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AGROINFORM

President of EUCARPIA
Zoltán Bedő

Zoltán Bedő, who has been a plant breeder for 37 years, first worked in the laboratory of Prof. Andor Bálint at the University of Agricultural Sciences in Gödöllő. Since 1977 he has carried out research on cereal breeding in the Agricultural Research Institute of the Hungarian Academy of Sciences in Martonvásár. He obtained a PhD in agriculture in 1983 and successfully defended his DSc thesis in 1993. He was elected a Corresponding Member of the Hungarian Academy of Sciences in 2004. He has been the Director of the Agricultural Research Institute of the Hungarian Academy of Sciences since 1992.

His first research field involved investigations on models of plant adaptability, after which he analysed populations of old Hungarian wheat varieties. One of his main endeavours was to combine the use of molecular and conventional plant breeding methods, which formed the basis for his involvement in European Union research projects. He is currently carrying out a molecular breeding programme as part of the integrated BIOEXPLOIT project, and is analysing the genetic variability of the nutritive components of cereal grains in the framework of the HEALTHGRAIN project. He is the author of a total of 327 scientific publications and co-breeder of 72 cereal varieties.

His international scientific and public activities have included acting as a consultant for the World Bank on a number of occasions. In 2000 he was granted the right to organise the 6th International Wheat Conference, and in autumn 2008 he was elected as President of the European Association for Plant Breeding Research, EUCARPIA.

He received honorary doctorates from the Debrecen University in 1999 and from Pannonian University in 2006. He is also a member of the Hungarian Academy of Engineering and chairman of the Editorial Committee of the scientific journal Acta Agronomica.

In recognition of results achieved in plant breeding in the 1980s and early 1990s he received an Academy Award from the Hungarian Academy of Sciences in 1992. In 1996 he won an Oscar from the International Federation of Inventors' Associations, in 1998 the Jedlik Ányos Award from the Hungarian Patent Office, and in 2001, on the occasion of the Millennium, the Knight's Cross of the Hungarian Republic for his work in improving Hungarian cereal production. He was awarded the Justus von Liebig Prize endowed by the Alfred Toepfer Foundation in Hamburg in 2004.

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Rose hips
(Photo by Gábor Kollányi

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Cultivation of Temperate Fruits of Peculiar Kind

Natural vitamins, complemented by other biotic accompanying substances in the fruit, are more efficient and have a more lasting effect than those produced artificially. Temperate fruits of peculiar (non traditional) kind, such as, for example, elderberry, black chokeberry and rose hip, also contain significant amounts of active ingredients indispensable to human body. These species have made their debut in national cultivation over the past two decades.

Cardiovascular diseases, as well as tumour diseases of various kinds, rank among the leading causes of death. These diseases can be attributed, among other things, to increased stresses, dietary habits and lack of physical exercise. The countries where vegetables and fruits rich in fibres, vitamins, flavonoids and minerals are consumed in greater quantity have a demonstrably lower proportion of those suffering from these diseases. The development of the aforesaid disease can be brought into close relationship with an increased level of free radicals (superoxide radical, hydroxyl radical, singlet oxygen etc.) and molecules (hydrogen peroxide, nitrogen monoxide). These free radicals have an adverse effect on lipids (lipid peroxidation), carbohydrates, proteins and nucleic acids, causing confusion in the protection system of the human body

The human body has developed its own protective mechanism against free radicals: the enzymatic protection and the antioxidant one which is associated with smaller or larger molecules. This mechanism is assisted, besides, by some mineral elements (Zn, Cu, Fe), by vitamins (A, C, E) and a number of molecules, such as flavones, flavonons, anthocyanides etc. of the flavonoid group, the significant part of which cannot be produced by the human body, but only plants can do it. This way we cannot do without the consumption of fruits with a high biotic value (Stefanovits–Bányai et al. 2002). The fruits species studied in our investigation are already produced in plantations on a large scale.

Elderberry (Sambucus nigra L.) Cultivation

Field of use: Due to the excellent fruit composition values, demand for elderberry fruit has increased in the country. Its high anthocyanin *(Figure 1)* content provides a natural colorant for the food industry. We determined the anthocyanin components of elderberry using the HPLC method. Prior analyses had identified three major anthocyanin components: cyanidin-3-glucoside, cyanidin-3-sambubioside and cyanidin-3-sambubioside-5 glucoside. However, in our own investigations we managed to distinguish seven components within the 'No.262' selection based on Rf values (*Figure 1),* but in the absence of standard

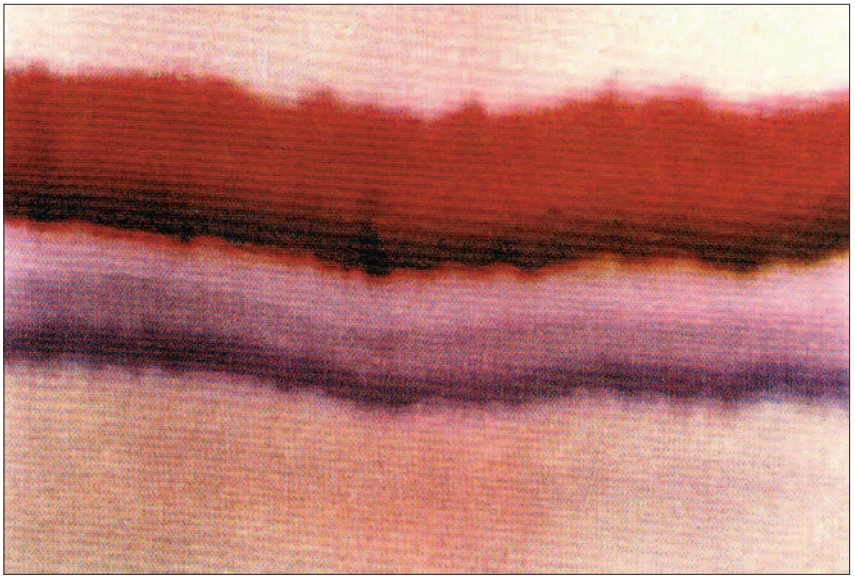

Figure 1: *Pigment composition of elderberry selection 'No. 296'*

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pigments we could not identify them (Porpáczy-László 1984, Stefanovits-Bányai 2004). Total anthocyanin content was determined using the spectrophotometric method. In this aspect significant differences were found between the varieties.

Compared to the standard variety Haschberg as one hundred percent, the varieties 'K 1/7' 110, 'K 3' 95 (national selection), a 'Sampo' produced a value of 110, the variety 'Samidan' 105 and 'Samyl' (Danish varieties) 115. The place of growing has a greater role in the anthocyanin content than the variety. The vitamin and mineral compositions are very favourable *(Table 1)*.

Table 1: Vitamin and mineral compositions of elderberry fruit (according to Stégerné, 2001 and Wieloch, 1978)

Vitamins	Concentration (mg/100g)	Minerals	Concentration (mg/100g)
Carotene	0.20–0.50	Potassium	390–530
Thiamine (vitamin B1)	65–70	Calcium	75–92
Riboflavin (vitamin B2)	78–80	Magnesium	77–79
Niacin (vitamin B3)	1.48–1.50	Phosphorous	40–95
Pyridoxine (vitamin B6)	0.24–0.25	Iron	1.6–1.8
Ascorbic acid (vitamin C)	120–140		
Folic acid	14		

Fruit amino acid fraction is also high, containing essential amino acids in 50–60% (Schmidt, 1987).

Spread of cultivation: The increased demand for elderberry fruit could no longer be met through gathering. The processing industry requires stable and calculable quantity and reliable quality which provided good reasons for the introduction of elderberry into cultivation. As its first step selective plant breeding was started then the elaboration of the cultivation technology was also undertaken in the early seventies. In this process, besides the research institutes in Austria and Denmark, as well as the Research Institute for Fruit Growing at Fertőd took an active role. Now the ones of the European countries having greater growing areas are: Austria, Germany, Denmark and Hungary, but also the Polish, Slovakian and Rumanian elderberry is present on the market in a smaller quantity. According to the survey of the Central Statistical Office of Hungary in 2001 the size of the elderberry plantations in the country was 1,682 hectares. According to the estimates, this number has by now grown to 2,400 hectares. The majority of the elderberry plantations have been established for the last 10 years and this way the proportion of young plantations with high yielding capacity is favourable. Average yields per hectare range between 8–22 thousand tons in accordance with age and growing site. In Hungary, annually 18 thousand ton elderberry fruit is produced in plantations and further 14-16 thousand tons are gathered from elderberry plants growing in the wild. The greater part of the fruit goes for exports. The national processing industry produces concentrate and four different jams, a syrup and three different nectars under the brand name 'Sambo'. For the past years the use in various dietary subsidy and medical products has also grown.

The formerly very strong demand for the fruit has stabilized itself for the last two and three years around 30 thousand tons.

Varieties and yield potential. Nowadays, both on the part of the processors and on the part of the growers a demand has risen for the enlargement of the variety assortment so far limited almost exclusively to the variety 'Haschberg'. Under our national conditions the varieties of earlier ripening have great value as with their fruit we can precede our western and north-western neighbours on the market (Porpáczy, 2004). In order to enlarge the variety assortment the exploration of the genetic resources of the endemic wild population and the search for foreign varieties and their introduction into test cultivation are also being carried out at the Research Institute for Fruit Growing at Fertőd. According to the results of the comparison trials, the perspective varieties seem to be 'Sampo' of the varieties from Denmark and the clone designated as 'K3' of the ones selected from the wild elderberry population in the region of Lake Fertő (Kollányi et al., 2005).

The variety 'Sampo' was produced in Denmark using cross selection. It is of medium growth and its canes are thin but set thickly with fruits *(Figure 2)* and in response to excessive fruit load they are liable to break. Their phenotype is different from that of 'Haschberg', the leading variety in present cultivation. Peduncles turn to a lilac red colour already at the beginning of ripening and leaves are big, broad and shiny green in colour. Flowering precedes that of 'Haschberg' with 5–6 days and flowers have an intense fragrance. Umbrellas are medium big in size and heavy, berries are big. Ripening is very

Figure 2: *Fruiting cane of Sampo set heavily with fruit*

Figure 4: *Large fruit clusters of clone designated as 'K3'*

early and it reaches full maturity already by the end of July – early August. It is a regular and heavy yielder *(Figure 3)*.

The clone 'K3' is of strong growth, its canes are rigid and thick. It flowers almost at the same time as the variety Sampo. Its flowers are bigger and yellowish white. The number of berries situated on large umbrellas (Figure 4) is over one thousand. Its is a medium early ripener and can be harvested in mid-late August.

Cultivation system: Elderberry can be successfully grown on medium heavy soils rich in organic matter. The replenishment of nutrient stocks prior to planting is the same as that of other fruit species but it has a high nitrogen demand before it begins to fruit.

Elderberry requires sufficient light in order to achieve even and favourable colouring of fruit. Planting too densely will have adverse effect on the simultaneous ripening of fruitlets and on fruit yields. The varieties with compact growth habit ('Haschberg', 'Sampo') have a commonly used growing space of 5.5 × 3.5 m (520 plants/ha). The varieties of greater stature ('Pragarten') are planted in a grid pattern of 6 × 3 m (476 plants/ha).

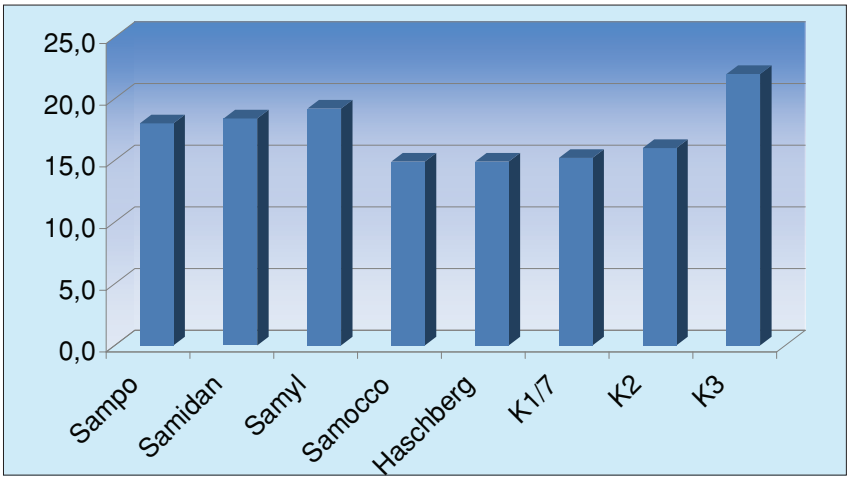

Figure 3: *Yields of tested varieties on average of four years (kg/tree)*

Elderberry is a shrub by nature. The apical dominance of its shoots is very strong and this way it can grow shoots as long as 2 meters within one year. From economical considerations it is more advantageous to grow an elderberry tree with 1–1.2 m trunk height. This way it will be possible to harvest the fruits standing on the ground and neither fruit quantity nor berry weight will be diminished.

Fruiting elderberry plantations need pruning every year. Canes which have finished fruiting and are long should be removed. 7–8 canes of full length should be left in a non irrigated area and 10–12 ones under irrigated conditions *(Figure 5)*.

Black Chokeberry (Aronia melanocarpa ELLIOT) Cultivation

Field of use. The skin of black chokeberry fruits has a high pigment content. The anthocyanin content is three times as much as that of the black currant. Its fruit is an excellent food dye which gives a nice ruby colour to the processed product. The black chokeberry can be used to make jam and fruit juice with a pleasant flavour, a special wine and liqueur.

The dry matter content of the mature fruit is 14–19 percent, the organic acid content is 0.7–1.3

Figure 5: *'Haschberg' plantation with trunks in full blooming*

Figure 6: *Detail of fruiting shrub of the variety 'Rubina' (Fertődi 1/7)*

percent and the tannin content is 0.6 percent at the beginning of maturing and 0.35 percent in the mature stage. The vitamin P content is 2,215–5,000 mg percent, the vitamin B2 content 0.1 mg percent, the vitamin B9 content 2215–0.1 mg percent and the vitamin E content 0.5–0.8 mg percent. Also the mineral salt composition is favourable (Porpáczy et al. 1996). 75% of the fruit juice can be extracted by pressing and the adding of pectinase enzyme.

Origin and morphology. The black chokeberry appeared in Northern Europe more than hundred years ago.

Our experiments for the introduction and adaptation of the black chokeberry, promising success also under our national climatic conditions, were begun in 1976 using Soviet, Scandinavian and Czechoslovakian base materials.

Black chokeberry is a perennial woody shrub growing to a height of 1.5–1.8 m in the South and 2–2.5 in the North. It has the typical characteristic of vigorous shoot development, thereby the shrub will become dense and large. It is a light demanding plant. Even as many as 20 flowers can be situated in the inflores-cences developing from the apical buds of fruit-bearing shoots, while inflorescences developing from the lateral buds generally contain 14 flowers. Flowers are small, are creamy in colour, bisexual and self-pollinating. The ovary is composed of five seed chambers (pome fruit). Chokeberry fruit is round, sometimes oval, shiny and its black base colour is covered with a waxy bloom. Berry diameter is 7–15 mm. Average berry weight is 1–1.6 g. Each fruit contains at least five well-developed seeds.

Black chokeberry has excellent adaptability. In Siberia it tolerates frosts as low as –35 °C without any damage. It prefers humid and wet habitats. Its vegetation period is 180 days in Hungary, where its flowering starts in mid April and lasts for an average of three weeks. It takes 93–95 days from fruit set to complete development of fruit. It grows well in lightly acid forest soils and its foliage will turn yellowish in soils with pH over 7.

Varieties and yield potential. In Scandinavia plots planted with seedlings yielded 5.2 t/ha on an average of 8 fruiting years, while plantations planted with improved cultivars yielded 7.3 t/ha. Using the variety 'Altajskaja krupnoplodnaja' a yield of 14 t/ha was achieved.

Our trials included the Scandinavian varieties 'Viking', 'Hakkija' and 'Ahonnen' and the Slovak varieties 'Moravska sladkoploda','Nero' and the one designated as 'BY.1.' Under our national conditions a high yield potential was shown by the varieties 'Viking' and 'Nero'. We also began the national cross-breeding and of our hybrids the one designated as 'Fertődi 1/7' has been registered on the national variety list under the name of 'Rubina' *(Figure 6).* Depending on the year, a yield of 5.2-8.1 kg per shrub was harvested from the variety 'Rubina'. It is grown in several European countries. It mass micro propagation has been elaborated (Porpáczy, P. Zombori, Zatykó, 1987).

Cultivation system. A row width of 3.5 m and an intra-row spacing of 1.5–2 m can be recommended for planting and this way 1,428 to 1,900 shrubs can be planted per hectare. The young plant will fill the growing space in the fifth year. The culture has a life span of 20–24 years.

Berries mature simultaneously in the umbels of the black chokeberry. For this reason, fruits

can be harvested with one picking. Fruits are picked together with the umbels. During industrial processing berries are separated from the umbels. The daily output of a picker can be as high as 150 kg.

The new varieties like 'Rubina' are of the spur type, have a compact shrub shape and this way there is hope that their harvesting will be possible using modified combine harvesters for currants. Black chokeberry fruit is not liable to contusion and consequently they can be transported in crates of 25 kg without any loss of juice.

In our experiments so far no diseases or pest have been found on the plants

Rose (Rosa canina L.)
Cultivation

Field of use. By now the establishment of rose plantations suitable for fruit production has become a reality. The professional preconditions (cultivation technology, variety assortment, supply of propagation material, processing and selling) rest on the basis of research over two decades. Our investigations included the study of available foreign varieties, the economic evaluation of selected taxa originating from national genetic resources and the breeding of new varieties.

Recently, growing demands have been seen for rose hips which exceed what could be met by collection from the wild in accordance with the increased quantity and quality requirements.

The national flora comprises rose species and variants with precious fruit. The climate of the Carpathian Basin is favourable for the rose and consequently also some natural species hybrids have managed to develop. Even now, among them it is possible to select types that are, in every aspect, competitive with or superior to the improved varieties produced by selection. Our investigations focused in the first place on the ingredients that determine the economic value, on fruit parameters and physical characteristics, as well as on the determination of the possibility of production. The cultivation of rose, as a fruit bearing plant, began in the 18th and 19th century in South Europe, in Asia and in South America. It was this period when the species *Rosa canina L.*, dog rose, *R. villosa L. (pomifera)*, shaggy or apple rose, *R. blanda Ait.*, smooth rose, *R. majalis J. Herrm. em. Mansf.*, double cinnamon rose, *R. pendulina L.*, alpine rose (which is a protected species together with its derivatives) and *R. rugosa* Thumb., Japanese rose, were introduced into cultivation. Part of the species above develop rhizome like underground shoots which later take root ensuring the continuous renewal of the shrub. These species should be propagated by slipping (on their own roots) for fruit production purposes. Rose hips can be consumed only in a processed form. For consumption purposes, they are used to make hip jam, syrup, wine and liquor. The pharmaceutical industry uses them, in whole (*Cynosbati pseudofructus cum seminibus*) or halved without seeds (*Cynosbati fructus sine semine*) to make dried fruit for further processing purposes.

The analysis of the major fruit ingredients is under way. So far the analytical evaluations of 12 selections and of the variety 'Karpatia' have been finished. Of the vitamins in rose hips the most important is vitamin C which is present as ascorbic acid AA and in a reversibly oxidised form as dehydroascorbic acid DHA. The intermediate form between the two compounds, the ascorbic acid mono anion, has vitamin C activity. Of the three forms with vitamin C activity it is the AA which is more precious. Fresh fruit is dominated by AA and dried fruit by DHA. Besides the

Table 2: *Major fruit ingredients of wild rose clones advantageous for production: ripening time and character*

Clone No.	Vitamin C (free)	β–carotene	Mg	Ripening	
	mg/100g			time	character
Karpatia	337.80	32.00	106	08.15-30	prolonged
FR.801	347.90	8.54	174	08.20-30	concentrated
FR.802	337.93	5.45	162	09.01-15	concentrated
FR.822	200.55	5.79	164	09.15-25	concentrated
FR.872	203.62	6.01	143	09.20-30	concentrated
FR.873	204.27	4.78	158	09.20-30	concentrated
FR.874	222.50	7.23	119	09.20-30	concentrated
KR.901	194.23	6.42	208	08.15-25	concentrated
KR.902	337.04	6.98	174	08.20-30	concentrated
KR.911	105.55	4.88	201	08.20-30	concentrated
KR.912	197.91	3.46	115	09.01-10	concentrated
KR.913	160.91	4.66	161	08.20-30	concentrated
KR.921	202.78	10.90	170	08.20–30	concentrated

Figure 7: *Elongated fruit of selection No. 'FR.822'*

Figure 8: *Very big, sphere like, squat oval fruit of the variety 'Karpatia'. Flesh proportion 75 percent*

compounds above, bound (methylated) vitamin C is also present in rose hips which can be reactivated depending on the processing technology. We carried out investigations only for the detection of the free vitamin C showing a value between 105.1–347.9 mg/100 g depending on the variety. Also fruit carotene content is significant (Stefanovits-Bányai 2002). Considering mineral elements, the most important ones are Ca, Mg, Fe, Zn, B and Cu *(Table 2)*.

Based on fruit physical parameters the selection No. 'KR.931', measured as the one having the lowest weight (1.15 g, flesh proportion 61.7 percent) and the No. 'FR.801' are good-yielding clones which, dried in whole, are considered to be suitable for making tea. The No. 'FR.802' (2.41 g; flesh proportion 70.1 percent),'FR 822' (2.59 g; flesh proportion 74.8 percent; *Figure 7),*'KR.911' (2.24 g; flesh proportion 69.7 percent),'KR.912' (1.83 g; flesh proportion 64.7 percent) and 'KR.913' (1.72 g; flesh proportion 73.3 percent) are hard fleshed selections the fruits of which in halved form are suitable for making dried hip flesh.

It is the varieties with greater fruit weight that are suitable for making canning industry fruit products. These are the derivates of the species *R. villosa L.*, *R. rugosa L.*, *R. cinnamomea L.* and *R. webbiana L.* Their fruit aromas, due to the particular volatile oil composition, are somewhat less characteristic as the ones of the derivatives of *R. canina L.* The variety 'Karpatia' is of such origin with an average fruit weight of 6.64 g and flesh proportion of 75.8 percent *(Figure 8)*. Hips standing in groups of three and five can be picked with high efficiency (50 kg/8 h). Over matured hips will become soft and gluey.

Due to the even yields and fruit quality, the selections No.' FR.872' (2.81 g flesh proportion 66.5 percent), 'FR.874' (2.73 g flesh proportion 64.1 percent), 'KR.915' (3.28 g flesh proportion 66.1 percent) and'KR.921' (4.23 g flesh proportion 72.9 percent) can be recommended for production. The evaluation of the types with no thorns or with few thorns is under way.

Cultivation technology. Hip roses like slanting areas rich in lime. The concentration of the biotic components may be higher in drier areas. They can also be grown in areas covered with grass with regular mowing of inter row strips, with the cutting of weed shrubs, but in an intensive culture also with inter row cultivation. Rose is a plant with high light demands.

Therefore, row width can be determined as 3 m and intra row spacing as 1.2 (2270 plants/ha). When using a narrow gauge tractor, row width can slightly be reduced with the parallel increase of intra row spacing to 1.5 m. The propagation material intended for planting should preferably have their own roots, consisting of cuttings or suckers because of the reasons mentioned above. The types having no underground creeping stems can also be budded onto the rootstock R. canina L.

Rose begins to fruit in the fourth year and requires light shaping pruning till then. Starting from the sixth year, it should be given regular renewal pruning every two years. The productive life span of a rose plantation can be estimated to 15 years. Wild rose does not require regular plant protection. Of the pests aphids and rose sawfly can occur temporarily, of the diseases powdery mildew, rust, cane blight and grey mould.

Rose fruit is picked by hand. The daily output of a picker, depending on yields and on the number of thorns, is 20–50 kg. Yield potential is 5.2–7.8 t/ha depending on the variety and on the state of cultivation.

Gyula Dudás[1], Katalin Dr. Takácsné dr. György[1]

Motivation Factors for Joining Fruit and Vegetable Producer Organizations (PO) from Growers' Viewpoint

In Hungary the fruit and vegetable sectors play an important role both in the national economy and in agriculture. The favourable natural characteristics of Hungary and the traditions of production offer a good opportunity for producing high quality fruit and vegetable. The two sectors have a share of only 3.2–3.7% of total agricultural land. Nonetheless, they produce 10–13% of total agricultural production value and 17–23% of plant production. The gross production value of the vegetable sector in 2007 (expressed in current value) was near to 146.5 billion HUF and that of the fruit sector 46.2 billion HUF.

In the regulation of the vegetable and fruit sector of the European Union fresh vegetables, fruits and basic materials of the processing industry are among the least regulated products. The market control regulation prescribes only strict quality requirements meaning that on the uniform EU market it is the market competition in the first place where one has to hold his ground (Erdészné – Radóczné, 2000). Viable producer organizations (PO) are key elements of market control. In 2004 more than 1,400 POs were active in the EU coordinating about 34% of fruit and vegetable production. The European Committee wishes to increase this proportion to 60% by 2013 (Dudás, 2007).

On January 1st 2008, 58 POs were active in Hungary and 11 of these had conclusive recognition. Their number is changing as the recognition period of the POs with preliminary recognition expired on April 30th 2009 in the majority of cases. As the processes of judging the applications for conclusive PO recognition were still under way in spring 2009, the status on May 1st 2009 offers a snapshot on the changes, but a clearer picture will only be obtained after January 1st 2010. Up to May 1st 2009, 22 of the 47 POs with preliminary recognition on January 1st 2008 managed to obtain the conclusive recognition and this way on May 1st 2009 the registry of the Ministry of Agriculture and Rural Development of Hungary contained 33 POs with conclusive recognition. 4 organizations of the 47 POs with preliminary recognition terminated their activity, but at the same time between January 1st 2009 and May 1st 2009 the Ministry issued 15 new preliminary recognitions, as a result of which on May 1st 2009 36 POs were in possession of preliminary recognition. It is important to underline that among the 15 newly formed POs 9 organizations are 'filial'[2] organizations of 3 POs with conclusive recognition and therefore 6 organizations were formed which were independent from the already present organizations.

The efficiency of the POs in Hungary in the organization of the fruit and vegetable product chain is significantly lower than the EU average. The proportion of sales by PO members was 16.5% of total fruit and vegetable sales in 2007

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[2]Newly formed PO with preliminary recognition standing in cooperation with the PO granted conclusive recognition and setting up a joint sales

and therefore it is by all means necessary to examine what factors motivate growers to join POs.

The article examines the reasons for joining the POs from the point of the grower through the example of the Producer Organization 'Zöld-Termék'. An introduction of the Producer Organization 'Zöld-Termék' (a PO granted conclusive recognition) is provided, then examining its membership (based on a questionnaire survey), we tried to answer the question what factors motivated growers to enter the PO and how their expectations formed on entrance had been fulfilled.

The reasons for **joining the organization** were analysed using 9 questions. The responses received were first evaluated with descriptive statistics. According to the mathematical averages of the answers to the questions the reasons were ordered. As significant difference was discovered between the founding members and the ones joining later on in terms of age, production experience and school qualification, therefore the responses to the answers were also examined respectively for the founders and for the members joining later on. Using factor analysis we examined the latent structures behind the reasons for entrance. During the factor analysis, 7 of the 9 factors were adopted for the final model, grouped in two factors. In accordance with the entrance reasons, using the same 9 questions, we also examined the **fulfilment of the organization's objectives** and this way made a comparison of the entrance reasons with the fulfilment of the latter.

Respondents had to rank the statements on a 1 to 7 scale in accordance with the approval with the given statement or with the truth of the given statement (1= absolutely no agreement, 7=full agreement). Questionnaires were filled in during autumn 2008. Questionnaires were delivered to the members of the Producer Organization 'Zöld-Termék' personally or by post and in each case the completion was optional and anonymous. Of the 99 cooperative members 57 gave their questionnaire back at the headquarters of the cooperative meaning that the sample represents 57.5% of the membership. At the time when the questionnaire was sent out, 47 of the 99 members were founding members and 52 ones joining later on. 29 of the 47 founding members and 28 of the members joining later on answered this question. The sample represents 61.7% of the founding members and 53.8% of the members joining later on. Almost every member of the sample population is from the county Csongrád (89 members) and 10 members have their farms in County Bács-Kiskun. The members are present in 17 towns and villages.

Major characteristics of the Organization 'Zöld-Termék'

The Producer Organization 'Zöld-Termék' was established on 21st Jan, 2003 at Üllő in County Csongrád, with 61 founding members. It was granted preliminary PO recognition on 25th Aug and since 1st Jan, 2009 it has conclusive PO recognition. The membership of the organization carries out fruit and vegetable production on about 150 ha producing commodity stocks from members on an annual basis between 2,100 and 2,600 tons. The most important crops of the organization are: green pepper , cabbages, tomato, potato and root vegetables. The operation of the organization is characterized by protected cultivation (plastic mulch, unheated plastic tunnel, heated plastic tunnel and glasshouse). The proportion of the areas of protected cultivation represented 30–34% in the structure of production between 2004 and 2007, while the amount of crops coming from here was over 73% by 2007. The proportion of remuneration paid to members (protected crops) is even higher and is constantly over 77% since 2005. Approximately 60–40% of the products of the organization are sold on the Hungarian and on foreign markets, respectively. The net sales revenue of the organization was 429 million HUF in 2007 (Dudás, 2008; Dudás – Fertő, 2009).

Demographic characteristics of respondents and farming data

Applying descriptive statistics we determined the characteristic values of the average member of the Producer Organization 'Zöld-Termék'. The average member is 45 years old, has been a member of the organization for more than 4.5 years and has a production experience of 17.5 years. 77% of his sales revenue comes from fruit

and vegetable production. We also saw that the average age of the **founding members** (49.5 years) is higher and that of those engaged in production for a longer time (20.1 years), but at the same time their school qualification is lower (3.62). The members joining the organization later on (**not founding members**) are younger (41,0 years), have a less production experience (14.67 years), but their school qualification is higher (4.21) than that of the founding members.

Reasons for joining the organization

Concerning joining the organization the **most important motivation factor was the certainty of sales** as indicated by the highest average score (5.67). The second most important motivation factor is the reduction of production risk with a score of 4.63 and the third one the joint purchase of input materials with a score of 4.56. A motivational role above the medium level was registered for the coordination of production according to market requirements (4.38 scores) and by the desire to belong to a community (4.30 scores). The possibility of obtaining professional advice was among the motives below the medium level for joining (3.87 scores). **It is surprising to see that the predictability of selling prices** with its 3.77 scores **is only the 7th motivational factor**. The possibility to apply environmentally friendly cultivation methods came only just before the need for tax and accountancy advice. The former reached an average of 3.58, while the latter one of 3.48 *(Table 1).* Studying the willingness for mechanical cooperation, in a farm survey, Baranyai – Takács (2007) concluded that if there was readiness for cooperation it was significantly motivated by the aspiration to carry out mechanical works in optimal time.

Comparison of motivating reasons of founding and not founding members (ones joining later on)

Both for the founding members and the ones joining later on the most important motivational point was the certainty of sales. The same level was reached also by the desire to belong to a community (Point 5), professional advice on production technology (Point 7) and the application of environmentally friendly cultivation methods (Point 8). Compared to the founding members, the joint purchase of input materials and the coordination of production were one place backwards, respectively in the case of those joining later on (Points 3 and 4) and at the same time the reduction of production risk was the 2nd most important point, in contrast to Point 4 of the founders. Whereas the predictability of selling prices was the least important point for the

Table 1: *Motivating reasons for joining the organization, total of members*

Rank order	Motivating reason	Average	Deviation	Relative deviation	Number of elements
1	Certainty of sales	5.67	1.45	0.26	55
2	Reduction of production risk	4.63	1.83	0.39	52
3	Joint purchase of input materials	4.56	1.86	0.41	52
4	Coordination of production according to market requirements	4.38	2.02	0.46	53
5	Desire to belong to a community	4.30	2.04	0.48	53
6	Professional advice on production technology	3.87	1.93	0.50	53
7	Predictability of selling prices	3.77	1.88	0.50	53
8	Application of environmentally friendly cultivation methods	3.58	1.92	0.54	52
9	Tax and accountancy advice	3.48	2.09	0.60	52

Source: Own elaboration based on the survey

founders, it occupied the 6th place in the case of the newcomers. The founding members gave invariably higher scores to the motivational factors, except for the certainty of sales and the reduction of production risk, compared to those joining on later.

Factor analysis of motivating reasons for joining the organization

During the first run of the method all the 9 motivational reasons were included for the comparison test. In the first case the communality of the joint purchase of input materials was low (0.159) therefore it was omitted in the second run. On the second running the communality of all the 8 variables was adequate, while it would have been difficult to attribute meanings to the factors and this way the factor matrix was rotated and consequently it was only the coordination of production that belonged to both factors. After the omission of this variable, too, we managed to obtain the 7 factors subjected to the final running. From the factor analysis run for the 7 factors 2 factors were obtained providing explanation for 57.485%-of the total information content (variance) of the original variables *(Table 2)*.

Based on Kaiser-Meyer-Olkin (KMO) index and Bartlett's test a latent structure, which is suitable for factor analysis, is present behind the 7 motives as the KMO value is above 0.5 (0.743) and the value of Bartlett's test (significance) is below 0.05 (0.000). The chi-square value (9.245) and significance (0.322) show adequate fit. Based on these, the 2 factors provide a satisfactory description of the space defined by the variables. The communality of the factors obtained was invariably over 0.25, i.e. preserved sufficient information on the information contents of the individual original indicators.

In order to facilitate the interpretability of the factors the factor matrix was rotated. The first factor obtained in this way provides explanation of 30.64 of the variance. The factor comprises the tax and accountancy advice, the application of environmentally friendly cultivation methods, the professional advice on cultivation technology and the desire to belong to a community. This factor is characterized by '**openness**' as suggesting susceptibility of farmers for objectives formerly non-existent or less existent. The factor contains the reduction of

Table 2: *Information content of factors obtained from tests*

Factor	Unrotated factors			Rotated factors*		
	Eigenvalue	Variance	Cumulated variance	Eigenvalue	Variance	Cumulated variance
1	2.873	41.037	41.037	2.145	30.640	30.640
2	1.151	16.448	57.485	1.879	26.845	57.485

Note (*). In the case of a varimax rotation
Source: Own elaboration based on own survey

production risk, the predictability of selling prices and the need for a greater certainty of sales. This factor is characterized by a '**pursuit of security**'. In the case of both factors the factor weights influenced the values of the factors in the positive direction.

Fulfilment of organization's objectives based on evaluation by members

The questions set up for the analysis of the fulfilment organization objectives tried to answer to which extent the organization's goals became reality according to the founding members and the ones joining later on. **The increase in the certainty of sales was the one of the organization's objectives that was most fully achieved** (5.07). As the certainty of sales was also the most important motivational factor, therefore it can be concluded that the organization fulfilled the expectations for a greater certainty of sales. According to the judgement of the respondents, the **joint purchase of input materials** (4.33) was **the second most fully achieved goal**. Only the coordination of production, improving sales possibilities and taking the third place was another among the objectives that were achieved to a greater extent than medium (4.13). The effect of the desire to belong to a community on the feeling of security was judged as medium (3.98). According to the members, the reduction of production risk was achieved to a lesser extent (3.93), as well as the role of professional advice on production technology for the reduction of production costs (3.70). The evaluation of the efficiency of professional advice can partly be attributed to the fact that professional advice includes not only the demonstration of cost saving production alternatives, but the provision of the conditions for fulfilling phytosanitary and food safety regulations. **Selling prices did not become more predictable and the application of environmentally friendly production methods did not broaden sales possibilities** *(Table 3).*

Comparison of founding and not founding members (ones joining later on) from the aspect of fulfilment of organization's objectives

Both the founding members and the ones joining later on considered the increase in the certainty of sales as the objective that had been achieved most fully. The same level was reached also by the joint purchase of input materials (2nd place), by the coordination of production (3rd place) and by the reduction of production risk (5th place). **While professional advice on production, according to the founders, was the 4th most fully achieved objective, the newcomers felt its positive effect in a less strong manner (7th place)**. According to the founders it was the predictability of selling prices, while according to the newcomers it was the revenue increasing effect of the environmentally friendly production methods that was achieved to the smallest extent. The newcomers ascribed a more prominent position to the positive effect of belonging to a community on the feeling of safety, ranking it in 4th place in contrast to the 7th place of the founders. **Except for the certainty of sales and the predictability of selling prices, the founding members judged all the organization's objectives as achieved to a greater extent, compared to the newcomers.**

The conclusions made on the basis of the results of the questionnaire investigations can be generalized first of all to the POs in the South Plain ('Homkhát'). Further on, the research can be extended to the study of other POs (also in a different region).

The primary research carried out at the Producer Organization 'Zöld-Termék' provides clear evidence that **it was the need for a greater certainty of sales that was the strongest motivation for the members to join the PO**. The **second** most important motivation factor was the reduction of production risk, the third place was taken by the desire for the **joint purchase of input materials**. It was surprising to see that **the desire for the predictability of selling prices and the demand for**

Table 3: *Fulfilment of organization's objectives based on evaluation by members, total of members*

Rank order	Organization's objective	Average	Deviation	Relative deviation	Number of elements
1	Increase in certainty of sales	5.07	1.63	0.32	55
2	Reduction of production costs through joint purchase of input materials	4.33	1.96	0.45	54
	Better sales possibilities through coordination of production	4.13	1.71	0.41	54
4	Feeling safe through belonging to a community	3.98	1.86	0.47	54
5	Reduction of productions risk	3.93	1.50	0.38	54
6	Through professional advice on production technology savings in production costs	3.70	1.94	0.52	54
7	Assistance in administrative tasks through tax and accountancy advice	3.57	1.96	0.55	54
8	Improvement of sales price predictability	3.54	1.50	0.42	54
9	Broadening of sales possibilities through the application of environmentally friendly cultivation methods	3.17	1.91	0.60	54

Source: Own elaboration based on the survey

professional advice on production technology were among the less important motivation factors.

Based on the answers by the organization's members **the PO fulfilled the most important expectation to the greatest extent, i.e. improved the certainty of sales and through the joint purchase of input materials achieved real savings in production costs of members.** In contrast, the professional advice on production technology did not reduce production costs and the selling prices did not become more predictable, either. Nor did the environmentally friendly production methods improve sales possibilities of the members. On the whole, it can be concluded that **the PO membership did not produce the results in sales revenue and in profitability that were expected by the members, still the members judge the advantages offered by PO membership to be positive.** It means that they would be in a more difficult position without PO membership.

A PO can offer an alternative only for the farmers that are able to produce high quality products by themselves, but have limited sales possibilities. This is also confirmed by the fact that the members consider the most important PO task to consist in the provision for the certainty of sales, i.e. the establishment of trade linkages. One of the important factors among the conditions of selling, on the other hand, is the acquisition of products in sufficient quantity. The members consider professional advice on production technology to be less important which suggests that they have the necessary knowledge for production. **For the PO, on the other hand, it is indispensable to operate an efficient professional advice system**, as the organization has to observe strict regulations on regulations on phytosanitary conditions, on environmental protection and on food safety, which is impossible without the participation of growers. It is also impossible to comply with the quality assurance systems of multinational companies without the involvement of farmers.

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Apricot breeding – aims and results: 'GNT – 5/47' hybrid

Origin

The 'GNT – 5/47' hybrid is an offspring from the cross between the French cultivar 'Bergeron' and Romanian selection 'Baneasa 4/11'. Both parents have unknown origins *(Table 1)*.

The cross was carried out in the year 1992 as part of the apricot breeding program that has been conducted at the Corvinus University of Budapest, Faculty of Horticultural Science, Department of Genetics and Plant Breeding in Szigetcsép (Hungary) for several decades (Pedryc 1996). One of the most important objectives of the breeding program is the releasing of new cultivars with excellent fruit quality. Both parents are characterized by better frost tolerance than traditional Hungarian cultivars ('Gönci magyarkajszi', 'Ceglédi arany' and 'Ceglédi óriás') and a quite late blooming time, which is a highly valuable trait in Hungary, a country located close to the northern border of apricot cultivation area (Pedryc et al. 1997).

Altogether, 137 seeds were obtained from the crosses and after germination 104 seedlings were planted on their own root in spring of 1994. After the juvenile phase, they were studied over 3 consecutive years and 12 highly promising hybrids were selected. These hybrids were propagated by grafting on myrobalan rootstocks and 4 trees of each genotype were planted as microclones.

The microclones were evaluated all seasons as from 2003 and an application was made for official cultivar registration in 2008 to the Central Agricultural Office.

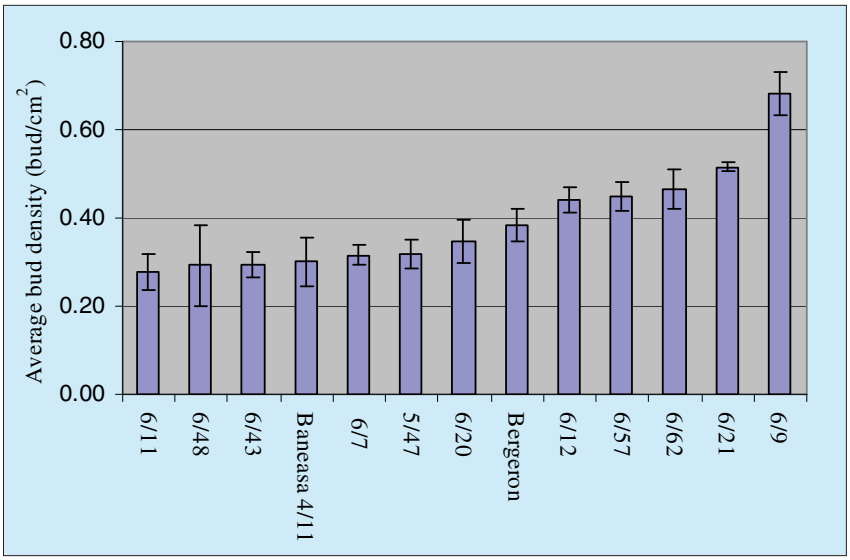

Figure 1. *Bud density of hybrids originated from the cross 'Bergeron' × 'Baneasa 4/11'*

Description of the cultivar candidate

Tree characteristics

Tree description. Trees of 'GNT – 5/47' are large, vigorous and moderately spreading, produces low density of flower buds (0.32 bud/cm2 of shoots) that are localized primarily on short fruiting spurs of 2-year-old

Table 1. *Pedigree and self-(in)compatibility of the hybrid tested and its parental genotypes*

Genotype	Origin	Pedigree	Self- (in) compatibility	*S*-genotype
Bergeron	France	Chance seedling (1920)	self-compatible	$S_C S_2$
Baneasa 4/11	Romania	Unknown	self-compatible	$S_C S_C$
GNT – 5/47	Hungary	Bergeron × Baneasa 4/11	self-compatible	$S_C S_2$

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branches *(Fig. 1)*. As compared to traditional Hungarian cultivars 'GNT – 5/47' is characterized by big-size fruit and medium productivity.

PPV resistance. The tree is susceptible to the plum pox potyvirus.

Time of bloom. At Szigetcsép, Hungary (47°N latitude, 18°E longitude and 116 m altitude) 'GNT – 5/47' full bloom occur 22 March 2008, which indicates a late flowering date among traditional Hungarian cultivars *(Table 2)*.

Compatibility properties. The flowers are self-compatible and hence trees do not require cross-pollination for considerable fruit set. In addition, it can be good pollen donor to any self-incompatible cultivars. DNA-based molecular analysis revealed an $S_C S_2$ genotype for this hybrid (Halász et al. 2005, 2007).

Figure 2. *Fruit of 'GNT - 5/47' apricot*

Figure 3. *Emasculated flowers of 'GNT – 5/47' apricot*

Fruit characteristics

Fruit size, firmness and color

'GNT – 5/47' bears large and elliptic fruit with an average weight of approx. 65 g. Fruits of 'GNT – 5/47' are also characterized by high firmness at commercial ripening, transportable, low skin cracking,

Table 2. *Blooming and maturation time in Szigetcsép*

Blooming period in the apricot orchard in Szigetcsép	Blooming time of the 'GNT – 5/47' hybrid in Szigetcsép	Maturation time of 'GNT – 5/47' hybrid in Szigetcsép
5–13 Apr 2005	9–11 Apr 2005	31 (4 d) July 2005
9–17 Apr 2006	13–15 Apr 2006	2 (4 d) Aug 2006
11–19 March 2007	15–17 March 2007	10 (4 d) July 2007
14–30 March 2008	21–23 March 2008	20 (4 d) July 2008

Table 3. *Fruit characteristics of parents and their hybrid*

Cultivar	Ripening time	Skin colour	Firmness	Size	PPV resistance	Soluble solids (%)
Bergeron	VII/3	orange	medium	middle	susceptible	15.9
Baneasa 4/11	VII/2	light orange	medium	middle to big	susceptible	14.1
GNT – 5/47	VII/2	light orange	firm	big	susceptible	14.0

Figure 4. *The experimental orchard of Department of Genetics and Plant Breeding, CUB before blooming time*

and a free stone without pit burning problems. Fruits have a light-orange skin colour *(Table 3)* with background colour space coordinates $L^* = 74.00$, $a^* = 14.12$, $b^* = 56.79$ determined with a MOMCOLOR 100 instrument (MOM, Budapest, Hungary) (Pedryc and Zana 1995). Fruits' surface may be covered by smaller or larger area of red blush ($L^* = 57.34$, $a^* = 33.13$, $b^* = 39.31$). Flesh colour is also light orange ($L^* = 69.14$, $a^* = 20.69$, $b^* = 54.78$).

Fruit organoleptic characteristics and inner content

'GNT–5/47' fruits are moderately sweet (14.0 °Brix on average from 2 years, 30 fruit/year) with an intermediate titratable acidity of 2.39 mg malic acid/100 g and consistently good eating quality. 'GNT – 5/47' fruits have a mild aroma. Total antioxidant capacity of 'GNT – 5/47' fruits falls within the values measured for the parents, while their total phenolic content was lower than both of its parents *(Table 4)*.

Maturation time

'GNT – 5/47' is characterized by a late maturation time and is harvested around the end of July, at the same time as 'Pannónia' or approx. 10 days after 'Gönci magyarkajszi' and the North American cultivar 'Orange red'.

Experimental procedure

All hybrids and their parents were examined in the experimental orchard over six consecutive years (2003–2008). Samples of 50 fruits per genotype were hand-harvested randomly for analyses (in general, 50 fruits from three trees) at the commercial maturity stage, assessed on the basis of their skin ground color (fully colored). Immediately after harvest, fruits were transported in an air-conditioned car to the laboratory, where they were carefully selected, to ensure that fruits were free of defects, and evaluated at room temperature (23 °C). Three replicates of 10 fruits each were selected for each genotype (average sample size was 3 × 10 fruits).

Table 4. *Total antioxidant and total phenolic contents of fruits*
Cultivar Total antioxidant capacity (mmol AA/L) Total phenolics (mmolGA/L)

	average	S.D.	average	S.D.
Bergeron	3.57	0.12	8.77	0.82
Baneasa 4/11	1.12	0.06	6.60	0.08
GNT – 5/47	1.51	0.07	1.81	0.04

Registration status

This hybrid was submitted for cultivar registration to the Central Agricultural Office on 24th September 2008 under the number 108810.

Acknowledgements

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Plant Tests of Freeze Drying Equipment and Operating Experiences

Nowadays, in the 21st century, there are some special quality requirements against the dried vegetables and fruits, for example stable microbiological, physical and chemical parameters, moreover production of excellent storing, packaging and transporting features. Besides these characters, the product should have the best chemical components for making functional foods and supplements. Fulfilling the above mentioned preservation demands, only a few drying methods is suitable to produce the necessary quality. The most gently and healthy way is the vacuum freeze drying.

In Hungary an extended research work has been going on to select different dehydrated fruit and vegetable powders since 2004, which are suitable for production of functional preventive and curative nutrition and supplements. The main goal is to prevent or cure some serious illness, such diabetes, osteoporoses and menopause, caused by negative hormonal change.

The shop drying equipment, applied in our experimental work, is a new method, which follows the dehydration process during lyophilisation (freezing, sublimation, post-drying), but the freezing happens not by the conventional compressor cooling unit, but with the help of an air-turbo refrigerator.

The present paper details the large capacity sublimation drying machine, examination of mass-transport, moreover introduce some special quality parameters, as the chemical components, rehydration capacity, product hardness.

Raw materials

Production of supplements happened by the following dried vegetables and fruits: broccoli, tomato, pumpkin, green pepper, colewort, carrot, cauliflower, orange, pineapple, apple, grape. In our study we should like to present the results of pumpkin (Cucurbita maxima) drying.

The production area of pumpkin is about 350 hectares, mainly in Szabolcs County (Nagydobos) and Békés-Csongrád County (*Géczi*, 2003).

The physiological effects of the pumpkin are very comprehensive. The pumpkin has a high level of carbohydrate from starch, fruit-sugar and glucose. The one part of starch changes to sugar under roasting. We can find some protein with trace fat in it. The pumpkin contains a small amount of fibre, but it is reach of vitamins and minerals. It is a considerable β-carotene source, the potassium content assures the optimal acid-base balance. This vegetable has a blood-pressure control and diuretic effect.

The antioxidants and pre vitamins (lutein, zeaxantin) restrict the free radicals, boost the immune system, and decrease confirmation of circulation and tumour diseases. The pumpkin seed contains 30-38 % oil, the curative power is due to its omega-3 fatty acid.

The measurements were executed by a regional (Nagydobos) variety, grown in Szabolcs County.

Vacuum-freeze drier

For running the sublimation drier two technical equipments are necessary. One of them is the air-turbo refrigerator. This unit can produce minus 50–130 °C range cooling demand by atmospheric air. The other unit is the sublimation equipment, which promotes the dehydration in vacuum.

In the coding process there are not any chemicals compare with the present methods, so it is an environmental protectionist and more economical technology. The main functional theory of the installation is that the cooling procedure eliminates the evaporation and compression phase. The conventional supercharger refrigerator can only produce minus 50–55 °C, but we can achieve about 85–110 °C by the developed method. The 100–120 °C hot air, leaving the equipment under running, can utilize for useful energy (for heating the drying unit), so we can realize a closed system.

The machine contains the following main parts: a seven degree axial compressor, turbo-expansion axial refrigerator, two regenerating units, three-valve hydraulic chamber, multiplicity unit and an electric motor.

The main favourable properties of the air-turbo refrigerator are:

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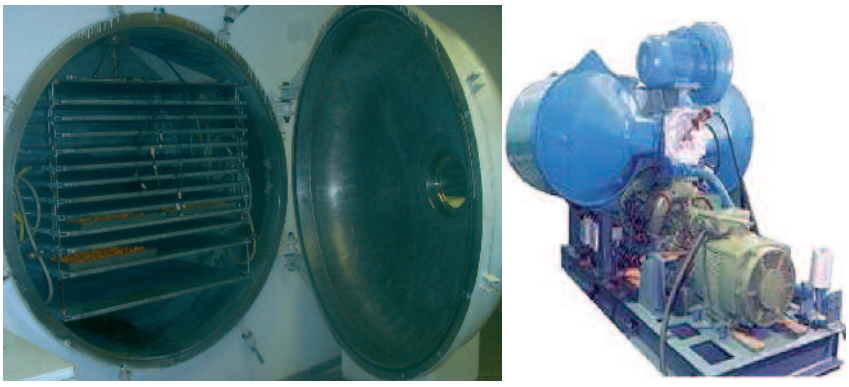

Figure 1. *Industrial lyophilising device with the additional parts*

- the unit uses atmospheric air as refrigerant and carrier agent, so the application of the machine is simple and safe;
- it does not need water for chilling the cold agent;
- the refrigeration process is generated by the direct connection with the air (cold agent) in the different objects;
- the planned nominal running parameters can be reached quickly;
- preliminary drying of the air is not necessary.

The other important part of the system is the sublimation device. This unit has two chambers for treating 160 kilograms material one by one. In this equipment you can find the turbo refrigerator, control system, refrigerant moving system and vacuum chamber system, on the branch of sublimation unit and condenser.

The working medium of the turbo refrigerator is the atmospheric air. Heating of the working space of the sublimation device and condenser can be happened by utilization of the pressed hot air in the compressor, without any plus energy.

The *Figure 1* illustrates the main parts of the lyophilisation equipment (sublimation drier, air-turbo refrigerator).

The sublimation process is realized by two phases. At the beginning the raw material goes through a quick freezing at a low temperature. During this phase the water content becomes to ice crystals. The second phase is the dehydration in vacuum: the crystal water eliminates due to sublimation (it changes to vapour on a high temperature). In this step the mass of product decreases by 80-90%, and there is not significant change in appearance and cell texture (*Antal* et al., 2009)

The *Table 1* contains the main parameters of the shop drier.

For comparing the collected data, the experimental work was also completed in our laboratory, by the ARMFIELD FT33 type vacuum freeze drying equipment.

The water content of the raw material and dried product was determined by the PRECISA HA60 type moisture control instrument. These data were very important for evaluating of the whole experimental work.

Table 1. *Technical parameters of sublimation drier*

Description	Data
Sublimation drier	
External dimension	11×8×3 m
Equipment weight	12 t
Number of working chamber	2 pieces
Surface of working shelve	11 m^2 ×2
Dimension of working shelf	1,05×0,83 m
Number of working shelve	12×2 pieces
Productive capacity of equipment	160 kg×2/cycle
Minimal temperature of shelve	–60 °C
Maximal temperature of shelve	+75 °C
Minimal temperature of condenser	–100 °C
Limit values of sublimation pressure	3000 Pa – 6 Pa
Air-turbo refrigerator	
External dimension	4,955×2,58×2,445 m
The equipment weight	4,8 t
Required power	110 kW
Speed of electric motor	3000 1/min
Cold-air consumption	3400 kg/h
Created air temperature	+120–130 °C

The electronic penetrometer

The research work included to measure some mechanical parameters of the examined biological materials, for example the hardness of the fruits. The basic theory is to press a special load head to the raw or dried material, until a determined deformation, while measuring the force and determining the maximum value of it. In this way we can measure only one point at the beginning part of the force-deformation curve. This measurement can be repeated many times at a given material, so the average hardness can be calculated at the end of the trials.

The instrument includes different size control heads, with 4, 6 or 8 mm diameters, and the deformation can be adjusted by different spacer rings (0.15 mm, 0.30 mm or 0.60 mm). Applying this method a gentle measurement (without any destruction) can be carried out at the soft and flexible materials. The successful measurement requires to apply suitable load head and spacer ring.

The portable hardness control unit includes the following parts: electronic penetration unit, measuring interface, power unit, computer, and software.

The electronic penetration device is a special construction, a spherical form, using by hand. This metal head unit contains the force measurement cell, the load head and the spacer ring (*Fekete* and *Felföldi,* 1994).

Evaluating the results, the elasticity coefficient can be calculated by the rate of the load-tension and deformation, with the following equation (1):

$$c_e = \frac{\sigma}{z}[kPa/mm] \qquad (1)$$

In the equation $\mathbf{c_e}$ is a elasticity coefficient and σ is a load tension and **z** is a deformation.

The practical use of the electronic penetrometer is shown in *Figure 2.*

Heat and mass transport processes

During the drying process one of the most important task to determine the drying diagrams (change of the water content in function of the time).

The *Figure 3* demonstrate the change of core temperature, temperature of the condenser chamber and the press (1-0,5 mbar) in the working unit, in function of the time.

The *Figure 4* shows the change of moisture level in pumpkin samples, during the laboratory freeze drying. The sublimation of moisture happened at 0,06–0,04 mbar vacuum.

The shape of the drying curve during lyophilisation is a third degree polynome, according to the calculated equation.

The shape of drying curve indicates that the drying period of the vacuum-freeze drying process is longer than the convective dehydration, because of the minor drying rate. The drying rate is determined by the heat transfer, due to the required slight heat-flux. The speed average of dehydration was 3,14 %/h in the laboratory and 2,6 %/h (percent per hour) in the plant.

Analysis of the chemical contents

The most important chemical components of the dried pumpkin samples were determined in the Agricultural and Molecular Research Institute of the College of Nyíregyháza. The results can be studied in *Table 2.*

Summarizing the completed examinations and experiences, it can be quoted, that the chemical

Figure 2. *The electronic penetrometer with pumpkin samples*

components of the vegetable lyophilized in the plant drier are better than that of the pumpkin samples sublimated in laboratory.

The main reason of it, that the vegetable was frozen very quickly on a lower temperature by the air-turbo refrigerator. In the plant freeze drier the cell walls suffered a smaller degradation by the ice crystals. Moreover the smaller drying rate was favourable to assure a relative stable structure.

Rehydration tests

The food industry has an increasing demand for dried greens and fruits to extend the selection for the market. The rehydration directs to restore the original features of the materials.

The dehydrated samples were rehydrated in 35 and 75 °C constant temperature water. The samples were taken out from the water after different period (0.5, 5, 10, 15, 30, 60 and 90 minutes), and the remained water on the surface was removed by a moisture tier

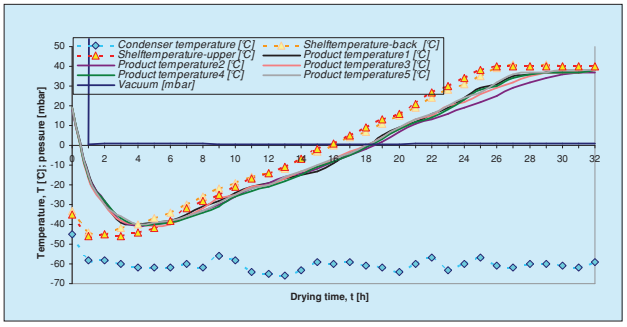

Figure 3. *Curve of freeze-drying of the pumpkin in sublimation drier*

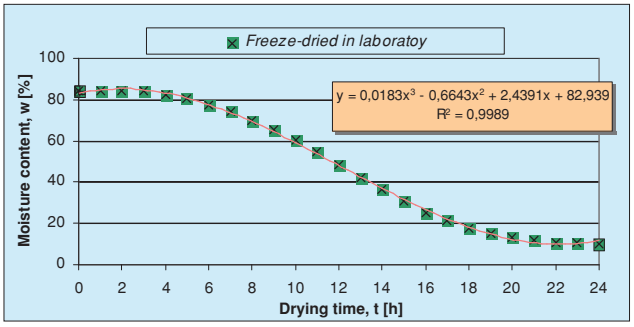

Figure 4. *Drying curve of the pumpkin samples in laboratory drier*

Table 2. *Chemical composition of lyophilized pumpkin*

Description	Lyophilized in plant	Lyophilized in laboratory
General data		
Water [%]	1,2	3,8
Protein [%]	8,8	8,2
Fat [%]	2,8	2,71
Carbohydrate [%]	70,3	62,9
Fiber [%]	8,4	7,3
Ash [%]	3	2,6
Mineral materials		
Na [mg/100g]	40,2	33,2
K [mg/100g]	1123,6	1071,3
Ca [mg/100g]	127,4	123,5
Fe [mg/100g]	2,9	2,8
P [mg/100g]	330,5	314,3
Chemical items		
Total-carotene [mg/100g]	30,1	25,4
β-carotene [mg/100g]	26,2	20,3
Cryptoxanthin [mg/100g]	2,1	1,3
Nicotinamide [mg/100g]	8,5	6,2
Ascorbic acid [mg/100g]	77,6	52,1
Carbohydrates		
Glucose [g/100g]	22,2	20,7
Fructose [g/100g]	23,3	21,9
Saccharose [g/100g]	25,4	20,8

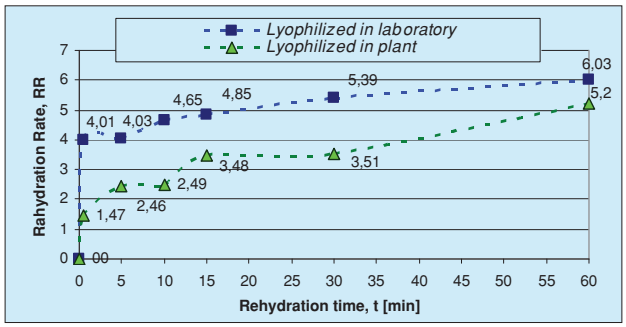

Figure 5. *Rehydration curves of the dried pumpkin at 35 °C*

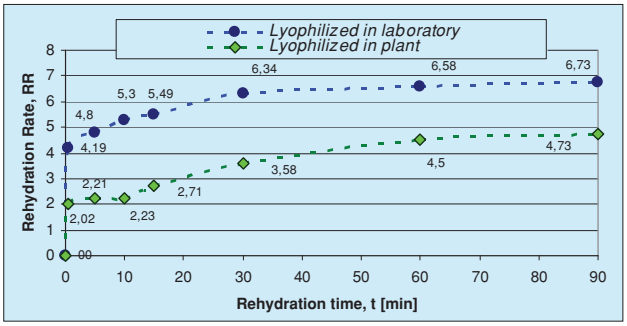

Figure 6. *Rehydration curves of the dried pumpkin at 75 °C*

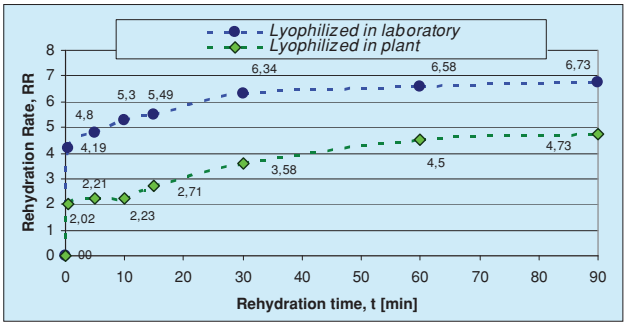

Figure 7. *Change of surface hardness of pumpkin*

paper. We measured the mass of the samples before and after rehydration by an electric balance (KEREKES et al., 2008).

The *Figure 5 and 6* illustrate the change of rehydration rate of the dried pumpkin.

The rehydration tendency can be determined by the rehydration rate (RR) of the dried product. The rehydration rate can be calculated in the following way (2):

$$RR = \frac{m_{rh}}{m_d} [dimensionless] \quad (2)$$

In the equation is a **RR** rehydration rate and $\mathbf{m_{rh}}$ is a mass of the rehydrated sample and $\mathbf{m_d}$ is a mass of the dried sample.

On the figures you can notice that the samples lyophilized in laboratory have a higher rehydration rate than the pumpkin dried in the special large capacity freeze drier. Moreover it is true, that the value of RR is increasing at a higher temperature of the water. We experienced that the rehydration rate did not change significantly after 60 minutes.

The *Figure 7* summarizes the value of hardness of pumpkin, in raw state, after drying and rehydration.

The hardness tests of the product also supported our experiences that the surface of the material dried in the large capacity freeze drier was more flexible and softer comparing to the surface of sample dried in laboratory. But the rehydration tendency of the experimental material was the opposite, the laboratory samples could be rehydrated better than that of the vegetable dried in plant.

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Winning Nobel Peace Prize

In 1988 the WMO and the United Nations Environment Programme (UNEP) set up the Intergovernmental Panel of Climate Change (IPCC). The objective of the IPCC is to provide politicians with a summary evaluation of climate change, of the causes and probable consequences, on the possibilities to prepare for the consequences and to prevent or mitigate climate change. The Panel acts as a bridge between science and politics. From its foundation to today, IPCC has compiled four Assessment Reports, the last one in 2007. According to the Fourth Assessment Report, climate change is already present and if there is no reduction in the emission of greenhouse gases, serious consequences might be expected by the end of the 21st century.

The compilation of the Fourth Assessment Report was carried out in four working groups. The first working group (WGI) dealt with global warming up, climate change and its causes and the second working group (WGII) dealt with the possible consequences and with the possibilities of adaptation and the fourth working group (WG III) with the possibilities of cutting or limiting atmospheric emissions responsible for global warming. All the three working groups prepared a report of hundreds of pages. A short Technical Summary (TS) and an even shorter Summary for Policymakers (SPM) were prepared on the most important conclusions by each working group, respectively. The assessment of the three working groups is summarized by the Synthesis Report (SYR). The scientific credibility of the reports is very important. Therefore, the working groups, in their reports, use peer-reviewed scientific articles put through a strict scientific screening and prior to finalization the reports are subjected to a review process consisting of several stages. In the first stage the authors of the reports themselves make mutual observations, in the second stage the observations are made by outside expert reviewers called upon and the third stage is assisted also by policymakers. The authors of the reviewers have to give relevant responses to each observation, one by one and that this task is done is controlled by reviewers. The discussion and the approval of the most important document of the Fourth Assessment Report, the report prepared for policymakers (SPM), take place in the presence of the government representatives of the IPCC member states in an open session. The draft of the report is discussed going from row to row and its approval requires the joint the common will of all present. Together with the Assessment Report a series of other special technical and methodological reports have also been prepared.

The Fourth Assessment Report played a strong role in the awarding of the Nobel Peace Prize 2007 to the IPCC, shared with Al Gore, according to the prize committee 'for their efforts to build up and disseminate greater knowledge about man-made climate change, and to lay the foundations for the measures that are needed.'

The compilation of IPCC Fourth Assessment Report was carried out with the participation of three Hungarian researchers. Béla Novák, assistant professor of the Szent István University, was a coordinator-author of Chapter 12 Europe of the second working group, Ferenc Tóth L. from the Corvinus University, currently expert of the International Atomic Energy Agency, was a leading author of Inter-relationships between adaptation and mitigation Chapter 18 Inter-relationships between adaptation and mitigation and Diána Ürge-Vorsatz professor of the Central European University (CEU) was a coordinator-author of Chapter 6 Residential and commercial buildings of the third working group. Zoltán Somogyi, scientific vice director of the Forest Research Institute was an author of Volume 4 of IPCC Guidelines for National Greenhouse Gas Inventories.

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