a solution from the point of plant protection and to overcome extremes of soil conditions. The adaptability to environmental characteristics besides biotic factors, the lime tolerance ability, the adaptation to low pH soils and to extreme humidity conditions and salt tolerance are important characteristics in a given area. Regarding the abiotic factors, heat and drought tolerance can be important on certain growing areas. The effect on the characteristics resulting from the co-habitation of rootstock and scion is the third field comprising the mutual affinity, the fastness of initial development, the life span of the grapevine plant, the growth vigour, the yield potential etc.

The study of rootstock scion interaction relative to the effect on the quality parameters of the scion, on yield quantity and on the quality parameters, on the development stages of the grapevine plant, on the rate of photosynthesis is still a question of interest also nowadays, the background of which is constituted by the expansion of stock roots, their anatomy, morphology, nutrient uptake and by the effect on the physiological characteristics (KOCSIS et al. 2000, SANJUN GU 2003). The importance of the issue is also supported by the fact that under the same ecological condition different scion varieties will produce the best result not on the same rootstock variety (HEGEDÜS and

Figure 4.

I'SÓ 1965, KOCSIS et al. 2000).

The availability of nutrients important to plants is influenced by all those factors that affect plant metabolism processes. In this process the role of the plant manifests itself through the expansion of the roots, their adsorption capacity and cation exchange capacity and through root respiration. In the uptake of soil solution nutrients the composition and amount of the materials flowing towards the scion is determined primarily by the selection ability of the roots of the stock. Besides the tissues of the scion make a selection and determine the nutrient transport, this way the grafted plant absorbs nutrients from the soil through a double selection: both the roots and the shoot have roles in the uptake of nutrients. The potassium and boron uptake of grafted grapevines was found to be more efficient on acid soils, compared to the 'Pinot noir' on its own roots. KOCSIS (1996) investigating the interaction between rootstock and scion varieties concluded that in the uptake of potassium and magnesium it is the rootstock characteristics that are dominant, while in the utilisation of calcium and iron and possibly of phosphorous (KOCSIS et al. 2001) it is the scion characteristics.

ROGERS and BEAKBANE (1957) in their work on the study of rootstock describe the major possibilities of the mechanism governing the rootstock-scion interaction (compatibility): of which one is the ability to absorb, synthesise and utilise nutrients, the second is the nutrient transport ability and the type and amount of plant growth regulating materials present in the tissues.

The root system absorbs the nutrients from its environment at a quantity and quality that are genetically encoded and transports them all or part of them towards the aerial parts. In the case of grafted plants, however, the scion grafted on the rootstock will take over only those materials and in such quantities as are also controlled by genetic codes.

National results

The objective of the experiments on rootstock effect is basically to determine the cultivation value of the individual rootstock varieties under differing environmental conditions in combinations with different scion varieties. The most important components of this value are: yield quantity and quality and condition and life span of the vine plant. These factors giving the real value of the variety can be determined by measurements and by evaluations. The factors of the value for cultivation and use of the variety and their numeric indicators reflect the value for cultivation and use of the variety, taken together and with attention to the interconnections *(Table 1).*

The rootstock variety 'Georgikon 28' *(Figure 5),* bred at our University, is characterized by an outstandingly high value for cultivation and use:

It was produced by Károly Bakonyi and his colleagues through the crossing of 'Berlandieri. X Riparia T.K. 5BB' and *Vitis vinifera* pollen mixture.

Its value for cultivation: variety with very strong growth, good cane yield. Lime tolerant, no special soil requirements, good resistance to fungal diseases, low susceptibility to phylloxera, average demand for canopy management, its testing is under way.

Shoot is semi rigid, young shoot tips are half-open, boat-shaped, bronze green, hairy, leaves are concave.

Internode is red on the dorsal side, reddish green on the ventral side, naked, has only weak patterns, is only slightly glaucous.

Leaf is pentagon-shaped, broad, big, funnelled, rugose, blistered, its tissue does not tear easily, is dark green, shiny, waxy, unarticulated. Its basal sinus is closed, the base is wedge shaped, bordered by the lamina. The margin is toothed, shallowly notched. Leaf surface is naked, the back of the leaf has hairs on the veins, veins are partly red, leaf stalk is wine red, naked, with weak patterns, is short.

Table 1. Important characteristics of grapevine rootstocks in Hungary

Rootstock	Phylloxera resitance	Tolerant		Effect on scion		Adaptation to soil
		Drought	Lime	vigour	Min. nutrition	
5C	good	poor	medium	medium-strong	N=poor, P,K=med	It likes good, well structured soils
5BB	excellent	medium	good	strong	N,P,K= med	It likes good, well structured soils
SO4	excellent	poor-medium	medium	medium	N=poor-med P=med K=med	It likes good, well structured soils
125AA	excellent	poor-medium	medium	medium	N=med, P=poor-med, K=med	Mg deficiency could ppear on it
Fercal	medium	medium	excellent	strong	N,P=med, K=poor	High lime, good water suppl.
Georgikon28	good	excellent	excellent	poor-medium	N=poor, P,K=med	High lim, drought condition

Rootstock experiments are going on even now at the experimental farm at Cserszegtomaj. Currently, our priority is the investigation into the effect of the rootstock on quality in the case of red wine grape varieties. Among the quality parameters special attention is given to the study of the effect of the rootstock on the quantitative and qualitative parameters of fruit pigment content.

Experiments relative to cultivation methods are also going on at the farm, since the health condition of the rootstock cane has great importance for the production of excellent propagation material *(Figures 3, 4, 5)*.

Figure 5.

References

Bravaresco, L. – Fegoni, M. – Praschini, P.: Investigation on iron uptake and reduction by excised roots of different grapevine rootstocks and a Vitis vinifera cultivar. Plant and Soil 130 (1–2) 1991.109–113. p.

Currle, O. – Bauer, O.: Biologie der Rebe. D. Meininger Verlag und Druckerei GmbH. Neustadt 1983. 311. p.

Csepregi P.: Alanyok a szőlőtermesztésben. Egyetemi Jegyzet Budapest 1951 106. p.

Hegedűs Á. – I'só A.: Egri borvidékre legalkalmasabb alanyfajták. Kísérletügyi közlemények 58/C. (3). 61–77. p.

Kocsis L.: Szőlő alany- és nemes fajták kölcsönhatása az oltványkészítéstől a termőrefordulásig. Kandidátusi értekezés, Keszthely 1996.

Kocsis L. – Bakonyi L. – Bakonyi K.: Szőlőalanyok használata Magyrországon. Milleniumi Szőlős-Boroskönyv. Agroinform, Budapest. 275–283.p.

Polyák D. – Fodor P. – Tné Surányi K. – Marczinkó F.: Alanykísérletekből származó furmint mustok „finom" összetétele. Kertgazdaság 1992. XXIV. évf. 6. sz. 65. p.

Rogers, W.S.– Beakbane, A.B.: Stock and Scion relation. Ann. Rev. of Plant Phys. 1957. 8. 217–236.

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Development of Traceability in Hungarian fresh vegetable and fruit sector

Introduction

Establishment of the traceability system in the food sector is explained by the following factors by Trienkens and Van der Vorst (2007): differentiation of product processes, in homogeneity of basic materials and semi- finished of basic materials and semi-finished products, mixed sources of batches, perishable character of the product, presence of bioactive material. Van der Vorst et al. (2004) carried out an international benchmarking, main features of the traceability system for vegetables-fruits were: very diverse chain structure very diverse chain structure, traceability based on law and consumer demand, more branding, chain performance of traceability few hours to grower, little use of ICT, use of bar codes (EAN). the main bottlenecks in fruit and vegetable supply chain were next: traceability is lost at retailers and traders, unit of traceability strongly depends on the packaging, regulation is leading to traceability being unsystematic, lack of standards for coding, too small batches to make traceability cost effective.

Establishment and further development of the traceability system effect a change in the features of transactions (asset specificity, complexity of transaction/uncertainty, frequency of transaction) (Williamson, 1979) and difficulty of performance measurement (Holmström and Milgrom, 1994), and interdependence/connectedness of a transaction to other (Milgrom and Roberts, 1992) or analysis of food safety and quality. The critical areas of organizational issues: information distribution of intermediate and final food products features and coordination of activities between all the supply chain's agents and governance option in relation to strategic positioning (Reynaud et al. 2004). Information distribution (asymmetry) is closely associated with quality and safety features of the product and with experience and credence product features (Martino and Perugini 2006). Information asymmetry leads to opportunistic behaviour and contractual hazards (Williamson, 1996). Costs of the coordination within the supply chain are closely correlated with the conception of interdependence (Thompson (1967).

Structure and features of Hungarian fresh vegetable-fruit sector

Two significant changes in the structure of Hungarian fresh vegetable-fruit sector took place during the last two decades. Main marketing channel types associated with each phase are as follows:

Period before 1989

Grower → ”Wholesaler market“→Small – scale vegetable and fruit retailers”

Grower→State – owned wholesalers (ZÖLDÉRT Companies)→Large – scale, state – owned retailers

Period between 1989–2003

Grower→”Wholesaler” market→Small – scale vegetable and fruit retailers

Grower→Private wholesaler→Large – scale private retail chains.

From 2003

Grower→”Wholesaler market”→Small – scale vegetable and fruit retailers

Grower→Private wholesaler→Large – scale private retail chains.

Grower→Producer cooperatives→Large – scale retail chains.

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Table 1. Main characteristics of transactions in Hungarian fresh vegetable and fruit supply chain

Factors	Retailers	Producer cooperatives	Producer
Asset specificity			
➢ Physical specificity	Low	Medium (logistics plans and control devices)	Medium-high (produce inputs and varieties)
➢ Time specificity	Low	Medium-high in season	Medium-high in season
➢ Site specificity	Low	Low-medium (member suppliers)	Medium
➢ Human resource specificity	Low	Medium (selected members and suppliers, trained personnel)	High (Trained personnel, different knowledge)
➢ Dedicated specificity	Low-medium (small role of branding)	Medium	High
Measurement problems	Low	Medium (quality and safety characteristics)	High (quality and safety characteristics)
Frequency of transactions	Very high	Medium in season	Medium in season
Uncertainty / complexity of transactions	Low (supplier selection)	Medium-high (diverse of inputs and suppliers)	Medium-high
Interdependency	Sequential (unilateral dependency of suppliers)	Pooled (bilateral dependency between coops and members)	Sequential (unilateral dependency from buyers)

The share of horticultural sector (vegetable- fruit, potato and flower) in the value of plant production amounted to 22%, (average of years 2002–2006) and 12.4% in the value or agricultural production. Both percentages show a decreasing tendency. Three-quarter and one-quarter of production of vegetables occur in small-scale and large-scale farms, respectively, 80% of fruit production may be found in small-scale farms, 20% of it in large-scale farms.

51% vegetable-fruit produced in Hungary is sold as fresh product on the market, in form of wholesale, retail or direct sales. The remainder gets to industrial processing and processing within the plant. (30+6%), 10 % to own consumption, 3% is constituted by storage loss or change in stock. In domestic sales of vegetables-fruits, the proportion of direct sales to consumers is still significant, main forms of which are sales on local markets, wayside sales, sales from the farm, as well as "pick and carry" actions. Another important element of the domestic distribution system of vegetables –fruits is the system of wholesale markets, within which the wholesale market of vegetable-fruit of Budapest has a share of 80% (other wholesale markets in Szeged, Szentes, etc.).

Of the organizations, taking part in the turnover, important role is held by vegetable-fruit wholesalers, one part of them consists of export-import wholesalers, the other part of wholesalers, possessing domestic regional market. The number of wholesalers, participating in export-import may be estimated at out 100. Among which the role of 8–10 (CR 8–10) is determinative. From this sphere come out the main and regional (in case of domestic chain) suppliers of international and domestic retail chains. Other group of domestic wholesalers, dealing mainly with regional distribution of vegetables-fruits originating from wholesale markets, domestic production and import or own purchases, participate first of all in supply of retailers, works kitchens, restaurants, schools, nurseries, special vegetables-fruits shops. Another part of wholesalers, having specialized themselves in mediation and speculation are the so-called "nappers", trading on the basis of utilization of short-term price fluctuations and possessing a circle of customers of ad hoc character. The system of traceability of these wholesalers is the most uncertain one, since a part of their activity proceeds in the grey economy.

The number of producers' cooperatives on 1st January, 2007 was as follows: 10 definitively acknowledged organizations, 103 were acknowledged in advance. Preliminary licence of the majority of producers' cooperatives was withdrawn during the year and a part of them joined, respectively. In the second half of the year, the number of operating producers' cooperatives amounted to 51, 10, 5% of the production was sold by the producers' cooperatives on the average of years 2002–2004. The final sales stage is meant by retail sales, where local vegetables markets, other direct marketing forms, traditional small shops (mainly vegetables-fruits specialist shops) HORECA agents, domestic and foreign retail chains and wholesalers, dealing with export-import are taking place.

Examination of the traceability system of Hungarian vegetables-fruit sector: research and methods

Analysis of the traceability system was carried out in four domains:

- System of official control (4 expert interviews by telephone)
- Large-scale retail chains (16 export interview by telephone)
- Producers' cooperatives (27/51 cooperatives by survey)
- Large-scale producers (46/320 producers by survey)

Organizational system of official control underwent a significant transformation during the years past. Control of certain fields, propagating materials, quality control of fresh vegetables and kinds of fruits, control of heavy metal- and plant protecting chemical content and hygienic control belonged to independent organizations, which were reorganized into an unified system during the years 2006–2007. In the field of official control, four half-structured expert interviews were made (telephonic interviews of 50–60 min duration). The main conclusions, drawn from official interviews are as follows:

- Traceability systems differ from one to another according to the sales channels. In case of direct and sales on the wholesale market, the system of traceability exists and operates partially exists and operates partially only. Llack of traceability documentations and lack of transparency of the sales channel represent a significant problem .
- In case of major producers, producers' cooperatives, major wholesalers and retail chains, a traceability system was established and operates on a satisfactory level. Main problems originate from the lack of regular official control, problems of laboratory conditions and problems of quick checking up of traceability documentations (paper-based traceability system, scarcity of labour force, lack of special knowledge). Minimum performance of traceability is not defined on level of the sales channel, thus checking up time is very slow and in several cases, it surpasses the duration of the consumption of the product. For sanctioning quality faults and food safety deficiencies serve first of all penalties, the amount of which is relatively low as compared with the hazard and the damage caused.
- The main problems associated with the control of plant protecting chemical – and heavy metal content are: the sample number, necessary for adequate analysis of hazard is low (about only 50% of the justified). Examinations, carried out by companies (producing, trading ones) extend to a few products and some market actors only. Companies make laboratory examinations mainly in case of export sales. Own laboratory is possessed by a few market actors only. Within the frame of official control, institution of automatic laboratories is now in progress. Costs of laboratory examinations are relatively high. The proportion of laboratory examinations of preventive character is low. Also the proportion of product withdrawals and recalls is low.

Regarding the retail chins, interviews were conducted with experts in vegetable-fruit purchase, operating in 16 chains. (Telephone interview, 50–60 min duration). Among the retail chains 3 hypermarkets (CORA, Auchan, TESCO) 3 supermarket (TESCO, SPAR, SMATCH), 3 discount chains (Penny, Plus, Profi) 2 C+C chains of department stores (METRO, Interfruct) and 4 retail chains (Coop Hungary, CBA, Reál, Heliker) were included.

The mmain conclusions drawn from retail trade interviews are as follows:

- The purchase system of vegetables-fruits is strongly differentiated, extending from local, small-scale chains (local ÁFÉSZ shop-nets) to regional

(Coop Hungary, Reál, CBA) purchase system and country-wide purchase system (international retail chains). A part of the retail chains has category manager-like connection with the wholesalers (e.g. regional wholesalers of Reál and a part of the Pro-Coop ZRt., e.g. Bács Zöldért).
- The traceability systems show significant differences depending on the degree o centralization of the purchase, product features (length of the production period, perishability, quality keeping of the product) and the proportion of repacked products. Traceability of products causes the greatest problem in case of repacked mass goods and when a few products originating from a few suppliers are packed together
- Traceability system according to phase's levels is applied by retail chains, main target of which is the determination of product liability and shift of hazards, respectively. The main purpose is first of all the treatment of quality reclamations and only secondly the prevention of food safety problems.
- In compliance with food safety requirements, the role of official control is determinative. There was a precedent for self-examinations or laboratory development in case of a few retail chains only. Regular inspection and control on the spot on behalf of suppliers is scare, they fail to perform regular hazard analyses.
- Main form of the paper-based traceability system is the use of labels and tickets. Identification of the product is done by the use of bar codes (EAN)
- Retail chains possess internet accessibility, but it is limitedly applied in purchasing activity because of differentiated preparedness of suppliers (infrastructural deficiencies, problems with specialist knowledges).
- Economic and managerial benefits of traceability systems are not comprehended by retail chains. They regard the paper-based system as efficient. They are aware of the length of transit time, surpassing consumption time, but this is mainly explained by the problems of official control.

Traceability systems used by producers' cooperatives was examined by means of a questionnaire (postal questioning) survey. At the time of the survey 51 producers' cooperatives had permanent or temporary authorization to operate. Of the questionnaires sent off, 27 (54%) were returned. The favourable proportion of return may be attributed to telephone contact established before and following the postal dispatch. Main conclusions in association with

***Table 2.** Main characteristics of traceability system in Hungarian fresh vegetable and fruit supply chain*

Factors	Retailers	Producer cooperatives	Producer
Characteristics	Mix of medium concentrated oligopol and atomistic market structure. Increasing concentration and market power	Atomistic market structure. Increasing role and market share.	Atomistic market structure. Diverse of size and level of technology and knowledge.
Forces of traceability	Mainly laws and regulation, ittle affect of consumer behaviour.	Mainly laws and regulation, power of retailers. Consumer behaviour on export markets.	Mainly laws and regulation, power of wholesalers.
Governance forms	Contracts with suppliers, mainly less than one year.	Contracts with members, mainly more than one year Joint planning of variety structure.	Contract with buyers (wholesalers), mainly less than one year.
Traceability performance	No exact time to suppliers or producers	No exact time to members of cooperatives	No exact time
Traceability forms	Based on paper documents (labels), parallel with using barcode (EAN) Little use of ICT	Based on paper documents (labels), parallel, with using barcode (EAN) Little use of ICT	Based on paper documents. Little use of ICT

the traceability system are as follows:

- Producers' cooperatives became unambiguously aware of the importance of the development of the traceability system. In sales relations, expansion and further development of the traceability system was assigned to the third place of 8 factors by the respondents. Among future tasks (3–5 years) it was regarded as the most important issue beside the strengthening of purchaser-supplier relations and branding activity on behalf of the producer and cooperative. The advantages of the traceability system are considered according to the following: precondition of market (first of all export market) penetration, tool of adaptation to purchasers' and consumer demands, reduction of costs originating from safety hazards.
- Regarding purchasing, purchase from producers or other producers' cooperatives is determinative. In sales relations, a most important role is played by sales to wholesalers, retail chains and direct export sales. the main form of coordination is the contract, within which forms shorter than one year are preferred, while the proportion of those for longer than one year is low (18.1%).
- The tools applied most frequently in supplier relations to purchasers are: positive or negative list of plant protecting chemicals, advice, prescription of quality assuring system, input assurance, prescriptions relating to variety and to f propagating material.
- The most frequent forms of quality assurance systems are as follows: EUREP-GAP, HACCP, Good Processing Practice
- The traceability system is exclusively paper-based, completed by the use of EAN-code. A smaller part of the producers' cooperatives possesses product recalling program, hazard handling system for treatment and registration of claims
- Regarding data transfer technologies mobile phone, fax (100%) are most frequently used, and wide-band internet (88,9%).

Main conclusions

- Lack of integrated traceability system, mainly sequential coordination and traceability forms.
- Lack of clear traceability performance level for chain actors.
- Lack of vertical organization to coordinate traceability system and transparency in chain.
- Incentives of traceability system based mainly on laws and legislation, less on economical ones.
- Lack of integrated chain information system, little use of ICT, only telephone and fax (though most of them has internet).

References

Holmström, B. – Milgrom, P. (1994): The Firm as an incentive system, American Economics Review, 84 (4).

Martino, G. – Perugini, C. (2006): Hybrid forms in the supply of safe foods, In: J. Bijman – S. W. F. Omta, – J. H. Trienekens, – J. H. M Wijands – E. F. M. Wubben (eds) International agri-food chains and networks, Wageningen Academic Publishers, Wageningen

Reynaud, E. – L. Sauvée – E. Valceshini (2004): Fit between branding strategies and governance of transactions. 8th Annual Conference of the New Institutional Economics, Institutions and Economics and Political Behavior, Tucson, Arizona

Thompson, J. D. (1967): Organizations in action: social science bases of administrative theory, New York

Van der Vorst, J.G.A.J. (2004): Performance levels in food traceability and the impact on chain design: results of an international benchmark study, In: H. J. Bermmers, – S. W. F. Omta, – J. H. Trienekens and E. F. M. Wubben (eds), Dinamics in chains and networks, Wageningen Academic Publishers, Wageningen, the Netherlands

Williamson, O. E. (1979): Transaction Cost Economics: The governance of contractual relations, Journal of Law and Economics 22.

Doyen of Hungarian Plant Breeding Ernő Kurnik (1913–2008)

The years 2006–2008 are a sad period of our national scientific life. Shockingly high is the number of those who passed away, e.g. Iván Bócsa, Sándor Rajki members of the Hungarian Academy of Sciences (HAS), Andor Bálint and Gábor Kovács Doctors of HAS, who in the second half of the 20th century were central figures in national plant breeding. This tragic process unfortunately continued in 2008 since on the 3rd of March, when, at the age of 95, Ernő Kurnik, HAS member , one of the last giants of classical Hungarian plant breeding passed away.

Heaven granted him a long life teeming with instances of success and failure, joy and sadness. The Professor, as in his life he had to be addressed with this title, reached almost everything that a plant breeder can achieve in our little homeland. On the mourning card announcing the of passing the Professor to relatives, acquaintances, friends and to scientists contains a long list of the various national and international titles, positions, prizes which are a clear demonstration of the greatness and reputation of Ernő Kurnik academician.

Who was this plant breeder and scientist? He was the doyen of Hungarian plant breeders, the last member of the generation of polymath plant breeders dealing with almost every field crop in cultivation. This is best illustrated by the fact that in his life out of 7 plant species, sunflower, soybean, pea, horse bean, bean, chick pea and rape-seed, 74 in all were granted state registration entering in commercial production. The varieties from Ireg were famous both at home and abroad. In addition to this, he was the author of 150 scientific publications, articles and studies. Of particular and lasting value are his monographs (3), books (2) and his many book chapters. He was president of the Plant Breeding Committee, HAS over several terms and its honorary president until the end of his life. He was one of the founders of the Hungarian Plant Breeder's Association and later its honorary president. He was also a founder member of the Academy Committee of the town Pécs.

If we try to recall his personality for a moment an elegant, a real gentlemen steps out of the gloom with the obligatory cigar in his hand. Anywhere and any time he was met he looked as if had just stepped out of the band-box There was not a single year when his friends could escape from going to see him at Iregszemcse. In the experimental area, between the plots, looking decades younger, neglecting the scorching sunshine, he presented his latest results, lines, varieties and hybrids.

He witnessed historical events. He was born in 1913 at Mecsekszabolcs in Greater Hungary before the Trianon Peace Treaty. He saw the First World War as a child and the Second as a soldier and then as a war prisoner. He graduated in agriculture at the József Nádor Hungarian Royal Academy of Technical and Economic Sciences where he obtained university doctor's degree. His masters were Zoltán Szabó and Géza Dobi, renowned professors. He acquired the degree of candidate of agricultural sciences in 1953 and the title of Doctor of HAS ten years later in 1963. In 1970 he became Correspondent Member of HAS and then in 1976 Ordinary Member of HAS.

He started his breeding activity two years before he was called up for military service, at the establishment of the Ödön Mauthner Stock Company, a private company, at Iregszemcs and remained faithful to Ireg over more than half a century (56 years). He was founder and director of the South-east Trans-Danubian Agricultural Experimental Institute and then of the Research

Institute for Fodder Production. He took an active part in the reorganisation of the agricultural research of the country after the war. The work of the organisation of the network of the institutes for regional research is linked to his name which network was naturally reorganised then wound up during the 1970s and 1980s. Nowadays the tasks deriving from our EU membership unfortunately justify the necessity of this regional research network. This way he was half a century ahead of his time with his organisation of the regional institutes as Chief Director of Experimental Issues in the Ministry (1952).

He made friends with Péter Veres after that the latter called plant breeding as ‘amusement for the idle rich’ in the early ‘50s in a county newspaper. The Professor immediately invited him to visit his institute in order to provide a demonstration of the opposite. It did not take too long before the response arrived: ‘*Young friend, you invited me, here I am*’.

His humane nature is evidenced by the fact that, similarly to our fellow academician Andro Jánossy, he was guard and benefactor and supporter of the intellectual victims of the take-over by the communists. Those who were permitted to continue their research work at his institute include, among others, György Mándy, professor of agrobotany and plant breeding, as well as the chemists Sándor Kuthy and Miklós Jáky.

There was an anecdote in circulation in the 1980s of the last century at the Ministry called as ‘MÉM’ at that time, saying that one was recommended to go to Iregszemcse, where for decades the director had been the professor, only in the morning or in the late afternoon because Director Ernő Kurnik would sleep in his office after lunch and a fiery young woman from Ireg would let no one enter his room. Naturally, this was based on true grounds, as even the heads of the Ministry, arriving unexpectedly at Ireg, had to wait in the anteroom until the professor was so kind as to wake up in the end. To tell the truth, in his field he was treated with such a great respect that he could do so without any fear.

He was recipient of numerous awards (Fleischmann Prize 1974, State Prize 1978, József Beszédes Prize 1992, Cross of the Order of Merit of the Republic of Hungary 1994, Millennial Prize 1996, Baross Commemorative Medal 1999, etc.) and he was elected Member of Szent István Academy and Honoris Causa Doctor and honorary university professor of the Pannon University. In his autobiography, he writes on this subject: ‘My research work and its results did not lack in recognition. Each award and honour is dear to me. But I can not resist from quoting the lines of the certificate granted by ‘OMMI’: ‘in recognition of the fruitful work done for the enrichment of the treasures of the nation’ He wore only one of his awards at all, but he wore it permanently, the Cross of the Order of Merit of the Republic of Hungary, ‘like once my grandfather wore the golden medal he won in the Balkan War’, he writes on himself.

He could never say farewell to plant breeding and was working until his death. On this point he writes: ‘Common sense would dictate that you should sit down by the fire-place and contemplate on the past since you had so many wonderful experiences. And what am I doing?’ he asks himself ‘While walking up and down I am meditating which is the one of my ideas for the accomplishment of which yet enough time is allowed by my fate given by God?’ Dear Ernő, Providence allowed you as much as this and let us admit it was not little.

You have died but only your body has passed away and left us; the results of your work continue to remain with us. Your varieties, of which more than a dozen are still in cultivation even nowadays in the country, your monographs which are present on our shelves and in the libraries of every university will keep reminding us of you. Dear and honoured Professor, in the name of the ordinary and correspondent members of the Committee of Agricultural Sciences of the Hungarian Academy of Sciences, of the doctors and members of Public Body of HAS, as well as in the name of the Hungarian Plant Breeder’s Association and of those who honour and respect you I say farewell to you, the scientist and, not in the last place, a friend of all of us.

Dear Ernő, rest in peace.

László Heszky
ordinary member of HAS
Szent István University

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