Economic analysis of sweet corn production
through the example of an integrator in Hungary

Introduction

The two most significant sweet corn producers in the world are the USA and the European Union, then Canada and Thailand. Hungary is one of the most determinant sweet corn growers in the European Union prior to France. Though, in a smaller proportion but sweet corn is grown in Poland, Italy and Spain, too. In Hungary sweet corn as a field vegetable is grown in the largest quantity and on the largest area.

Hungary's climatic, relief and soil conditions make our homeland suitable for the growing of sweet corn. Our homeland's competitiveness is due to the fact that sweet corn is grown on relatively big areas by competent growers, which expands on the economical work organization and the efficient plant protection. (FRUITVEB, 2013.) Sweet corn produced in Hungary is sold primarily as preserving industrial raw material (canning industry, freezing industry), on the other hand fresh consumption of it is trace. Sweet corn grown for fresh consumption, opposite to that which is grown with preserving industrial aims, is produced on smaller size plots and with the withdrawal of big needlework.

From among the row crops sweet corn can be said as one of the most demanding one. The success of the plant's growing is determined by agro-ecological and agro-technical factors, like the weather of the given growing year, the quality of the soil, its water demand, and its technological and input use. In spite of the fact that water supply has a central role in the cultivation, sweet corn is not grown only under irrigated circumstances.

My main objective is to do the farm business management's examination of the domestic sweet corn production between 2009 and 2013, to which belongs the undermentioned part aims:
  a. the exploration of the expense and income relations of the applied production technology used at the typical grower district's economic unit
  b. the calculation of the expense and income relations on the basis of corporate farmers' data, dealing with sweet corn growing on a national level
  c. the assessment of the examined farm compared to the national average

2. Literature

The farm business management in such approach is not new, but sometimes it gets more or less attention depending on the level of the occurrent agricultural questions. It is therefore possible that today the term "farm" has become so fashionable, as the sector has been subject to international attention and guidance through the European Union (CAP).

Several terms are used from which the expression "farm business" can be considered traditional. "The farm business is the term that should be understood as the entity itself, regardless of its legal form and size. In addition to the farm business, economy, agricultural enterprise or firm can be used as synonymous expressions of course in a narrow sense." (SZÉKELY and TAKÁCSNÉ, 2008)

The agronomy involves the economic processes of the in-house production and the principles, procedures and methods by which we can examine the plant's resources, economic factors of its production and which are necessary to operate the plant profitable.

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SZÉKELY and TAKÁCSNÉ (2007) formulated the essence of agronomy as follows: "The agricultural farm business management is the traditional name of a science area dealing with the rational creation, the profitable operation and the sustainable development of production, service and other activities in agricultural enterprises, business associations, cooperatives and other factories." It is important that agricultural companies differ from other companies in that they perform their production primarily in natural environment with biological systems, but at the same time engage in industrial, commercial and service activities, too. This fact is confirmed by HAJÓS (2005), that the agricultural producers need first of all land to plant different products. It involves the field demand of the developments and the efficiency improvements.

On national level several factors affected the yield of our country. Sweet corn was grown in 2007 on 33 thousand hectares, in 2008 on 31 thousand hectares, while in 2009 the planted area decreased only to 22 thousand hectares. The reason of decline related to the moderation of the processing demand deriving from the reduction of the international corn consumption and the unfavourable inventory financing and the delays in the payment of growers experienced in 2007 and 2008. (FRUITVEB 2009) In 2010 the decline of the planted area of sweet corn continued, the reason could be that in 2007 the yield surface of sweet corn broke a record in the European Union, and also the yields were high. Because of it significant inventories were accumulated in the manufacturing sector, which could be sold only at a low price and slowly due to the economic crisis in 2008, thus the production mind fell back in 2009 and 2010, too. In addition, in 2010 neither the extreme weather conditions favoured for the domestic corn cultivation. (FRUITVEB 2010.) In 2011 there were positive changes, also the planted area and also the yield increased. The large increase related to the lack evolved all over in Europe because of the previous year's low yield surface and bad weather, which resulted that our country was also completely out of sweet corn stocks. Then, the growers expanded their growing areas. (FRUITVEB 2011.) Although the planted area was extended in 2012, there was no overproduction due to the unfavourable weather conditions. An unusual extent and proportion of crop failure was experienced as a result of the drought, there was a small amount of precipitation only in Hajdú-Bihar County. In this year the crops were taken over totally. (FRUITVEB 2012) In 2013 the work of the farmers was very difficult because of the extreme weather conditions, since the late spring and the rainy May delayed sowing. From mid-June drought periods occurred, so the irrigation of the corn tables was necessary. The yield was very unbalanced depending on the level of production technology. The domestic producers were in a good position because there was demand for the sweet corn in all over Europe due to the previous year's unfavourable yield. (FRUITVEB 2013.)

We need to measure and evaluate the effectiveness of the agricultural enterprises that can be done on the basis of many factors. NÁBRÁDI and FELFÖLDI (2007) dealt with the analysis of these, which are presented built around three management categories, which are the followings: value, cost and profit. They draw attention to the content of the applied expenditure and cost concepts. According to this there is difference between expenditure and cost obviously, because expenditure is nothing more than the amount of resources expressed in natural unit utilized for the production of goods or services during the production process. While the production cost is a monetary value of expenditures used in order to produce products and services. This distinction clarifies the cost calculations based on technological expenditures. The connections of plant management are presented also by FELFÖLDI and SZŐLLŐSI (2006), in a comprehensive study of Hajdú-Bihar County's agriculture.

There are different categories due to the calculations of costs (ATRILL and McLANEY, 2005), but HUSTI (2013) pointed out the costs of mechanization, since nowadays growers invest more and more in machinery. It underlines the fact that the quality of work done by agricultural machinery has been improving significantly. At the same time it makes recommendation to the statement and calculation of the cost of mechanization.

We can provide accurate data to the control of farming if the given grower pays attention to the adequate and proper registration of the given farming. Other authors (WARREN, 1992) also draw attention to the above mentioned fact. It makes easier for the company to measure its profitability and financial situation, in addition it provides data to business analysis and makes the efficiency of the sector measurable, as KAPRONCZAI and BÁCS (2013) also suggest it. The exploration of factors affecting to the result and the determination of their importance is inevitable during the economic analysis of the given activity. SZŐLLŐSI (2009), although his works are mainly connected to livestock, he provides a wide range of examples to these analysis, who examined these factors with deterministic models.

3. Methods

The subject of my study was the farm business management's analysis of the production of domestic sweet corn, data was provided by an integrator enterprise located in Hajdú-Bihar County.

Hungary's key corn growing districts are Hajdú-Bihar County, a significant amount of sweet corn is produced also in Békés, Bács-Kiskunk, Jász-Nagykun-Szolnok and Szabolcs-Szatmár-Bereg Counties, which is shown in Figure1.
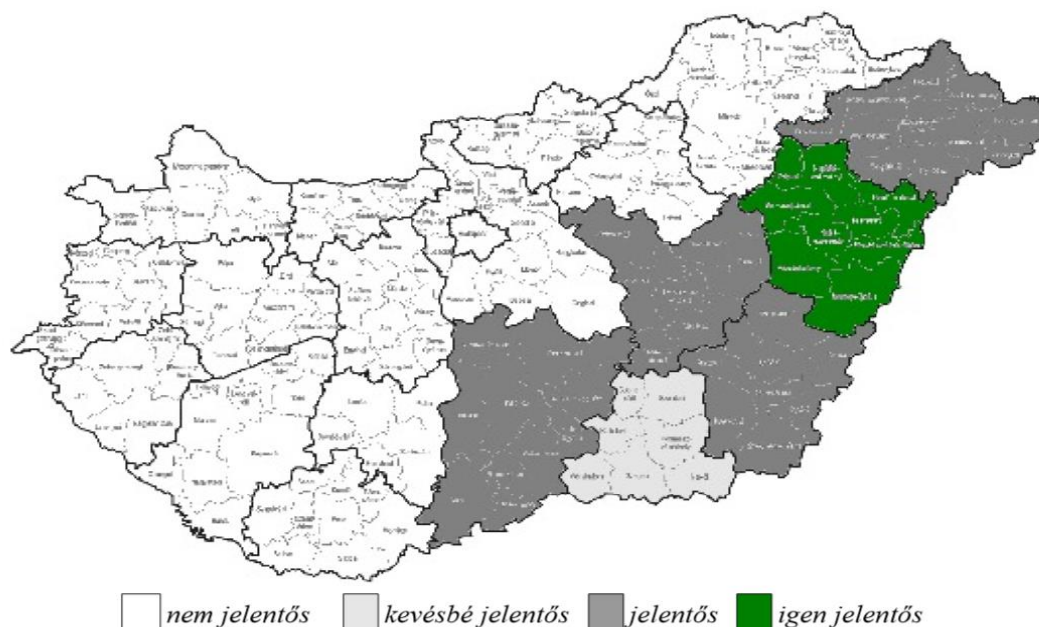

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Figure 1: The location and importance of sweet corn production in Hungary.
Source: FRUITVEB, 2009

My primary research was personal contact at several times, using the method of structured interviews and the records of the company. The data collection covered the period between 2009 and 2013, including 1300 hectares of integrated area between 30 and 40 gold crown, using

the technological expenditures, costs, and the data of the yield and sales price. I introduce the applied production technology and along it I have written down the basic and derived data in the division of technology. On the basis of these I carried out cost and technology-based aggregations, and the creation of key indicators. The works of APÁTI and FELFÖLDI (2008), FEFÖLDI (2007), FELFÖLDI (2008) serve as a guideline to the examination of horticultural crops. I followed the recommendations of KERÉKGYÁRTÓ-MUNDRUCZÓ-SUGÁR (2003) to the creation of indicators. According to this I composed distributional and intensity ratios, and I calculated arithmetic and geometric means. At the same time I characterized the rate and the magnitude of the data's average change. On the other hand my secondary research was based on the data of Agricultural Economics Research Institute.

In my work I evaluate the most important data on the basis of the technology used in the production, which I present below. Each year in March the examined integrator company starts with **harrowing**, which means making the top layer of the soil loose without rotating it. At the same time they scatter, pave the ground and carry out chemical weed control. They can preserve the moisture of the soil and promote the penetration of air into the soil with harrowing. At the beginning of April they **apply chemical fertilizer** to prepare sowing. Then they **cultivate** in order to get a good quality of seed bed, after it still in April they **sow the seeds** using chemical fertilizer at the same time. In May it is needed to use **chemical weed control and cultivate the line spaces**. During cultivation the soil is loosen from 5 to 10 cm without rotating it. In June they carry out **protection against moth** twice. In August the next task is to **harves**t sweet corn, then they **carry** the corn to factories in order to process them. After it they **disk** in which the soil particles are mixed, fragmented, loosened and the porosity increases. The applied fertilizer gets into the soil that destroys young weeds. In autumn they use again **chemical fertilizer** (MAP) that destroys organic residues and with it they prepare the soil for the next year. Finally **deep plowing** follows, which helps to receive winter precipitation, to destruct perennial weeds and to cultivate the basic fertilizers into the soil.

I introduce my results in a division of cost and technology, then I show the direct costs separately and together, in addition I submit the changes of yield and yield value and finally I present some economic indicators of sweet corn and their comparisons.

4. Results

First of all I present the cost structure compiled on the basis of the applied production technology. I worked with the basic and derived data on the basis of the above described production technology. Along these I formed different groups due to the technology, which are shown in *Tables 1-4.*

Table 1: The input material costs of sweet corn production (in division of technology) 2009-2013.

Denomination	Cost (HUF/ha)	Division (%)
Chemical fertilizer (I.)	22360	17
Seed	50470	37
Soil fertilizer	12680	9
Weed control	12120	9
Protection against moth (I.)	5820	4
Protection against moth (II.)	4020	3
Chemical fertilizer (II.)	27512	20
Total amount of input material costs:	**134982**	**100**

Source: Own editing

Among the costs of input materials seed gives the highest rate with 37%, then the costs of chemical fertilizers with 17 and 20%, altogether they also mean 37% in the division of technology.

Table 2: The machinery costs of sweet corn production (in division of technology) 2009-2013.

Denomination	Cost (HUF/ha)	Division (%)
Harrowing	4540	6
Chemical fertilizing (I.)	4140	6
Cultivation of line spaces	6200	8
Sowing + soil fertilizing	5700	8
Weed control	4660	6
Cultivation of line spaces	8080	11
Protection against moth (I.)	4660	6
Protection against moth (II.)	4660	6
Disking	7300	10
Chemical fertilizing (II.)	4240	6
Deep plowing	20400	27
Total amount of machinery costs:	**74580**	**100**

Source: Own editing

According to machinery costs deep plowing with 27%, then protection against moth with 12-12% and chemical fertilizing mean the highest costs of sweet corn production in division of technology.

Table 3: The input material costs of sweet corn production (in division of input materials) 2009-2013.

Denomination	Cost (HUF/ha)	Division (%)
Chemical fertilizer	49872	37
Seed	50470	37
Soil fertilizer	12680	9
Weed control	12120	9
Protection against moth	9840	7
Total amount of input material costs:	**134982**	**100**

Source: Own editing

Due to the division of input material in the input material costs we can see obviously that the seed and the chemical fertilizer give altogether 74%, separately 37-37%.

Table 4: The machinery costs of sweet corn production (in division of technology) 2009-2013.

Denomination	Cost (Ft/ha)	Division (%)
Chemical fertilizing	8380	11
Soil cultivation	38440	52
Crop protection	22060	30
Sowing + soil fertilizing	5700	8
Total amount of machinery costs:	**74580**	**100**

Source: Own editing

In that case if we take into consideration the machinery costs in division of technology, soil cultivation (harrowing, cultivation, disking, and deep plowing) take up 52%, while crop protection (weed control, cultivation of line spaces, protection against moth) give 30%.

In the followings I will introduce and evaluate the costs of different years, which I begin with a detailed description of machinery costs, then I examine together the costs of machine services, input materials and the total direct costs of machine services at the integrator entrepreneurship and at other corporate farms.

In *Figure 2.* I presented the machinery costs where the causes of rise could be the followings: the continuously increasing price of fuel and depreciation. The rates of growth were the followings: from 2009 to 2010 6,7%, from 2010 to 2011 9,3%, then 8,7% and finally from 2012 to 2013 it was 2,5%.
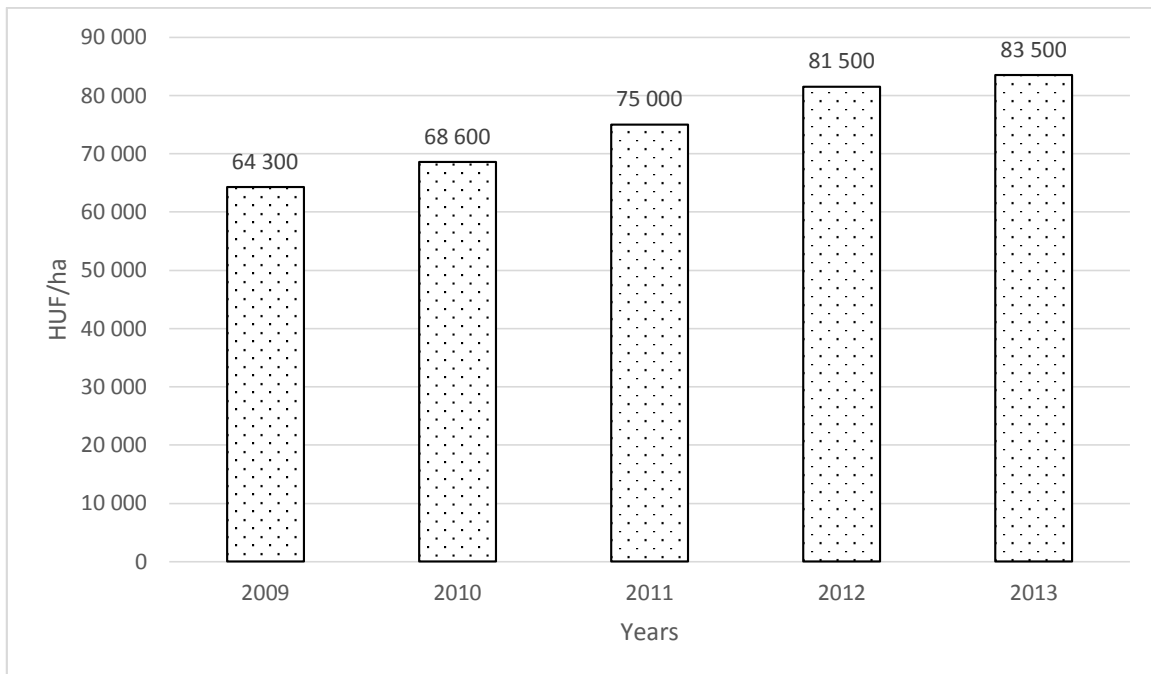
Figure 2: The change of machinery costs at the integrator entrepreneurship.
Source: Own editing

Figures 3 and 4 show the change of the costs of harvesting and transportation of corn from year to year. Both values of costs are affected by the given year's yield that are presented in the figures. Due to the harvesting the outstanding results of the years 2011 and 2012 were caused by the high yields, whereas conversely the fees of machine uses have not increased to the same extent. On the other hand, regarding the costs of transport both factors increased, so first there were 9%, 12%, 7,2% and 0,7% growth year by year.
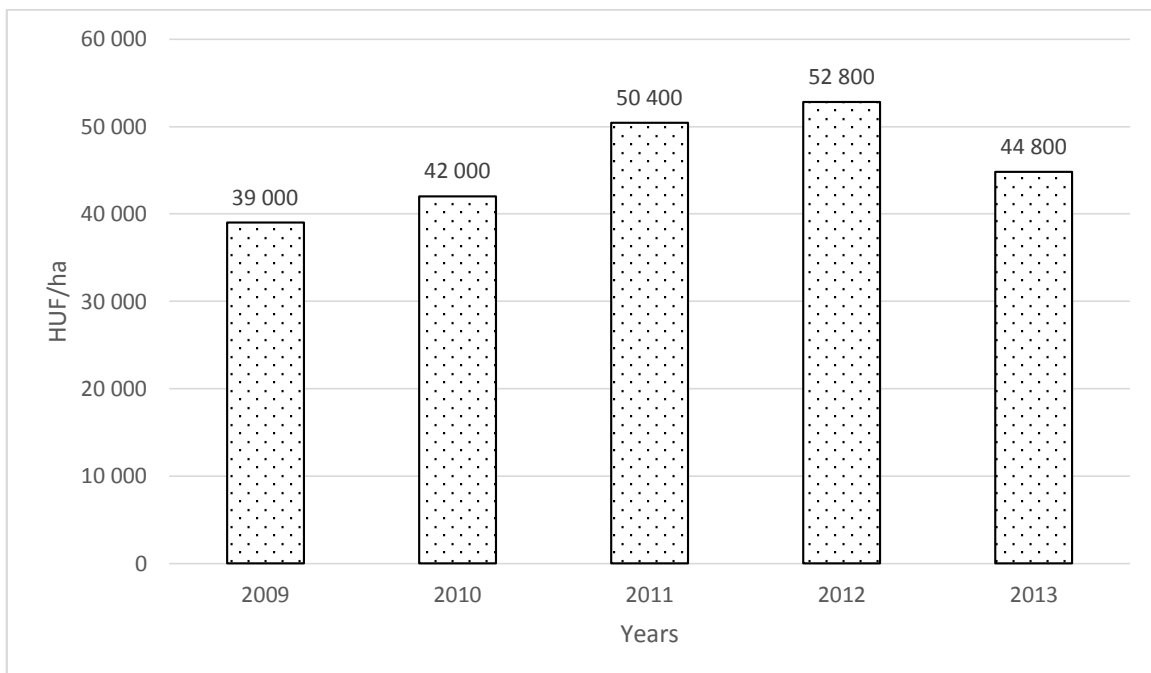

Figure 3: The change of the costs of harvesting at the integrator entrepreneurship.
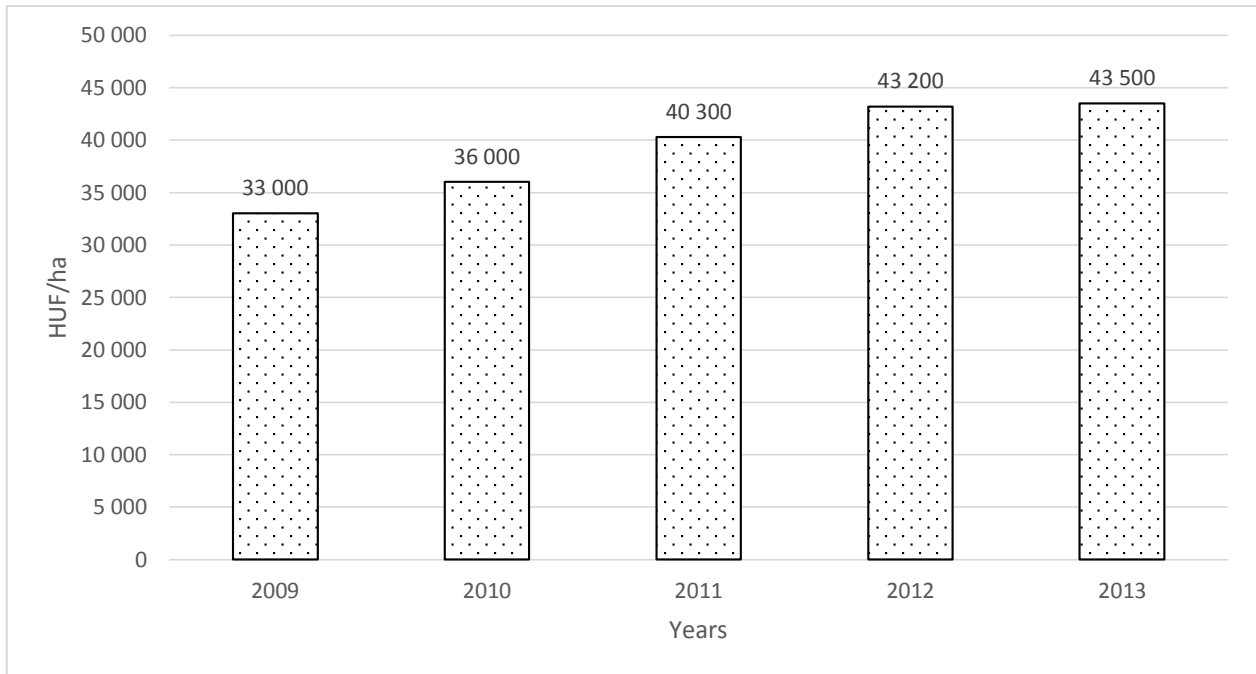*Source: Own editing*

Figure 4: The change of costs of transport at the integrator entrepreneurship.
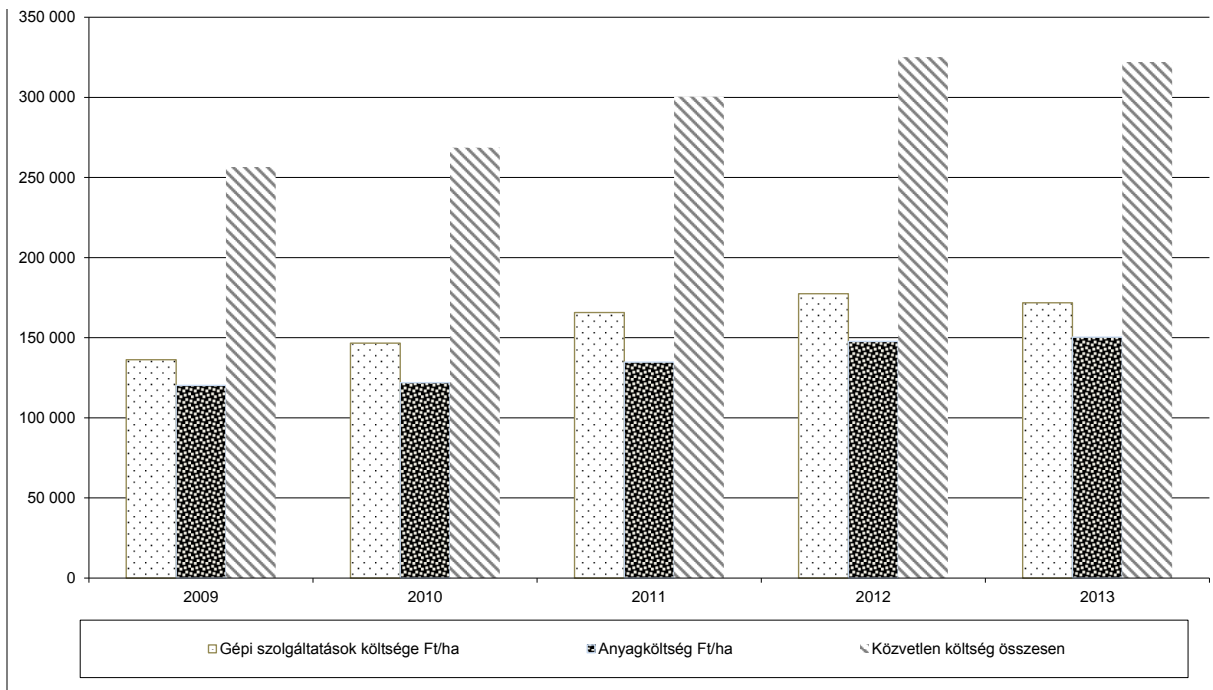*Source: Own editing*

Figure 5: The change of direct costs of sweet corn production at the integrator entrepreneur 2009-2013.

Source: Own editing

During the observed five year the machine services' average rate of change was 6% increase, while this rate resulted the same growth due to the material costs. In this case the annual rate of growth was the same that was 6%. The average magnitude of change was 7100 HUF per hectare

regarding the machine services, due to the material costs it was 6020 HUF per hectare and in the case of total costs the average change of magnitude was 13 120 HUF per hectare.
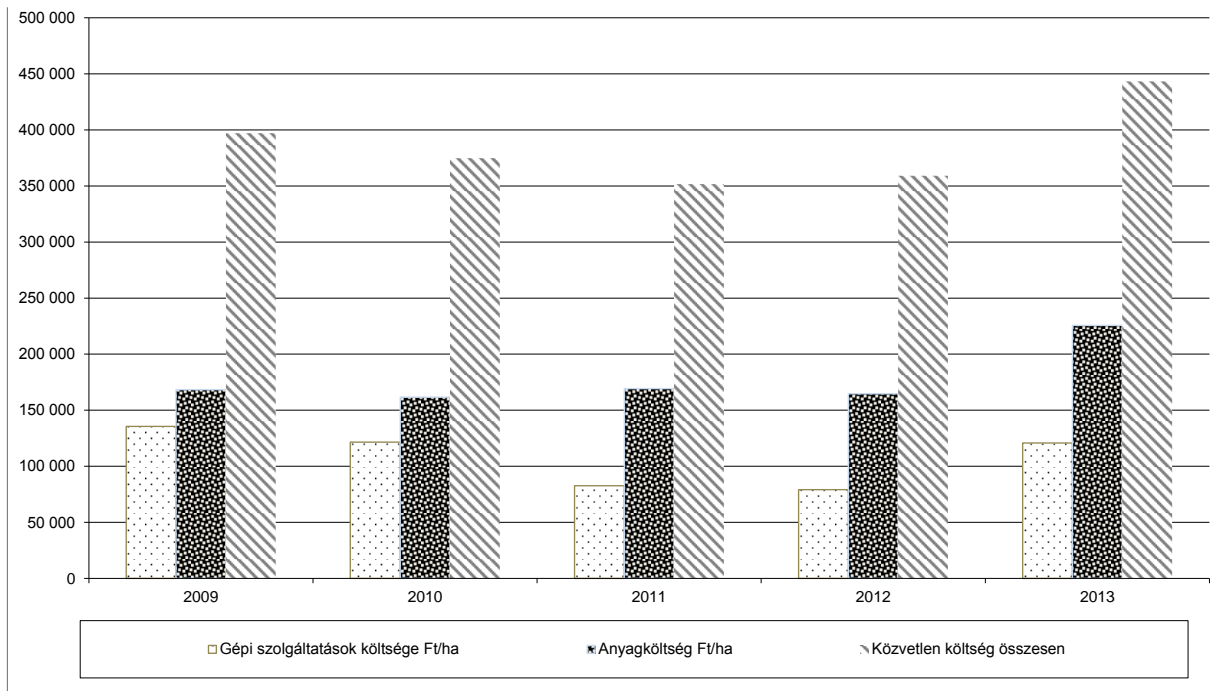

Figure 6: The change of direct costs of sweet corn production at corporate farms 2009-2013.

Source: Own editing

In the case of corporate farms due to the machine services the average rate of change shows 3% of decrease, at the same time we can see 11% annual change regarding the costs of material. Thus the average rate of change of the total direct costs presents 3% of increase. The average magnitude of change decreased approximately 3000 HUF per hectare regarding the machine services, but due to the material costs it meant 48 813 HUF growth per hectare and in the case of total costs the average change of magnitude resulted 9259 HUF increase per hectare.

In *Tables 5 and 6* I summarized the main indicators of the integrator entrepreneurship and the corporate farms in the period from 2009 till 2013. I presented the yield of the examined integrator entrepreneur in *Table 5*, where we can experience the above mentioned influential factors, like the positive changes of the year 2011, the slight decline in 2012, and the effect of extreme weather in 2013. We can observe the change of the yield value parallel to the change of the yield. This increase is due to the fact that in addition to the yield we need to take into consideration also the purchase price of sweet corn, so these two parameters' product results the yield value, in this case the production value, too.

Table 5: Some indicators of sweet corn at the observed integrator entrepreneurship.

Some economic indicators of sweet corn-observed integrator entrepreneurship	2009	2010	2011	2012	2013	Average of 2009-2013
Yield (t/ha):	13,5	15	16,8	16	13,6	15
Selling price of the product (HUF/t):	26500	24700	33100	38000	44000	33260
Yield value (HUF/ha):	357750	370500	556080	608000	598400	498900
Total amount of direct costs (HUF/ha):	256500	268600	300410	325200	322100	294562
Gross margin (HUF/ha):	101250	101900	255670	282800	276300	204338
Production value (HUF/t):	30120	28064	37011	42352	49366	37382
Prime cost of corn (HUF/t):	19000	17907	17882	20325	23684	19759
Product gross margin (HUF/t):	7500	6793	15218	17675	20316	13501
Direct cost related profitability (%):	39	38	85	87	86	67
Yield proportional profitability (%):	28	28	46	47	46	39

Source: Own editing

In the case of the observed integrator entrepreneurship located in Hajdú-Bihar County the average of the five years' yield was 15 t/ha, the selling price of the product was more than 33 000 HUF/t that resulted about half a million yield value per hectare. The total amount of direct costs reached almost 295 000 HUF/ha, thus we could count with 203 584 HUF/ha gross margin. This meant 37 382 HUF production value per unit, so the prime cost of corn was almost 20 000 HUF/t. Above all resulted 67% of direct cost related profitability and 39% of yield proportional profitability. The first two years of the observed period, 2009 and 2010 presented low profitability indicators because of the low sales prices.

Table 6: Some economic indicators of sweet corn at corporate farms.

Some economic indicators of sweet corn-observed integrator entrepreneur	2009	2010	2011	2012	2013	Average of 2009-2013
Yield (t/ha):	15,47	15,34	16,47	14,31	14,91	15,3
Selling price of the product (HUF/t):	26644	25308	36972	37239	42408	33714
Yield value (HUF/ha):	412306	388225	608822	532907	632498	514952
Total amount of direct costs (HUF/ha):	396997	374832	351571	359055	443291	385149
Gross margin (HUF/ha):	15309	13393	257251	173852	189207	129803
Production value (HUF/t):	29803	28597	40962	42104	47301	37753
Prime cost of corn (HUF/t):	25655	24435	21350	25090	29722	25250
Product gross margin (HUF/t):	989	873	15622	12149	12686	8464
Direct cost related profitability (%):	4	4	73	48	43	34
Yield proportional profitability (%):	4	3	42	33	30	22

Source: Own editing

In the case of corporate farms in the period from 2009 till 2013 the average yield was 15,3 t/ha, while the selling price was 33 714 HUF/t, thus the yield value was 514 952 HUF per hectare. On the average we could calculate with 385 149 HUF/ha of direct cost, so the amount of gross margin was 129 802 HUF/ha. This meant 37 753 HUF production value per unit, which was produced for 25 250 HUF/t prime cost. Overall it resulted 34% of direct cost related profitability and 22% of yield proportional profitability. The first two years of the period, 2009 and 2010 presented low profitability indicators because of the low sales prices.

If we compare the main indicators of the two tables, we can see the similarities and the differences between the data of the observed integrator entrepreneurship and the corporate farms in the period from 2009 and 2013. In both cases the average yield was 15 t/ha, while the selling price of the product showed a value about 33 000 HUF/t, so the yield value resulted almost 500 000 HUF/ha. We could observe larger differences in the total amount of direct costs, as in the case of the analysed integrator entrepreneurship it was 294 562 HUF/ha, while in the case of the corporate farms it was 385 149 HUF/ha, which meant more than 100 000 HUF/ha difference. It follows that there was about the same amount of difference in the gross margin. In both cases it meant about 37 000 HUF production value per unit, which was produced for 20 000 HUF/t prime cost at the observed integrator entrepreneurship and for 25 000 HUF/t prime cost at the corporate farms. There are big differences among the values of direct cost related to profitability and yield proportional profitability, because in Hajdú-Bihar County the direct costs were lower, in addition the two farms reached about the same yield values during the examined five years.

Summary

We can determine relevant conclusions regarding different years if we examine in addition the expenditures and costs, also the change of yields and yield values from year to year. The hectic weather, the effects of nature and the market conditions of the past years have key role in the cultivation of sweet corn. Sweet corn can be grown safely in irrigated conditions. At the same time there is no irrigation system in the observed areas, which is reflected in the yield only slightly, and even more in certain periods of drought.

Finally I could identify benefits at the input side but I could not determine benefits at the output side in the comparison of the data of the Agricultural Research Institute with my data in the period of 2009 and 2013. I defined significant differences neither in the yield nor in the selling prices from the side of result, consequently there was no distinction in the yield value. In the average of the five years I got almost the same values. On the other hand there was significant difference on the side of costs, which meant about 25% of benefit for the integrator entrepreneurship. We could observe lower values at the integrator entrepreneurship located in Hajdú-Bihar County, the reason for it were the integrator business type and excellent quality of the soil. On the basis of my results I agree with those who consider the production of sweet corn as one of the prospective cultures from the point of farm business management.

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Bibliography

1. APÁTI, F.- FELFÖLDI, J. (2008): Ökonomie der Sauerkirschenproduktion In: Nyéki J, Soltész M.,Szabó T., Hilsendegen P., Hensel G. (ed.): Sauerkirschenbau, UD RDI, 2008, ISBN 978-963-9732-81-0; p. 89-98.
2. ATRILL, P.-McLANEY, E. (2005): Management accounting. Prentice Hall. Pearson Education Limited. Harlow. ISBN 0-273-68867 7 77-78 p.
3. FELFÖLDI, J. (2007): Gazdasági jellemzők, költség- és jövedelemviszonyok a szántóföldi zöldségtermesztésben. In: Hodossi S.(szerk.): Piaci ismereteken alapuló versenyképes zöldségtermesztés (szántóföldi zöldségtermesztés) Kiadó: InterClaster Kht. Kecskemét, 2007. ISBN 978-963-9773-10-3; 8-17.p.,
4. FELFÖLDI, J. (2008): Gazdasági helyzet és gazdálkodási mutatók a szántóföldi zöldségtermesztésben. In: Madai H, Nábrádi A (szerk.) Kárpátalja bekapcsolódásának segítése az Észak-alföldi régió gazdasági életébe. Lícium - Art Könyvkiadó és Kereskedelmi Kft., ISBN 978-963-8030-54-2; 2008. pp. 89-98.
5. FELFÖLDI J. – SZŐLLŐSI L. (2006): „6. A gazdálkodás üzemgazdasági alapjai" In.: Hajdú-Bihar megye mezőgazdasága – gazdálkodás az egyes tájegységekben – Bihar – Hajdúság – Hortobágy/Tiszamente – Erdőspuszta/Érmellék – Sárrét (Szerk.: Szűcs I.) Debreceni Egyetem, Debrecen, 2006. 89-108. pp. ISSN 1588-8665
6. FRUITVEB (2009-2013.): Bulletin. Fruitveb Zöldség-gyümölcs Termék Tanács és Szakmaközi Szervezet. Budapest.
7. HAJÓS, L. (2005). Növénytermesztés. In: A mezőgazdasági termelés gyakorlatának alapismeretei. Szaktudás Kiadó Ház. Budapest.
8. HUSTI, I. (2008): Mezőgazdasági gépesítés és géphasználat. In: Kay, R.D.-Edwards, W.M.-Duffy, P.A.: Korszerű farmmenedzsment. Szaktudás Kiadó Ház Zrt. Budapest. ISBN 978-615-5224-21-8 442-465 p.
9. KAPRONCZAI, I. -BÁCS, Z. (2008): Információgazdálkodás és vezetői információk. In Kay, R.D.-Edwards, W.M.-Duffy, P.A.: Korszerű farmmenedzsment. Szaktudás Kiadó Ház Zrt. Budapest. ISBN 978-615-5224-21-8 442-465 p.
10. KERÉKGYÁRTÓ, GYNÉ.-MUNDRUCZÓ, GY.-SUGÁR, A. (2003): Statisztikai módszerek és alkalmazásuk. Aula Kiadó Budapest, ISBN 9639479490 1-245.p.
11. NÁBRÁDI, A.-FELFÖLDI, J. (2007) : A mezőgazdasági vállalkozások eredményének mérése. In Üzemtan I. Debreceni Egyetem Agrár- és Műszaki Tudományok Centruma Agrárgazdasági és Vidékfejlesztési Kar. Debrecen.
12. SZÉKELY, CS. – TAKÁCSNÉ GYÖRGY, K.(2008): A mezőgazdasági üzem fogalmának változása. Gazdálkodás, 2008. 02. szám 172 p.
13. SZÉKELY, CS. -TAKÁCSNÉ GYÖRGY, K. (2007). Az üzemtan, mint tudomány. In Üzemtan I. Debreceni Egyetem Agrár- és Műszaki Tudományok Centruma Agrárgazdasági és Vidékfejlesztési Kar, Debrecen.
14. SZŐLLŐSI, L. (2009): A gazdasági és technológiai tényezők szerepe a vágócsirke termékpályán. BAROMFI ÁGAZAT 9:(2) pp. 12-18. (2009)
15. WARREN, M.F. (1992): Financial management for farmers. Stanley Thornes Publishers Ltd. Leckhempton, ISBN 0-7487-1544-4 47-49. p.