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OPERATING RESULTS OF SILAGE ENTERPRISE OF A FARM - A CASE STUDY

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Abstract: *Improvements in agriculture has been focusing on innovations to improve the efficiency of the activity by making the traditional production structure currently in use more flexible and by making the necessary technological changes for farmers with large areas and the necessary machinery and equipment. Farms with significant arable land are able to offset the effects of changes affecting efficiency and profitability. The decisive sector of agriculture in Hungary is crop production, therefore its performance is largely determined by the annual output of the crop sector and the volatility in prices. From the farm data, we calculated farm-level results that support the need for machinery modernisation efforts, as precision tools and improvements already started in maize production can be applied fruitfully even in the light of the increasing frequency of negative climatic effects. During the development of silage maize cultivation technology, the achievements of precision farming were applied. Differentiated nutrient replenishment and sowing operations were used, in addition to the fact that harvesting was also documented. We set ourselves the goal of analyzing the management data of the study period between 2019-2022 in order to reveal the nature of the changes that occurred in terms of production value, production cost, and income, as well as the components that shape them. The presented values are average values of such conditions which are also suitable for crop-level conclusions. At the same time, they can be used to identify sector-level challenges and trends.*

Keywords: *silage production, site-specific technology, costs, gross margin*
(JEL Code: Q12)

INTRODUCTION

Maize is the world's largest cultivated crop. In Europe, France with its 3.2 million hectares has the largest maize-growing area, of which the silage maize area is around 1.3 million hectares each year. Germany follows with 2.4 million hectares, of which 1,5 million hectares are used to produce silage maize. In Hungary, maize is grown on 1.2 million hectares each year, of which 1.1 million hectares are grain maize and over 80 thousand hectares are used to produce silage one. Silage is a critical input to milk production. Dairy cattle farmers have long struggled with low milk buying-in prices, which draws the attention to explore all options to reduce their impact. As milk prices are independent of them, they are looking at the costs of milk production and how it can be reduced by influencing input costs. Almost half of the total cost price raw milk is the feed cost, in which the bulk feeds such as silage produced in-house account for a large proportion. By using maize silage, which is the basis of domestic recipes, farmers have a direct impact on nearly a quarter of these costs. Modern hybrids today is not about high green yields. Meeting the needs of dairy cattle farmers must produce silage maize hybrids with excellent feed value. Dry matter yield, energy content and digestibility of silage all have an impact on the economics of milk production, increasing milk yield and reducing the cost price. That highlights the production technology and the demand for continuous improvement in production technologies of inputs that conributes to the overall efficiency of farming as a constant demand from management point view (SZŰCS-FARKASNÉ FEKETE, 2008; BOIKO, 2019). SMUK et al. (2009) revealed the relationship between the returns on precision farming as a modern approach and farming assets and the size of farming, highlighting the farms with larger croplands are able to offset the change in yield or the expected interest level. KALMÁR et al. (2004) stated in relation to precision technology that this is a reasonable alternative for farms only with over 1000 ha crop land. Bulky material such as harvested maize for silage demands for transporting large quantities over long distances relatively, which needs additional capacities (HUSTI 2007). To improve the perfomance when cultivating crop lands on the spot, farmers must develop suitable field (soil etc.) conditions as possible or organise several shifts or even by blocking (HUZSVAI et al, 2012). KEMÉNY et al. (2017) analysed farming performance of different sizes including farms with over 1,000 hectares and smaller ones as well, drawing the attention to those cultivating smaller areas being capable of generating positive returns as well. Since agriculture performance is largely determined by the annual output of the crop production in Hungary (POPP et al., 2019), flexible operation should be a constant aspiration for the productivity of the plant growing sectors and to increase their competitiveness (FELFÖLDI, 2013), taking into consideration the framework given by the natural-economic environmental factors. This can improve the product chain operation by its better flexibility that is highly expected in the agri-food sector as well (YOUSUF et al. 2022).

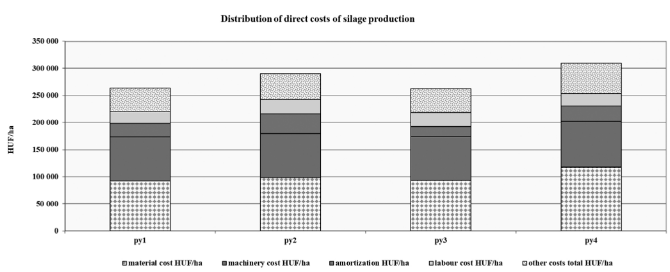
MATERIALS AND METHODS

During the development of silage maize cultivation technology, the achievements of precision farming were applied. Differentiated nutrient replenishment and sowing operations were used, in addition to the fact that harvesting was also documented. In addition to the base fertilizers, top fertilizers were also applied in a differentiated and positioned manner in several rounds in the years of experiment. Collected data came from production technology and enterprise management data for the years 2019-2022, in order to evaluate the efficiency of production by a complex economic approach of its technological process (APÁTI et al. 2010; SULYOK et al. 2013; Zhang – Kovacs, 2012). Recording the material costs, machinery costs, labour costs and other direct costs, the sectoral cost-income analysis was carried out for silage cultivation technology variants. From the enterprise data, farm level results compiled according to the crop structure were calculated (KAY et al.1994). The basic data used for the study were collected and processed annually. Based on this that data set, we compiled a breakdown of value, cost, and income data and the components that make them up, which represented the initial data. This included not only basic data, but also derived data, which were examined to evaluate the main management indicators.

RESULTS AND DISCUSSION

First, the cost data used during the investigation will be presented. The direct cost is related to the basic activity of the organization, it is directly related to the production of a product. The following graph (Figure 1.) shows the distribution of direct costs. In the examined period (2019-2022), the amount of direct costs was between HUF 260,000 and HUF 310,000. The largest proportion was represented by raw material costs and machine costs. These two items account for more than 50% of direct costs. The raw material cost includes the cost of organic fertilizer, seed, artificial fertilizer and plant protection product. The cost of machinery includes variable costs related to the machinery, the cost of the activity and the cost of external machinery services. The depreciation cost does not vary greatly between the years under examination. The cost breakdown represents the usual and accepted ratios in the sector. Raw material costs showed a significant increase during the last year, partly due to the incredible price increases in the sector. Overall, input prices in agriculture rose by 41%. The dramatic price rises in recent years have been caused by a combination of factors. A Europe-wide drought due to unfavourable weather conditions reduced yields, which caused price increases. The supply and demand shocks caused by the Covid19 epidemic have not yet been resolved. International demand for fodder crops has continued to grow. Energy prices have risen in parallel with the economic recovery.

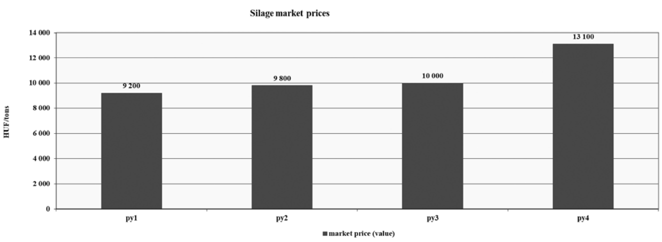
Figure 1: The Triple bottom line sustainability model



py=production year
Source: Author's own construction

The following graph (Figure 2.) shows the change in the market price of silage during the examined period. There was a minimal price increase in years 1-3 of the study. In 2022, the drought in Europe will directly affect the presence of moulds and mycotoxins. Mycotoxins are produced by certain types of moulds that affect feed quality and performance. As a result of the 2022 harvest, prolonged heat and drought resulted in very high aflatoxin contamination. High levels of contamination may have been behind the significant price increase (around 24% compared to the previous year) as the supply of quality silage was limited due to the drought.

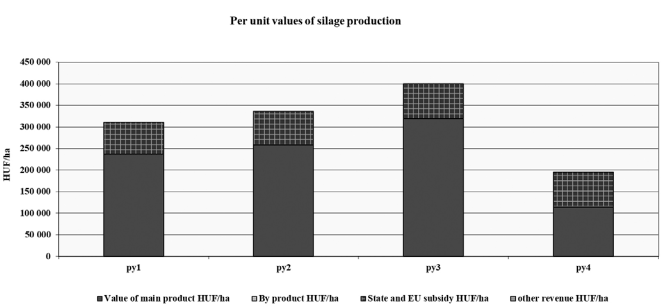
Figure 2. Silage market prices



py=production year
Source: Author's own construction

The third graph shows the unit value of silage production per hectare. As in the previous results, negative values are shown for the year 2022. The graph also shows the value of the main product by product revenue and other revenue. These items have a value of 0 in the database. The production value per hectare shows an increasing trend in the first three years. It has varied between 300 000 and 400 000 HUF. Compared to the first year, the third year shows an increase of 25.6%, due to both the increase in yields and the increase in market prices. The fourth year value of main product shows 51% decrease compared to the first year under review and a 64% decrease compared to the third year. Production fell by nearly a third to about a third in a critically dry, drought-stricken year. Although market throughput increased, yields were critically low. Production value data are shown in Table 1. We can see that the yield in the fourth year was 8.7 t/ha.

Figure 3. Per unit values of silage production



py=production year
Source: Author's own construction

The following figure (Figure 5.) shows the gross margins of silage production. The term gross margin refers to a profitability ratio that examines a company's gross profit relative to revenue or sales. The company's gross margin is expressed as a percentage. Gross profit is determined by calculating gross sales. The higher the gross margin, the more capital the company has left, which it can then use to pay

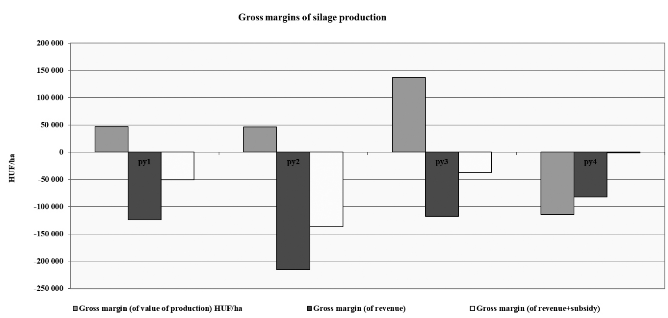
Table 1. Value of main product

Denomination	Unit of measure	py1	py2	py3	py4
Value of main product	HUF/ha	237 176	257 740	319 000	113 970
Average yield	t/ha	26	26,3	31,9	8,7
Market price (value)	HUF/t	9 200	9 800	10 000	13 100

py=production year
Source: Author's own construction

other expenses or meet debt obligations. The first column shows the gross margin per hectare. The difference between the first and the second year of the study is minimal, but in the third year it almost triples. Gross margin (of value of production) was highest in the third year. In the fourth year it becomes negative. Gross margin of revenue is negative in all the years under review (total income of enterprise - total direct costs). The third column shows gross income per value of production plus subsidies. It was highest in the fourth year, as that year saw a doubling of state and EU subsidies compared to the previous three years due to the critical drought (drought damage).

Figure 5. Gross margins of silage production



py=production year
Source: Author's own construction

The fourth year was a year of critical failure. State and EU subsidies have helped somewhat to mitigate the drop in profitability, but the figures perfectly reflect the damage caused by the drought. The following table (Table 2.) compares the average figures for years 1 to 3 with the results for year 4. We can see that the direct cost elements represent similar proportions on average over the three years compared to the fourth year. In the first-three years, the value of main product was 78% (271 305 Ft/ha) of the production value (348 905 Ft/ha), while in the fourth year it was 20% less, 58%. The State and Eu subsidy was 42% of the production value (81 300 Ft/ha), as the yield was less than a third (average 28 t/ha > 9 t/ha). In 2022 grants represented for 42% of revenue. Examining direct costs probably due to the precision equipment, machinery costs were 3% lower in the fourth year compared to the three-year average and labour costs were 2% lower. The direct cost averaged 92% of total production costs over the three years. In the fourth year it was 94%. The Delta column shows the absolute difference between the periods under consideration, while Delta% shows the magnitude and direction of change.

Table 2. Summary table

Denomination	m.u.	py1-3		py4		Delta	Delta %
value of main product	Ft/ha	271305	78%	113970	58%	-157335	-0,58
average yield	t/ha	28		9		-19	-0,69
market price (value)	Ft/t	9667		13100		3433	0,36
by poduct	Ft/ha	0	0%	0	0%	0	0,00
State and EU subsidy	Ft/ha	77600	22%	81300	42%	3700	0,05
other revenues	Ft/ha	0	0%	0	0%	0	0,00
Value of production	Ft/ha	348905	100%	195270	100%	-153635	-0,44
material cost	Ft/ha	94463	35%	117960	38%	23497	0,25
machinery cost	Ft/ha	81308	30%	84320	27%	3012	0,04
amortization	Ft/ha	26491	10%	28281	9%	1790	0,07
labour cost	Ft/ha	24852	9%	23099	7%	-1752	-0,07
other costs	Ft/ha	43200	16%	55881	18%	12681	0,29
Total direct cost	Ft/ha	272246	100%	309541	100%	37295	0,14
Gross margin (of value of pr	Ft/ha	76660	100%	-114271	100%	-190931	-2,49
Indirect cost of enterprise	Ft/ha	5575	24%	2621	13%	-2953	-0,53
Overheads (farm)	Ft/ha	18074	76%	16859	87%	-1214	-0,07
Total indirect cost	Ft/ha	23648	100%	19481	100%	-4168	-0,18
Total direct cost	Ft/ha	272246	92%	309541	94%	37295	0,14
Total indirect cost	Ft/ha	23648	8%	19481	6%	-4168	-0,18
Total cost of enterprise	Ft/ha	295894	100%	329022	100%	33128	0,11
Net profit margin	Ft/ha	53011	100%	-133752	100%	-186763	-3,52

py=production year
Source: Author's own construction

CONCLUSIONS

Initially, the crown virus pandemic in 2020 did not have a significant direct impact on the natural output of agriculture. Overall, despite the negative effects of the epidemic, agriculture had an average year, as shown in the yield table. However, there were difficulties in marketing and the sector was not spared logistical problems, stricter safety standards, financial difficulties and labour shortages. What can also be seen from the farm data is that the extreme economic and market changes have had a major impact on the agricultural input markets, with fertiliser, seed and pesticide use facing significant price increases. The military conflict has further disrupted the market, and the data for the 4th pilot year perfectly reflect the consequences of the historic drought that has hit domestic agriculture, giving a new impetus to price increases. The conclusion of the study is that, based on the analysis of the four years, there are some factors that show drastic changes, but there are also some factors that have not developed negatively despite the unfavourable market and economic conditions.

In crop lands with good fertility, good crop yields were harvested even with the use of traditional and differentiated sowing and nutrient management. In this case the decisive influencing factor was the available absorbable soil moisture content. On the other hand, in the experimental areas with more heterogeneous soil properties, it was the differentiated cultivation technology that resulted in additional yields even in the year with less precipitation. These effects were reflected in the figures and influenced the management indicators.

Farmers developing a plan to manage farm businesses also have to figure out the technology, which may be different from one plots to another. The presented values in this paper are average values, which are also suitable for crop-level comparisons. At the same time, they also help to recognize national sector averages and trends. In the case of a given economy, these values may be very telling.

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REFERENCES

Apáti, F., Nyéki, J., Szabó, Z., Soltész, M., Szabó, V., és Felföldi, J. (2010). Cost and profit analysis of sour cherry production for industrial purposes in Hungary. International Journal of Horticultural Science, 16(1), 75–79. https://doi.org/10.31421/IJHS/16/1/868

Boiko, I. (2019): Precision agriculture in the Ukraine. ISPA Newsletter Volume 7. Issues 1. p. 219. https://www.ispag.org/about/newsletters?preview=84

Felföldi J. (2013): Növénytermesztési ágazatok vállalkozásszintű versenyképessége. In: Szűcs, I (eds.) Mezőgazdasági ágazatok gazdaságtana : Elméleti jegyzet. Debrecen, Hungary : Debreceni Egyetem. Agrár- és Gazdálkodástudományok Centruma pp. 114-124. , 11 p.

Husti I. (2007): A gépesítés ökonómiája. [In: Üzemtan I. (Szerk: Nábrádi A. – Pupos T.- Takácsné Gy. K.]. DE AMTC AVK . 141 p.

Huzsvai L, Ferencsik S, Sulyok D. (2012): Optimális erőgép és munkagép-szükséglet meghatározása a növénytermesztésben (Visual Basic és R alkalmazások). Agrárinformatika 2012 Konferencia. CD kiadvány. Debrecen

Kalmár S, Salamon L, Reisinger P, Nagy S (2004): Possibilities to apply precision weed control in Hungary: (A precíziós gyomszabályozás üzemi alkalmazhatóságának vizsgálata) Gazdálkodás 48 : Suppl 8 pp. 88-94. , 7 p. (2004)

Kemény G, Lámfalusi I, Molnár A (2017): A precíziós szántóföldi növénytermesztés összehasonlító vizsgálata. Agrárgazdasági Kutató Intézet, Budapest, 170 p. ISBN: 978-963-491-601-7

Ronald D. Kay, - William M. Edwards, - Patricia, Duffy (1994): Farm management, ninth edition, McGrow Hill

Sulyok D, Ferencsik S, Rátonyi T, Huzsvai L, Nagy J. (2013): Agronomical and agro-economical evaluation of maize production in various cultivation systems, Növénytermelés 62 .33-36. pp.

Popp J, Szenderák J, Fróna D, Felföldi J, Oláh J, Harangi-Rákos M. (2019): A Magyar mezőgazdaság teljesítménye 2004-2017 között. Jelenkori Társadalmi és Gazdasági Folyamatok 13 (3-4):9-20.

Smuk N, Milics G, Salamon L, Neményi M (2009): A precíziós gazdálkodás megtérüléseinek vizsgálata. Gazdálkodás 53 (3) 246-253

Yousuf A, Kozlovskyi S, Leroux J.M., Rauf A, Felfoldi J (2022). How does strategic flexibility make a difference for companies? An example of the Hungarian food industry. Problems and Perspectives in Management, 20(3), 374-386. doi:10.21511/ppm.20(3).2022.30

Szűcs I, Farkasné Fekete M. (2008): Hatékonyság a mezőgazdaságban. Elmélet és gyakorlat. Agroinform Kiadó, Budapest.

Zhang Ch. – Kovacs J. M. (2012): The application of small unmanned aerial systems for preciosn agriculutre: a review: Precision Agriculutre Volume 13. pp. 693-772. DOI: 10.1007/s11119-012-9274-5