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„Ph.D. dissertation”

**ANALYSING THE STATUS OF FRUIT PRODUCTION IN THE NORTH GREAT  
PLAIN REGION**

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## INTRODUCTION, OBJECTIVES OF THE RESEARCH

The *objective* of my dissertation is to analyse the status of the *Hungarian horticultural sector*, especially that *fruit production*, examining development and market possibilities in the North Great Plain Region.

Our temperate climate *provides possibilities to produce excellent quality fruits*. However, in past decades we have not exploited this opportunity. The sector can calculate with significant losses due to our EU membership. The *dismissed workforce* inflicts a significant burden on Hungarian society, and *one option to solve this problem* is the expansion of *labour-intensive agricultural sectors*, primarily that of vegetable and fruit production. The development of the horticultural sector is *also an important element of rural development*.

The *production* of the fruit sector has *significantly decreased* after the change of regime due to *compensation*, the *loss of export markets*, *privatisation* and *lack of capital*. The current situation calls for rapid modernisation and increased competitiveness. In order to exploit opportunities in the sector, it is *necessary to resupply the hundreds of billions of HUF capital* that has been taken from agriculture (including horticulture) in the past years and so agricultural production can reach levels that of 1988 at least.

European Union accession is a great challenge for Hungarian horticultural production, but it is also an opportunity that we could not imagine before. *The development of fruit production fits well into the modernisation programme of agriculture*, it provides a method for the production of essential food products, and being a hand labour intensive sector it can also *sustain employment levels and provide sufficient incomes for producers*. Agriculture has an outstanding place in the instrument system of regional development. Hungary is poor in natural resources, but its conditions for agricultural production are excellent. *Natural conditions allow the production of unique products, typical of Hungary in a number of agricultural regions*.

Following the change of regime, economic development and the stabilisation of markets happened differently in the various regions. Based on statistical data, from the seven regions of Hungary, the North Great Plain Region is one of the most underdeveloped region. I have examined *development possibilities in fruit production in order to ensure sustainable development in the region* and to reduce underdevelopment.

The main objective of my dissertation is to introduce the role of fruit production in the North Great Plain Region, as well as its role in the economy, employment, export, investment and regional development. *My objective is to reveal the strengths and weaknesses of the sector by assessing its current status and to develop suggestions for the success of the sector by considering natural conditions and the economic environment.* My objective also includes the examination of opportunities in growing various fruit types from an economic point of view along with possible economic hazards, *to identify economically important types and varieties, their optimal growing area and the technologies to be applied* for competitiveness.

I examined the need for specific technological investments, the rate of return and the effects of application on profitability and the sector as a whole. *I am going to make suggestions for the development of our domestic and export markets and for sustainable fruit production.* My main objective with the preparation of the dissertation, is to evaluate ongoing tendencies in the sector and to identify those development priorities which determine the profitability of the sector over the long term and at a macro level. *I also aimed to provide an evaluation with my dissertation that is suitable for application to promote the sustainable development of our country and applicable for regional policy.*

## **MATERIAL AND METHOD OF THE RESEARCH**

Firstly, I examined the general status of Hungarian fruit production in my dissertation. I revealed the role of the North Great Plain in the sector. *I examined the distribution of various fruit types in the region, the habitats of main fruit types according to type, their cultivation technology* and the application of other methods that ensure the success of production. I compared these to the national average, in some cases to European Union averages. I examined the processes of domestic and export markets, prices and the production of the processing industry.

*The information basis of my research comes from the census and publications of the Hungarian Central Statistical Office.* I relied on the general census publication of 2001, on Regional Statistical Annuals, Agricultural Statistical Annuals and the database of County Annuals by the HCSO when preparing the evaluations. I examined those plantations in the evaluations which are classified as ones by the Hungarian Central Statistical Office, such as „area of 1500 m<sup>2</sup> or greater with trunked fruit trees and area of 500 m<sup>2</sup> or greater, which

consists of a single fruit type and was planted in one year”. I also used the publications of the *Hungarian Vegetable and Fruit Product Council*, which precisely include the market price of fruits according to type and month. I also reviewed the publications of the *Apple Product Council* to observe domestic and international tendencies of our main fruit product. I also made *in-depth interviews to gain knowledge* from professionals in the region and their remarks regarding the sector. *I prepared SWOT analysis in the evaluation and assessment*, where I analysed separately and collectively the strengths and weaknesses, possibilities and dangers.

During the evaluation of the database I used various economic and statistical methods. I analysed the location, structure, type and variety distribution of fruit plantations with *regional and distribution relative numbers* along with the technological standard. I *examined relationships between income and domestic fruit consumption* in regions with different development levels by using *correlation calculation*. I *analysed* the formation of producer price indexes of agricultural products, especially that of fruits, by using *regression analysis* based on the principle of smallest squares, and the changes of industrial product prices applied during production.

I applied economic methods to examine the investments of apple plantations. *I applied the indicators: investment return, investment efficiency and return rate*. I developed my own model to examine relationships between machinery harvest and profitability.

## MAIN FINDINGS AND RESULTS OF THE DISSERTATION

### Hungary's fruit production

The agricultural area of the country was 6122 thousand hectares in 1994, 1.5% of which, 92.7 thousand hectares were utilised as orchards. The agricultural area decreased to 5863.3 thousand hectares, by 259 thousand hectares in the past 10 years, while the area occupied by orchards increased by 10.6% or 9900 hectares. *Fruit production occupied 102.6 thousand hectares and 59.819 plantations in 2004, the total harvested fruit yield was 724 thousand tonnes.*

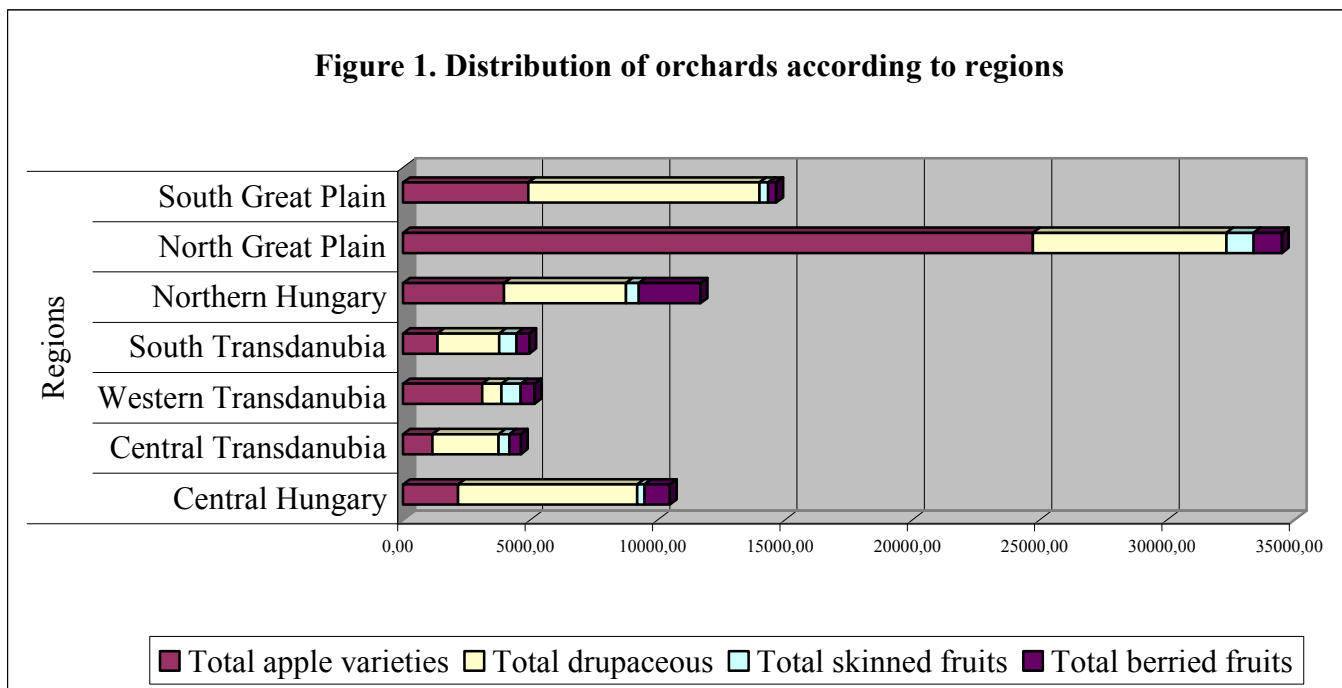
The total production value produced from all harvested fruits was 44.9 billion HUF in 2003, which is 3% of the total agricultural production and 5.8% of plant production and horticultural production value.

When examining export, we find that the ratio of proceeds from the foreign trade of agricultural and food industry products decreased from 17.4% to 7.5% from 1996 to 2003, while *proceeds of fruit export decreased by 26%*. 1.1% of the export proceeds originated from fruit export in 2003.

### Fruit production of the North Great Plain

In the North Great Plain Region, fruit production occupied 38.7 thousand hectares in 2003. It is our most important growing region, which makes up almost 40 percent of the total fruit production area. *The North Great Plain Region has the largest fruit production area of all the regions, over twice as large as the one in the South Great Plain Region and three times the size of the one in the North Hungarian. 87.5% of the plantations in the region are located in Szabolcs-Szatmár-Bereg county. 59.7% of apple varieties and 62.1% of the total apple growing area can be found here. 22.2 % of drupaceous plantations, 26.5% of skinned and 17.5% of berried fruits are located in the North Great Plain Region. The fruit occupying the second largest area is sour cherry, the ratio of which from national sour cherry plantations is 37%. The ratio of apple plantations within the region is 69.9%, while sour cherry is 13.7%.*

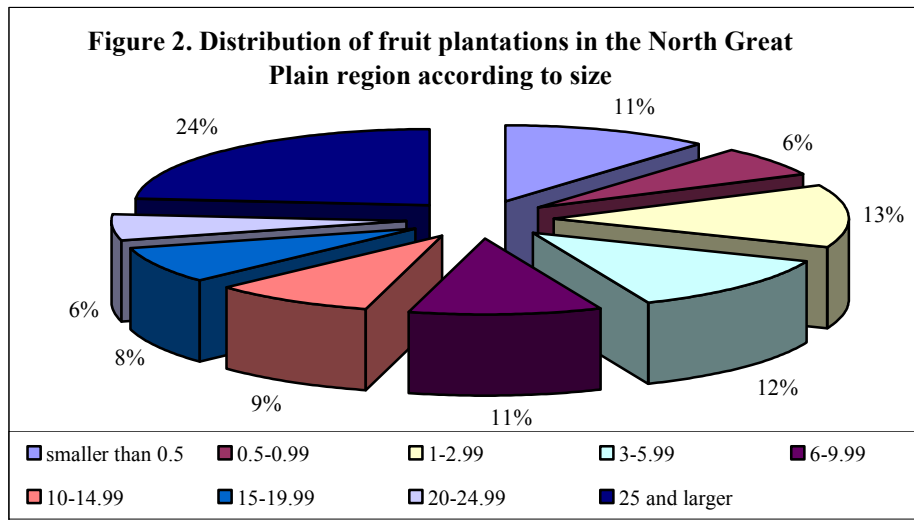
The regional distribution of fruit production areas is illustrated in figure 1.



Source: Own illustration based on HCSO Fruit plantations in Hungary, 2001

The distribution of fruit types is very different *within the region*. The number of plum and walnut plantations, beside apple and sour cherry plantations, are considerable. The role of private farms in the utilisation of orchards is significant in the North Great Plain, which occupy 80% of the area and 85% specifically in Szabolcs-Szatmár-Bereg county.

According to the publication entitled „Fruit plantations in Hungary, 2001” by the Hungarian Central Statistical Office, published in 2002, there are 1546 fruit plantations in the region; the distribution according to area size is illustrated in *figure 2*. 24% of the total fruit production area are 25 hectares or larger plantations and 11% are smaller than 0.5 hectares.



Source: own calculation based on HCSO data

*The role of agriculture in retaining the population of the North Great Plain Region is more powerful compared to other regions and will remain so over the long term, in fact considering EU tendencies, it could gradually strengthen. However, increasing employment in agriculture cannot be expected, since the development of knowledge and labour intensive sectoral structure significantly depends on external sources and the self-organisation of workers in agriculture as well.*

*The fruit production of the region is outstanding in the national average. I analysed those fruit types in my dissertation, which occupy over 15% of the growing area. These are the following: apple, pear, cherry, sour cherry, plum, walnut, European blackberry, gooseberry, strawberry.*

### **Development possibilities of fruit production**

*Agriculture is in the most difficult situation from the macroeconomic sectors since the beginning of the XX. century. This process began and is ongoing since the great geographical discoveries, as with the utilisation of the north and south American as well as the Australian production areas, the quantity of produced agricultural products significantly increased. The increasing global population is not a way out for the sector, since the developed world, where lasting overproduction occurs cannot produce at prices that would satisfy the requirements of the underdeveloped areas. In order to avoid overproduction, these countries are pressured to cut down their production. Increasing production scales and introducing integrated technologies can make production economical. The consequence of such developments in*

production can aggravate problems in agriculture, since *an increase in product price levels cannot be expected* due to overproduction. In countries where land ownership status is limited, or property acquisition is not allowed for foreigners and legal entities (e.g.: Hungary) significant government support is needed to make production sustainable.

On the basis of these it can be said that the following developments are required to achieve market success:

- changing variety and type structure;
- increasing farm size and improving competitiveness;
- cutting out old plantations and replacing them with new ones;
- increasing storage capacities;
- increasing domestic fruit consumption;
- organisation of integrated production;
- making agricultural market information system efficient;
- increasing the concentration of Co-operatives;
- loans for land mortgage.

### **Allocating optimal micro districts**

Growing area includes natural and economic environment. Ecologic conditions have to be considered during the establishment of plantations: height above sea level, relief conditions; climatic and weather factors; soil characteristics; natural plant cover and presence of plant cultures.

Climatic conditions are decisive when selecting growing site: *light; temperature; precipitation and wind*. With the evaluation of these data, we can decide whether an area is suitable for fruit production or not. Economic environment is also significantly important beside environmental conditions. *It makes sense to consider the labour force environment, the distances of market and processing capacities, infrastructural supply and the degree of production integration.*



## **Variety and type structure, foliage forms and the development of cultivation technology**

*Apple is the most significant fruit of the North Great Plain Region. Currently, the old age of plantations is a problem but it can also help in replacing outdated variety and type application. The most popular subject in Hungary is MM106, which can be found on 33.2% of the plantations. The ratio of the M4 subject is also significant, which has a share of 27.5%, then M9, and the wild variety with a share of 15-15 percentage. The subject application of the North Great Plain Region is similar to that of the national. The dominance of the Jonathan apple can clearly be detected in Hungary. It has a 55% share in national production. The significance within the region exceeds the average, since 62% of the apple production is Jonathan. This is followed by 13.4% of the Red Delicious variety, then 10.1% of the Golden Delicious. The disadvantage of the Jonathan type is expressed primarily in the fact that the size of the fruit is small or medium, which is not really favoured on current markets. Types that are marketable and known have to be favoured in the future. Such plantations have to be established, which are suitable for intensive production and can produce 50-60 tonnes/hectare yield average with the application of modern technologies.*

*Sour cherry is the second most important fruit of the region. The subject choice is primarily determined by technological aspects, since machinery harvest requires suitable foliage and a subject with a strong structure. The subject type has to be selected according to the planned method of harvest and use.*

*The most important criteria in type selection is satisfying market requirements in the most versatile way, whether it is for fresh consumption or industrial use. Quality requirements depend on the nature of consumption. Types suitable for industrial use: Érd jubilee, Érd bountiful, Dwarf cherry types, or the Debrecen bountiful. The most suitable types for fresh consumption are the ones with a size of at least 20 mm and weigh at least 5-6 grams. Types suitable for fresh consumption: Érd large fruit, Pyramid, early Meteor. More focus should be placed in the future on types that ripen between 25<sup>th</sup> June and 5<sup>th</sup> of July, since we can gain competitive advantage against Polish sour cherry this way.*

## **Frost protection**

Winter and spring cold can inflict significant damages on plantations. Three times in ten years, significant *yield loss occurs due to frost damage* in Hungary. *Therefore, frost protection has significant economic effects.* Distinction can be made between mechanic and chemical frost protection. *Chemical frost protection can delay spring flowering by about a week through autumn spraying.* Frost protection irrigation has an important place among mechanic instruments.

*Appropriate protection against winter and spring frost is significantly important to achieve quality fruit production in the future.* In an intensive apple plantation, where 40 tonnes/hectare yield average is produced, a 30% yield loss due to frost damage can result 1560 thousand HUF loss, calculated at 130 HUF/kg average market price.

*A number of frost protection techniques are known, such as paraffin candle, air shuffle and the technology of rain-like irrigation. Characteristics of micro climate should be of primary importance when choosing the suitable technology.* In areas, where *spring frosts are frequent, the most appropriate solution is establishing rain type irrigation.* The significance of this is outstanding, because it could also be used for other purposes. The paraffin cans should be used in areas where frosts rarely occur. The air shuffle technology is suitable for protection against reflected frost and frost on plain areas.

## **Integrated production**

*Environmental protection* was revalued with our accession to the European Union, the requirements of which were reflected in agriculture as well. *The environmental protection tasks defined by the Union are planned for implementation in the National Agricultural-Environmental Protection Programme (NKAP).*

This programme defined the following in its objectives:

- The introduction of such technologies is required, that increasingly protect the environment, preserve our natural resources, the landscape, soil and water resources.
- Production of competitive products, - thus increasing export and profitability – which can have an effect on improving the establishment of alternative income sources.

*The objective of integrated production is to reduce the number of chemical interventions with the application of various tools and ultimately the degree of chemical residues but without damaging the quality of the fruit. Health consciousness plays an increasing role in the shopping habits of consumers, and they are willing to pay more for such a product that was produced among controlled circumstances. Beside this, the system could be considered as a type of PR (Public Relations) activity the producer considers other living organisms during production and thus positioning himself on the market. Considering these tendencies it can be said that fruit free of health hazardous substances is a new category in quality.*

## **Storage**

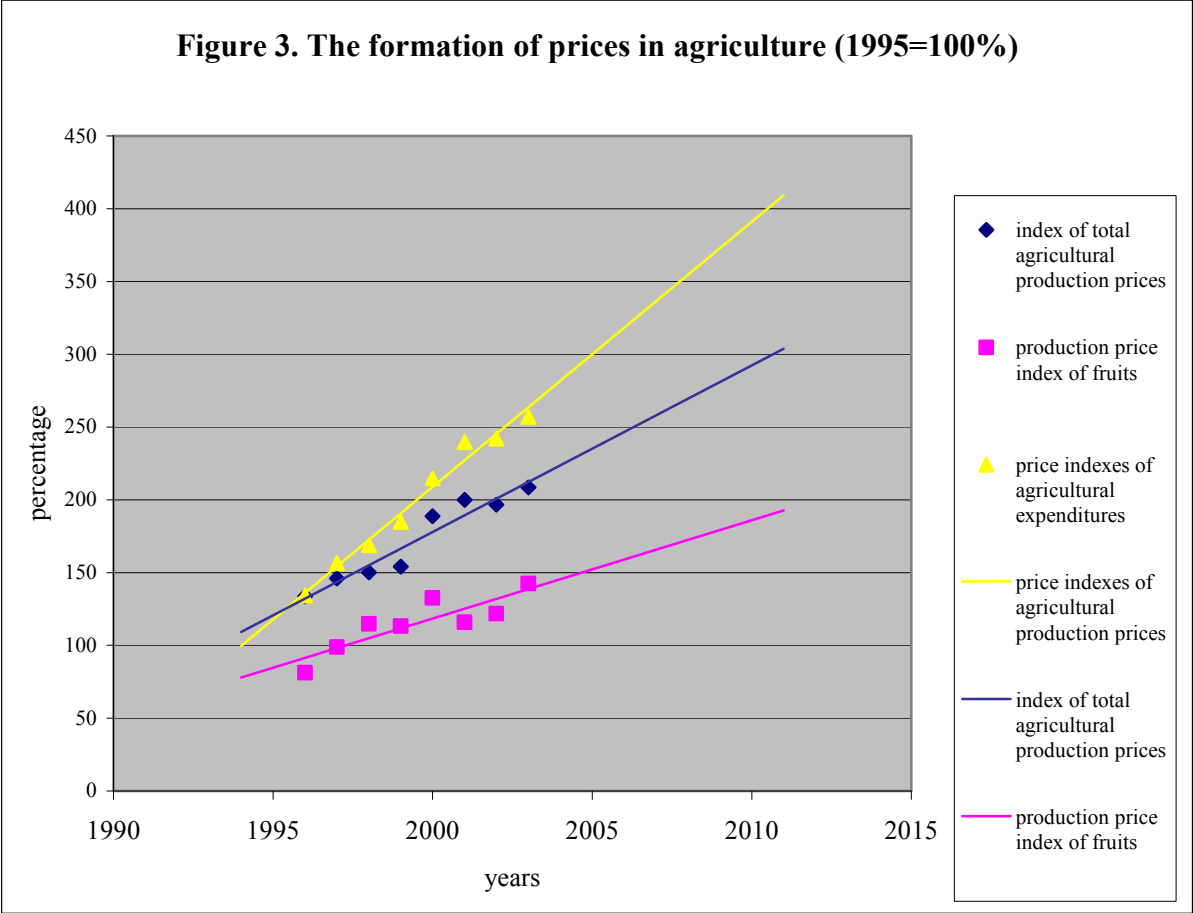
*Storage is an especially important economic issue in the case of apple, pear and plum, since extra profit can be achieved with fruits sold during the winter period. Therefore, the development of storages is a significantly important issue for the entire sector.*

In the case of apple, Golden Delicious, Jonagold, Idared, Fuji and Red Delicious types can be stored well. *Increasing the length of storage and minimising losses during storage are especially important economic issues.* Our storage capacity consists of fixed atmosphere and controlled atmosphere (ULO) storages. In ULO storages, the content of the air can also be controlled, setting the appropriate O<sub>2</sub> and CO<sub>2</sub> levels. *Apple types can be stored for a relatively long period of time.* The main difference between apple and pear, is that the latter requires *post ripening* after cold storage. This can last for even two weeks in some cases, through gradually increasing the temperature. From the drupaceous fruits, *cherry can be stored for a couple of weeks while sour cherry can be stored up to a month. The storage time of plum is much longer, it can reach up to 2-3 months,* but choosing the optimal time of harvest is especially important, since it does not ripen in cold storage thus the expected profit cannot be achieved due to the quality of the product. Skinned fruits do not have to be stored in cold storage, dry place is perfectly suitable.

## **The profitability of fruit production**

In horticultural production, similarly to other enterprises that compete on the market, the establishment of income conditions is important which depends on the method of production, the prices of the competition, the market and the produced quantities. *The prices of agricultural products has been stagnating and does not increase over the long term.* A reason

for this is the increasing efficiency in production and the established market supply. *However, this process is the opposite regarding technical products which are used in agriculture.* This is illustrated in *figure 3*.



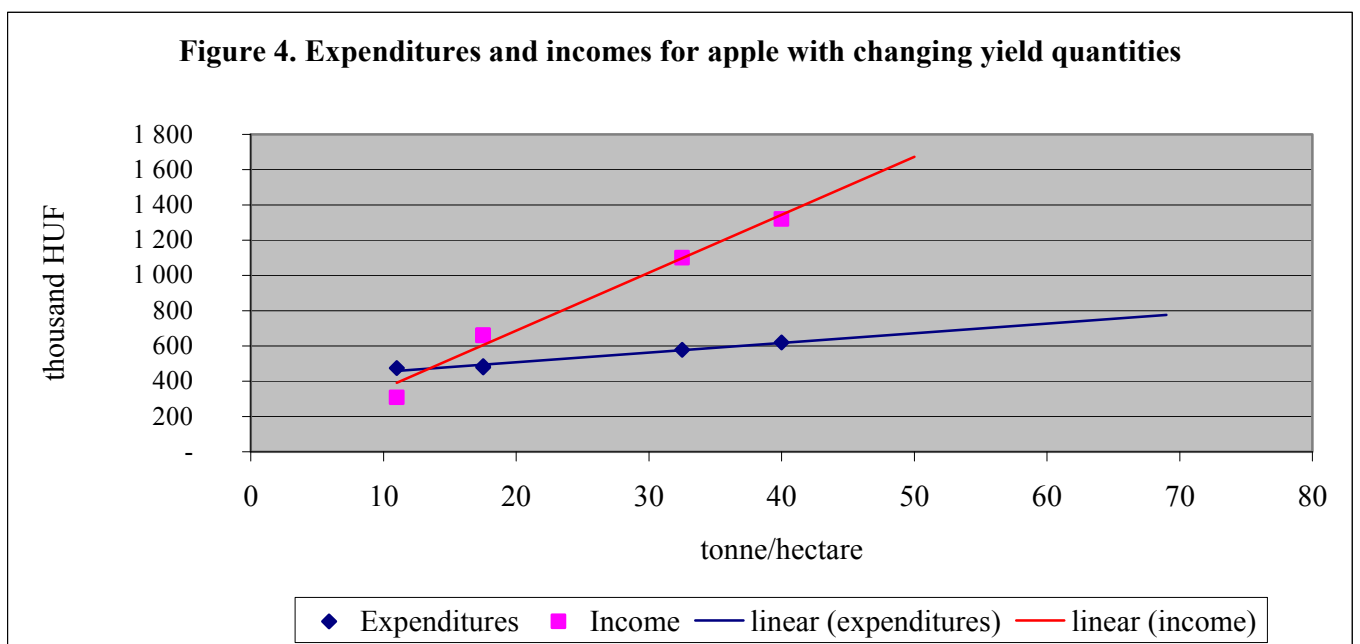
Source: Own calculation base on HCSO data

The figure displays the formation price indexes of agricultural products, fruits and expenditures. The price level increases less in the case of fruits, price index differences between fruit and agricultural expenditures is greater, which can greatly influence the success of production in the future. The slow increase of producer price indexes of fruits is supposedly due to the standard of apple production.

### *The profitability of apple production*

*Currently, the establishment of a modern plantation, equipped with a supplementary and irrigation system, including the labour of the first 3 years, costs around 6.2 million HUF per hectares. This relatively high value returns faster and safer than with a traditional plantation. Expenditures do not increase significantly with intensive cultivation, and so the production cost of 1 tonne of apple decreases. With the establishment of modern foliage structures, the costs of harvest significantly decreases, its efficiency increases, along with an increase in yield quantities.*

In this work phase, the utilised hand labour makes up the significant part of the expenditures. While in the case of *traditional foliage structure*, 20 and 40 kilograms of apple can be harvested per hour, in the case of *slim reel* this could reach up to 100-130 kilograms. The formation of expenditures and incomes in the function of yield quantity is illustrated in *figure 4*.



Source: own illustration

*The breakeven point is around 15 tonnes/hectare, which means that production is not profitable below this yield level. The income increases by 32858 HUF per tonne. Among current market conditions, the dominant portion of the yield is processed in the industry, which significantly decreases incomes. In 2003, our total apple production was 508 thousand tonnes, 85% of which was utilised as juice (concentrate) or as dried fruit. The modern slim*

and free reel foliage forms of intensive plantations can return, since the average yield quantity multiplies due to high plant density while harvest costs increase to a much smaller extent. With the evaluation of statistical data, I have found that *producers often prefer lower plant density, traditional foliage forms during the investments of a plantation*. I used three indicators for the explanation, which are as follows:

- *Return of investment*:  $Mt = B/Tj$ , where  $Mt$  is return,  $B$  is the total investment,  $Tj$  is the average, annual profit.
- The *efficiency of the investment*, the formula of which is  $H = Tj/B*100$ , displaying how much HUF profit can be expected with an invested 100 HUF annually.
- The *return rate* displays how many times does the investment return during the operation of the plantation. Formula:  $Mf = \acute{E}t/Mt$ . (I used 30 years of operation for the plantation)

Table 1 displays the formation of this, where total investment includes costs occurring until the actual yield is achieved. The indicators are values calculated from first yield.

Table 1.

**Investment costs of apple plantations and return indicators according to cultivation system**

Method	Total investment (B) (HUF)	Annual average profit (Tj) (HUF)	Return (Mt) (year)	Efficiency of investment (profit per 100 HUF investment) (H)	Return rate (Mf)
Traditional	603 600.00	252 560.00	2.4	41.8	12.6
Yield reel	741 500.00	541 200.00	1.4	73.0	21.9
Hedge	1 004 800.00	541 200.00	1.9	53.9	16.2
Free reel	3 620 000.00	902 000.00	4.0	24.9	7.5
Slim reel	4 903 000.00	1 082 400.00	4.5	22.1	6.6

Source: own calculation based on on-site survey

When examining these data, we find that the *economic environment does not promote the development of competitive cultivation systems*. Reasons for this include land market regulations and unrealistically low land prices. In those developed countries, where the price of land is high, direct costs of plantation make up lower portion of the total investment. *Due to low land prices, the dominant portion of the investments in Hungary is made up of technological investments which ensure the success of production*. I also made the calculations by considering a land obtained prior to the investments for both Hungary and, as

an extreme example, for Germany, Bavaria. *When examining the two examples, the Hungarian situation becomes more understandable.* The price of land is 1.000.000 HUF in Hungary and around 20.000.000 HUF in Bavaria if converted. In this case, the traditional production form returns in 6.3 years, while slim reel over the course of 5.5 years. In Germany these two indicators are 81.6 and 23 years. It can clearly be seen that *the lack of land market leads producers to operate at lower technological standards.*

In order to reverse current market trends, focus has to be placed on quality. *The fresh market share of domestic apple has to be increased, which could result the multiplication of incomes.*

The other apple type fruit of the region is *pear*. Altogether 2047 hectares of plantations exist in the country, and 354 hectares can be found in this region. *Traditional foliage form dominates among cultivation methods for pear as well, which produces 16.6 tonnes of yield per hectare on average.* The processing industry utilises small quantities, the canning industry purchased 1.4 thousand tonnes in 2003 for producing concentrate at an average price of 95 HUF. The remaining quantity was utilised on export and domestic markets as fresh fruit. *The average producer market price is 238 HUF per kilogram, which is the same as two years ago.* According to market trends, 57% of the fruit is purchased by the processing industry, the remaining amount is sold on fresh and export markets. The investment cost of the plantation, considering traditional plantation, is 2.3 million HUF and the expected income is around 600 thousand HUF annually. *From the import quantities we can conclude that deficiency is present on the market and further pear plantations could be profitable.* Regarding quality, *sales could significantly be increased from pears larger than 70 mm both domestically and on traditional export markets.* We export primarily to Slovakia, Slovenia and Austria.

#### *The profitability of cherry and sour cherry production*

The yield quantity of *cherry* has decreased significantly in the past few years and import increased in parallel.

190 hectares of cherry plantation can be found in the North Great Plain Region, where 4-5 tonnes/ha is harvested annually on average. The ratio of high plant density, intensive plantations is low, altogether 1 hectares. *The average plant density* in the cherry plantations of the region is *288 trees per hectare*. If we compare it with the plant density of western-European, intensive plantations then it is far below since plant densities can reach 2800 there. *The average purchase prices stagnate and form around 130 HUF/kg from one year to the next.*

Regarding *sour cherry* plantations the overall picture is somewhat more favourable. *Plant density in the region is around 416 trees per hectare, which produce 5-6 tonnes/hectare yield on average.* Profitability is greatly damaged by the lack of machinery for harvest. Compared to the national technical standard the North Great Plain Region is very underdeveloped. While 53.7% of total sour cherry plantations are harvested by hand, 27.2% with machinery and 19.1% mixed then these values are 82.7; 1.3; and 16 percentage in the region. The average yield in the region was 6.8 tonnes per hectare, the cost of hand harvest was 258400 HUF, which indicates a 38 HUF harvest cost per kilogram. One person can pick 12 kg of sour cherry per hour, which means that *900 work hours are needed for harvesting one hectare of yield.* Machinery harvest could significantly increase efficiency, since the a *Kilby shaker can harvest a hectare in 7.5 hours with the employment of 3 or 4 people.* In this case, the harvesting of 1 kg sour cherry costs 2.2 HUF with salaries and energy consumption. *Obtaining such machinery is costly and has a long return period.* The machinery investment would make a fast return if many farmers would buy a machine in collaboration. Among current property conditions, we rarely come across such plantations where without the coordination of surface size and type constitution, investments would return. The ripening of sour cherry lasts from 3<sup>rd</sup> June to 20<sup>th</sup> July, so the *size and type association has to be established to fully exploit the machinery in the meantime.* Table 2 displays such type association with the optimal size of the plantation that enables full exploitation of machinery. Table 2.

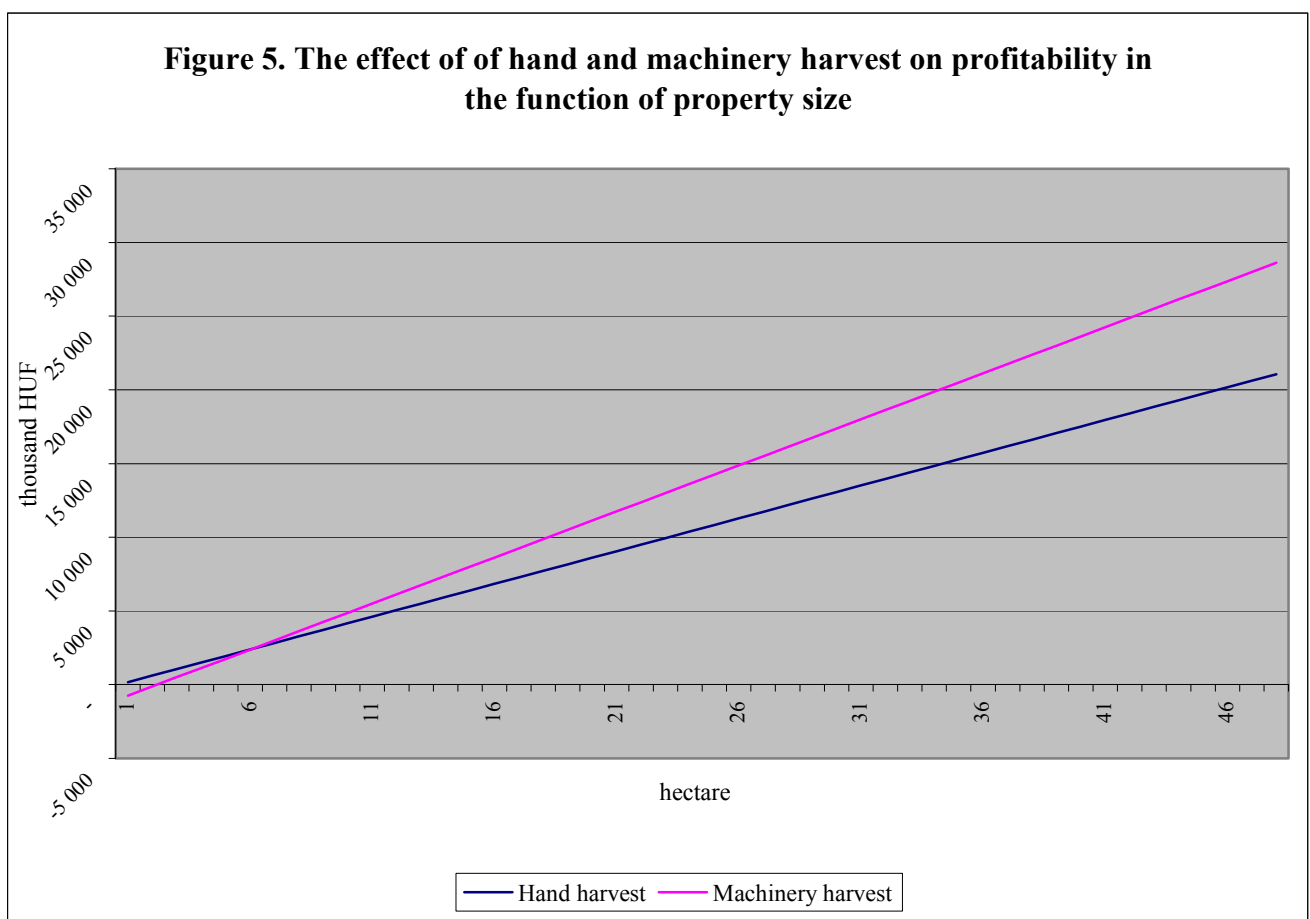
**Recommended type association and growing area (hectare) for efficient machinery harvest**

Possible type sortiment	june						july				hectare
	5	10	15	20	25	30	5	10	15	20	total
Érd jubilee			0	5	5	5					15
Maliga recollection						0	5	2			7
Debrecen bountiful								3	5	2	10
Újfehértó ringleted										3	3
Total	3	5	5	5	5	5	5	5	5	5	33

Source: own compilation based on professional publication data



Income increases significantly with the application of machinery harvest, but in order to make a return for machinery investment, it has to be operated for a long time. I prepared my calculations by considering the fact that *machinery harvested sour cherry is strictly for the processing industry at lower prices and the machinery is operated for 30 years*. If the machinery is bought based on the previous model, and its purchase price is 40 million HUF, upon examining the cumulated incomes it can be found that obtaining such machinery will make a return by the sixth year and then, only costs of maintenance have to be bore by the producer. Profitability is displayed in *figure 5*. It is clear from the figure that *below 7 hectares and considering 30 years of use, the machinery investment does not make a return at all and propety sizes below this results in loss*. In the interest of profitability in the sour cherry sector, it is *important to increase property sizes or producer organisations should purchase machinery and harvest on their planned type sortiment plantations*.



Source: HCSO data, own calculation based on technical description of Kilby shaker and on-site survey

### *Profitability of plum production*

The yield quantity of Hungarian *plum* is stagnating, which is around 80 thousand tonnes annually. For many years there has been a problem with the size of the fruit, which makes the marketing of fresh fruit difficult. There are 1848 hectares of plum plantation in the North Great Plain Region, this 25.8% of the total area. Choosing the right harvest time is important to ensure success of marketing. Fresh marketing requires picking by hand with stems, while for the processing industry, shakers could be used efficiently. *The effect on increasing incomes with machinery harvest, mentioned before in the case of sour cherry, is also true for plum.* Since the ripening of plum happens in different time, efficiency could also be increased by using the same shaker later for harvesting plum.

### *Profitability of berried fruits*

*Gooseberry* in the region is produced on 282.5 hectares, which is 71% of the national area. Production efficiency is greatly damaged by the fact that there is no irrigation system on the majority of plantations, unfavourable water supply decreases yield quantity and quality. *The ratio of irrigated plantations is 13.5% in the country, this ratio in the region is 9.6%.* A significant portion of the produced quantity is sold on export markets. *65.1% of the yield was exported fresh to primarily Germany in 2003,* but frozen fruit export was also significant. *The standard of profitability could be increased by introducing the product in trays for consumption.*

Almost 20% of blackberry plantations can be found in the North Great Plain Region. Similarly to gooseberry, the development of irrigation systems would have an equally significant role. This would be a basic condition to ensure appropriate product variety.

The yield quantity of strawberry decreased further. We could increase export somewhat in the past period, but import tripled which primarily comes from Spain and Italy. *Increasing the sold quantity could only be realized at competitive prices.*

### *Profitability of skinned fruits*

*Walnut* production is increasing in the country, and shows a *promising picture for marketing in the future*. 33% of the plantations can be found in the North Great Plain Region. The relatively high price of saplings (which is currently 2000 HUF) is counterbalanced by the fact that plantations can be kept for longer period of time, and walnut is less vulnerable when shaking and does not require cold storage. Shaking is made difficult by the fact that after 10-12 years of age, yield could only be collected with branch shaker.

## OBSERVATIONS AND SUGGESTIONS FOR THE DEVELOPMENT OF FRUIT PRODUCTION IN THE REGION

In order to determine the future fruit production strategy of the North Great Plain, I analysed strengths, weaknesses, possibilities and dangers with the help of SWOT analysis.

Strengths	Weaknesses
<ul style="list-style-type: none"> <li>• Excellent natural conditions;</li> <li>• High standard of production culture;</li> <li>• Cheap labour;</li> <li>• Proximity of processing capacities;</li> <li>• Cheap land;</li> <li>• All round training system (vocational-university);</li> <li>• Knowledge of developed technologies, rich propagating supply;</li> </ul>	<ul style="list-style-type: none"> <li>• Hig ratio of old plantations;</li> <li>• Lack of fixed and current assets;</li> <li>• Unfavourable type sortiment;</li> <li>• Low ratio of irrigation;</li> <li>• Lack of land market;</li> <li>• Low concentration of production and marketing organisations;</li> <li>• Lack of appropriate storage capacities;</li> <li>• Low yield averages;</li> <li>• Lasting, low price levels of fruits;</li> </ul>
Possibilities	Dangers
<ul style="list-style-type: none"> <li>• Could be an important element of regional development due to the labour intensive nature of products;</li> <li>• Development of integrated and eco-production;</li> <li>• Increasing the share of fruits suitable for fresh market, thus enhancing profitability of the sector;</li> <li>• Developing export opportunities;</li> <li>• Establishing efficient information system;</li> <li>• Developing infrastructure;</li> </ul>	<ul style="list-style-type: none"> <li>• Currently, producer and marketing organisations do not represent enough economic power to have a strong basis for negotiations;</li> <li>• Increasing the quantity of import products;</li> <li>• The competition;</li> <li>• Changing commerce habits;</li> </ul>

Source: own compilation

In order to make suggestions for developing fruit production in the North Great Plain Region, the SWOT analysis has to be evaluated. Strengths have to be exploited by gradually eliminating weaknesses. *Special attention has to be placed on micro districts, which could increase yield safety and reduce production costs.* Additional strength of the region is that it *possesses the necessary processing capacities and cheap and trained labour is provided* for the entire work process. The *weaknesses of the region* primarily originate from the *lack of capital*. In order to ensure the competitiveness of the sector, new plantations have to be established along with favourable type assortment. Hungary has a certain market for selling 500-700 tonnes of apple. This could be produced on around 20 thousand hectares, 60-70% of which should be intensive plantation. Considering the share of the region from production, it can be concluded that *12-13 thousand hectares of modern apple plantation would be enough*. With apple, it is *important to increase the share of fruits for fresh consumption*. In developed apple producing countries this ratio is around 80-90%, while in Hungary it is only around 10-15%. The production of good quality fruit is important, since the apple production of China has multiplied in recent years and it is significantly competing on concentrate and juice apple market. Emphasis has to be placed on *establishing modern storage facilities*, which can also improve profitability. *The development direction in Hungary will be integrated fruit production*. Without certification, producers cannot supply hyper- and supermarkets and their chances on export markets will significantly decrease as well. The further advantage of *intensive plantations* is that they *can be kept in production for shorter periods* and thus as a result of type renewal, *producers can react faster to new market challenges*.

*Frost protection* is more emphasised *when establishing intensive plantations, since the investment surplus is significantly lower than the possible loss*. On modern plantations 60 tonnes/hectare can be achieved compared to the 10-15 tonnes/hectare yield of traditional plantations. If we consider the frequency of frosts in Hungary, three years out ten, the damage in yield could reach up to 70%, so surplus investment returns.

The establishment of modern plantations is essential, we can only meet the requirements of the Union this way. During the evaluation profitability I have pointed out the effect of land prices on technological investments. *Unless significant changes occur on the land market in the near future, this will limit the application of modern technologies which endangers the efficiency of the sector over the long term*. Modernisation has to be expressed in cultivation technology as well, since the value of hand labour is significantly increasing in our country as well. Reasons for this have to be searched in the ageing society, migration from the region,

general economic growth and our European Union membership. *The increasing cost of hand labour can greatly decrease profitability in the future which can only be solved through machinery and the establishment of intensive plantations.* The application of modern foliage forms can help reduce the expenditures on hand labour.

*Capital is missing in the entire process of production and processing, which could be complemented with production integrations.* Machinery purchase is a really costly part of production, which sometimes cannot be realized by individual farmers or investments are not worth it on small plantations thus leasing or hand labour are the only but more expensive solutions. Naturally, integration is not only an advantage on plantations but also in processing to ready product, in the establishment of cold storage places, procurement of sorting machinery and in logistic tasks. These investments complement each other and increase the efficiency of the sector while efficient development cannot be realized without any of elements.

*Based on the above mentioned I recommend the following steps for the fruit sector*

*The establishment of 12.5 thousand hectares of apple plantation is required in the region.* In order to ensure appropriate rotation of the plantation, an annual 833 hectares of modern plantation has to be established. The cost of this is an annual 4.2 billion HUF, which of course requires government support. Storages have to be modernised for further success of the apple sector along with increasing their capacities. A total of 107.5 thousand tonnes of apple can be stored *in the region*, while the *total produced quantity* was more than 312 thousand tonnes in 2003, in other words only 33% could be stored. 71.8% of storages are traditional and thus only suitable for limited storage. The ULO storages (which allow longer storage) have a total capacity of 6700 tonnes in the North Great Plain Region. If the outlined plantation „reform” was realized and 450-500 thousand tonnes of apple was produced in the region, then storage capacity would have to be increased to *300 thousand tonnes in the long term.* *The conditions of integrated production are optimal in the region, suitable quality assurance systems are provided but their capacities have to be increased.*

*The second most important fruit of the region is sour cherry.* We have favourable ecologic conditions and globally acknowledged types, thus production can still have a great role in the future. *The direction of development can be enhancing the efficiency of harvest, by using modern harvest machinery.* Low land prices can mean a competitive advantage in the case of sour cherry, since machinery harvest does not favour the establishment of intensive

plantations. The ratio of deficient and old plantations has to be reduced in the future. Early types should be preferred during plantation since higher prices can be achieved with these. *The type assortment of sour cherry is rich in Hungary but their application is narrowing.* More efficient frost protection is required in the future. Plantations should be established according to consumption purpose (fresh, industrial). *When producing for fresh market, high plant density intensive plantations are recommended while wide spatial structure plantations should be established for the processing industry.*

Emphasis should be placed on *frost protection* as well. *Primarily, the role of passive protection can have an increased role in Hungary due to cost reduction.* The increasing ratio of intensive plantations requires active protection as well. During passive protection, the selection of suitable growing site, the role of type and variety, choice of subject and chemical treatments have to be emphasised. Active protection significantly increases costs for the producer such as: reducing reflection, increasing air temperature, air shuffle protection and irrigation frost protection. *Different protection investments have to be made depending on specific site.* The widespread application of frost protection could be hampered by producers who would rather take the risks than to make further investments.

## NEW SCIENTIFIC RESULTS

1. During my evaluation I have found that the role of agriculture in national economy is constantly decreasing. While in 1992 it had a share of 8.6% from gross domestic product, in 2003 it only had 2.9 and compared to 10% in export. The production price indexes of fruits has increasing moderately in the past period, while the price index of agricultural expenditures increased significantly compared to other agricultural products. *Apple is still the most important fruit for Hungary, the role of which will decrease in the future.*
2. I detected that the type and variety structure of the North Great Plain Region, which is the largest fruit production area of the country, is not suitable. *The area of apple plantations has to be reduced, the average yield and quality of plantations has to be increased with new type and cultivation technology. The rate of this has to reach or exceed 40 tonnes per hectare at the same time the ratio of apple for consumption has to be increased.* In the interest of pear production efficiency, our market position could be enhanced with the improvement of quality. *Drupaceous fruits have to be selected according to fresh market and processing industry use, and cultivation technology and the technical level of machinery has to be decided accordingly. The second most important fruit of the region is sour cherry, the production costs of which has to be reduced.* This can partly be achieved through technological investments (irrigation system, frost protection, machinery harvest). Our cherry production constantly decreases, which could be solved through high density, high technological standard provided for intensive plantations. The quantity of our plum production stagnates, we can increase our market share through producing larger fruits. The growing area of walnut has to be increased based on market data. Here, technological development will have an important role here in the future. *Better profitability can be achieved with the development of postharvest in the case of berried fruits.*
3. I have found that the role of drupaceous and skinned fruits is increasing in the fruit production of the region. The reason for this should be searched in the market role of sour cherry and walnut. *Salaries are constantly increasing in Hungary, so machinery could have an increasing role in the future.* Competitive advantage can only be gained through cheap and good quality products. *Expenditures could be reduced through a higher standard of machinery.* Hand labour is mostly made up of labour during harvest in fruit



production. *In my dissertation I have introduced the surplus profits that can be achieved through machinery harvest.* This harvest form similarly reduces costs on walnut and plum plantations. The type and variety assortment has to be established in the future by fully exploiting machinery provided.

4. With my evaluative work I have pointed out that good quality and balanced yield quantity became a basic requirement for fruit producers. This includes the minimising of effects due to weather extremes. Thus, it is important to use *irrigation for protection against drought.* In Hungary, the widespread application of *micro spray irrigation can be expected* in the North Great Plain Region as well. In areas where spring frost can occur, rain-like irrigation systems can also be applied for frost protection. The application of other frost protection technologies should be decided after evaluating the specific micro districts.
5. In my dissertation I have evaluated the *return rate of modern technologies and concluded that the lack of land markets can partly be blamed for the lack of developments.* The gradual liberalisation would be an important task in the interest of the region's fruit production.
6. I have pointed out that in the interest of increasing competitiveness in the region, *storage capacities have to be developed along with the standard of product preparation.* In my dissertation I have determined the optimal storage capacity considering market conditions as well.
7. *I have determined that to make apple production competitive, a total of 12.5 thousand hectares of modern plantations are needed.* Such investments significantly exceed financial possibilities of farmers thus government involvement is essential.

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