András Nábrádi[*], Madai Hajnalka[*], Miklós Lapis[**]

[*]Universityof Debrecen, Hungary, [**]Rural-Nord Ltd, Hungary

ECONOMICS OF OIL PUMPKIN SEED PRODUCTION

EKONOMIKA PRODUKCJI OLEJU Z NASION DYNI

Key words: greening, oil pumpkin seed, profitability

Słowa kluczowe: zazielenienie, olej z nasion dyni, opłacalność

Abstract. Regulations of new CAP reforms moving from product to producer support and now to a more land based approach. This is in response to the challenges facing the sector, many of which are driven by factors that are external to agriculture. These have been identified as economic, environmental and territorial. To achieve these long-term goals, the existing CAP instruments had to be adapted. The reform therefore focused on the operational objectives of delivering more effective policy instruments, designed to improve the competitiveness of the agricultural sector and its sustainability over the long term. Accordingly there is a great need to restructure the formal crop rotation and to introduce new alternative crops as food industrial crops and vegetables. Both cases have high invested special asset and manual work requirement. This paper as a case study gives an analysis of oil pumpkin seed production, which serves as an example of economic and technological planning a formal crop production farm over 100 hectares. The new crop was introduced as a possibility to face with diversification under the new CAP regime of greening. The economic analysis covers five years of production and financial data on the basis of the given crop rotation.

Introduction

As for the new EU budgetary period, 30% of direct agricultural supports are to be spent on agricultural practices beneficial for the climate and the environment. An alternative of this assistance policy is the conditionality called greening**,** prospectively including the most applicable element in the practice of plant production: diversification. The list of plants included in potential diversification includes priority and other industrial crops, of which percentage covers 26% of domestic arable land today. Oil pumpkin is represented here by 0.5% (approximately 20-25,000 ha). Pumpkin has high nutritional needs and chemical sensitivity, therefore its production requires expertise and good growing conditions. Due to its special production equipment, its investment needs are also high, therefore its production presupposes a long-term production structure. In this case, however, a highly profitable and perfectly suitable plant will be integrated in the rotation system. Its important benefit is that when pumpkin is marketed, the percentage of its annual export accounts for 90% of the total yield, indicating a healthy economic environment. In addition to Austrian customers, mainly German and Dutch traders purchase Hungarian pumpkin seed. Pumpkin producers can be divided into two large groups: small-scale producers of oil pumpkin on 1-2 ha of land and bigger ones with arable lands of more than 30 ha. Naturally, the latter ones are capable of producing significant quantity and homogenous products, as they possess the required expertise and machinery. In this market segment, the average area of arable land is about 60-70 ha, including farms with pumpkin plantations as large as 200 ha. The above mentioned suggest that oil pumpkin is an alternative plant with a perspective both in terms of technology and economy, in the system of crop rotation suitable for diversification. If the conditions satisfy all its needs, its production is safe and profitable. As a stoop crop, it is an excellent green crop, exerting a highly beneficial agro-technical influence on soil structure. The other positive aspect of pumpkin production is its profitability. It is a cash-crop, its contractual production potentials ensure safe and satisfactory revenue; moreover, it is a key element of farm financial management as a result of the selling practices of traditional crop cultures. Its revenue can be boosted by eco-production. It

can be stated that due to the needs of oil pumpkin and its large scale production technologies, oil pumpkin seed may become a competitive, alternative food industrial crop in the domestic crop structure, as it is clearly demonstrated by yield and profitability indicators.

Research material and methods

Despite the difficulties of statistical data collection, the bibliographic review sought to highlight the specialities of the sector and to define pumpkin production both as a challenge and an opportunity. Primary data collection used farm data, luckily not merely restricted to the documentation of area payment applications, as the farm manager had relatively precise written reports about the technological and economical production data of plant cultures over several years. Secondary data collection posed several problems in terms of both international literature and statistical data. As a result, firstly the assessment of regional and estimated data was possible. Data series in the international statistical system include other seed and oil seed categories, so oil pumpkin seed is hard to find in comprehensive, summary statistics, mostly in export/import data. The other problem about international data collection is that certain countries classify oil pumpkin seed in different categories, making follow-up, comparison and summary difficult. Clearly, the generally used FAO and EUROSTAT databases did not provide useful data in English. The domestic database is also not explicit, and although both KSH (Central Statistical Office) and MVH (Agricultural and Rural Development Agency) collect data about oil pumpkin seed, their findings are different. They show highly diverse sowing area sizes of 5000-17,700 ha in certain years, and these data are not supported by the estimation and experience of purchasers and sowing seed traders. The reason behind these great differences might lie in the different interpretation of the classification of oil pumpkin. It is sometimes listed as an industrial (oil) plant and sometimes as a horticultural plant (just like squash or courgette), which must be indicated in area payment applications differently, leading to statistical differences.

Origin, popularity and production of pumpkin

Cucurbitacea have been known for almost 10,000 years. They can be used for multiple purposes, they are suitable for human and animal consumption, their nutritional and dietetic values are high – all these account for their widespread popularity. The usefulness of pumpkin was appreciated in all ages and accordingly it was regarded important not only as a food crop. Today shelled pumpkin seed has become widely known as a medicinal and functionally health-preserving food crop [Madai 2008]. More than 800 varieties of dioecious pumpkins are produced for human and animal nutrition, but in some areas the long-lasting types are also used as dishes. The original home of the pumpkin is Middle and South America. In the highly developed Inka, Maya and Aztek cultures, in addition to maize and bean, pumpkin was similarly a staple food. It is also indigenous in Mexico, as it is suggested by the name. In the form of "pepita de calabaza" the word "pepita" means tiny pumpkin seeds. [http://www.whfoods.com/genpage.php?tname=foodspice&dbid=82]. The first pumpkin types arrived in Europe, mostly to the Mediterranean region not long after the discovery of the American continent. In Asia, besides its use for nutritional purposes, it gained significance as a medicinal plant. From the XVI. Century, pumpkin could be found in each and every sea port. In international statistical data series seeds and oil seed categories are displayed, so oil pumpkin seed cannot be found in more comprehensive, summary statistics, mostly in export/import data. The other problem with international data collection is that certain countries classify the oil pumpkin seed differently, making data difficult to follow-up, compare and summarize. In 2004 a report was made in the USA about pumpkin production in Austria (Styria), regarded as the main base of traditional pumpkin production. According to the data published there, its cultivated area was 10,376 ha in 2000, growing to 15,450 ha by 2003 [*Pumpkin Seed Oil...* 2004]. This is equivalent to 1.5 million litre of pumpkin seed oil. In Slovakia, formerly a part of Styria, oil pumpkin was produced on 2500 ha, claims the report. Considerable oil producing areas are

also mentioned in Hungary, the former North-Yugoslavia, Romania and Ukraine. The growth of croplands was observable in Hungary, North-Ukraine and in the area of the former Czechoslovakia in the studied period. Without authentic data, the report mentions that China, Russia and Turkey might become determinant in the global production of oil pumpkin seed. The report discusses the production of Lithuania, Poland and Germany, also without available data. It suggests that New-Zealand, South-Africa and Korea are also significant pumpkin oil users.

As for other sources, the greatest producer of various pumpkin types and seeds is China. India, Russia, Ukraine, Mexico have large sowing areas for pumpkin, the United States of America and South-Africa also produce it. In the USA, the highest volume of oil pumpkin seed is produced in California, Ohio, Pennsylvania, Michigan and New York, on more than 50,000 ha [http://www.tafco.com.au/images/pdfdocs/pumpkinseedrirdcpublishedreport.pdf]. Regarding its trade, the price of pumpkin from overseas is lower than that of the domestic product, but in terms of quality and residues, they are regarded problematic.

The onset and current situation of shell-free pumpkin seed in Hungary

The type of pumpkin that Charlemagne ordered to produce on his estates in the VIII Century and which the Romans also consumed, was not the same as the varieties from tropical America, belonging to the Cucurbita genus, still produced today. From here it spread to the temperate zone and several varieties can be found all over the world [http://trebag.hu/tudasbazis_cikk/71/maghej_nelkuli_tok_termesztes]. No-shell oil pumpkin with non-woody shell may have been the result of spontaneous mutation, and became known in Hungary merely from the 50`s of the XX Century.

The production of no-shell pumpkin looks back more than 100 years in Europe. Oil pumpkin was produced in Hungary in the 30`s, especially for the purpose of oil extraction. During World War II, it proved to be a significant source of fat (oil)" [http://www.agrarbazis.hu/index.php?option=com_content&view=article&id=1240:agroselect-kft-&catid=217:noevenynemesitesrl]. The above sources underlie that in Hungary oil pumpkin seed production was relatively significant before and under World War II and related plant breeding activities were also carried out. After the war, due to farm structure transformations oil pumpkin lost its importance and was not a key element of wholesale farming any longer. However, its production survived as a response to domestic and international demand. In the 70`s and 80`s as a result of growing basic material demands it was put into wholesale production again.

The most important oil pumpkin user and producer is Austria, especially Styria, where we borrowed some varieties and technologies from. Accordingly, the Western Transdanubian region has a longer tradition than the Plain; however, the North-Plain has become the centre of production by now. The oil pumpkin from Styria is a mutant with a non-woody, thin layer of suberised cells. Some researchers claim that it might have been developed by spontaneous mutation. Others suggest that a recessive gene might have triggered the change. At present (on the basis of data from distributers) its production area is approximately 20,000-25,000 ha. Both its bio and traditional versions play an important role to maintain a safe domestic export fund. Production practices show the volume of pumpkin seed per ha in Hungary is 0.4-1.2 t [http://www.biokontroll.hu/cms/index.php?option=com_content&view=article&id=1217%3Aamit-a-hejnelkueli-olajtoekrl-tudni-erdemes&catid=278%3Anovenytermesztes&Itemid=127&lang=hu]. In the Hungarian crop structure, the proportion of cereals is of key significance, as for KSH (Central Statistical Office) data, it covered 66% of arable land in 2014. Major industrial plants account for 25% of the arable land, whereas oil pumpkin can only be found on less than 0.5%, according to data from traders and purchasers. However, the value chain of oil pumpkin seed production can be easily traced and demonstrated in the domestic crop system (Fig. 1). Although oil pumpkin seed is produced and processed, its volume is much lower than the production of oil pumpkin. Most of the sowing seed demand is covered by import (by producers or by the trade of foreign sowing seeds). Processing and marketing also take place on international grounds.

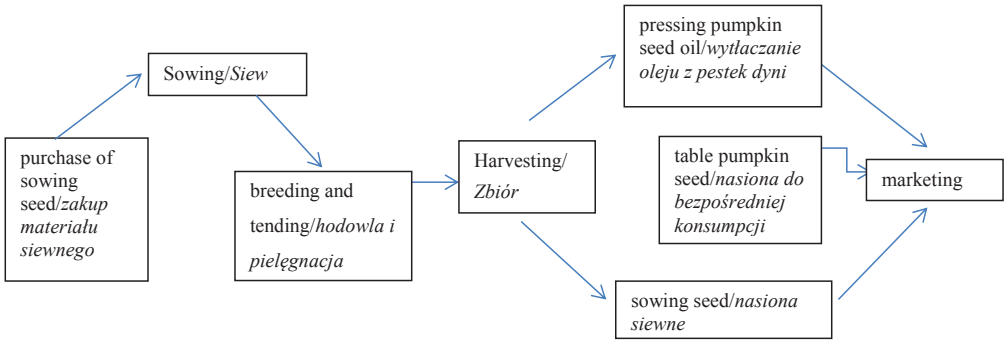

Figure 1. Structure of shell-free pumpkin seed value chain
Rysunek 1. Struktura łańcucha produkcji dyni
Source: own elaboration
Źrodło: opracowanie własne

General cost – output – revenue conditions

Under average conditions, the annual oil pumpkin yield is continuously 5-6 quintals under domestic conditions, but some years see a record output of 8-9 quintals of dried, shelled seeds on one hectare. The starting price for one quintal of pumpkin seed was 90,000 HUF in September 2014, but later it rose to 120,000 HUF. Total costs per hectare are 300-350,000 HUF, and in terms of selling price, returns may reach 500,000 HUF per hectare. In worse-than-expected years, a revenue of minimum 300,000 HUF can be reached. Information of technological parameters clearly suggests that the launch of production has high invested asset requirements and it is only worth for long term pumpkin-producers or for those who integrate other producers in the process through custom work, sales, consultation and the organization of production. In addition to the high investment and maintenance need of machines, their seasonal nature makes their operation rather expensive, so practically the integration of other producers with custom work might improve machine utilization and enhance returns.

Research results

The characteristics and findings of oil pumpkin seed production were analysed through the example of a sole proprietorship with an arable land of 109 ha. The farm produces maize, wheat, oil pumpkin and sunflower on much favoured areas, in crop rotation. The usual greencrop of oil pumpkin is wheat, oil pumpkin is followed by maize and sunflower comes after oil pumpkin or maze. Maze and sunflower are greencrops to maize, thus increasing the positive green crop effect of wheat on pumpkin, avoiding monocultural production for all the involved crops. The sowing area of sunflower is the lowest, as it is sowed to the same area only every 5th years, i.e. due to its diseases shared with pumpkin, it is difficult to fit into the system of crop rotation.

Results of cost analysis

Cost analysis results that production costs for oil pumpkin per one ha, excluding the year of 2014, were the highest every year. In 2014, the production costs of maize were increased by a massive amount of contained water at harvesting and also by the fact that referring to gas transport conditions, the drier plant increased its prices 40% higher, triggering a considerable increase in drying costs. Specific production cost was the lowest for wheat, due to the low input-demand of its production technology.

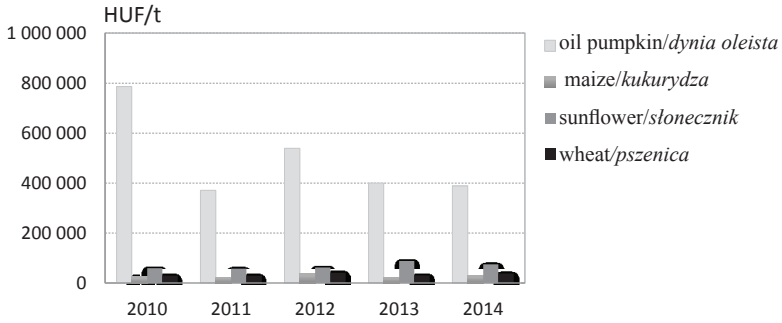

Figure 2. Net cost of plant production in period 2010-2014
Rysunek 2. Koszty netto uprawy dyni w latach 2010-2014
Source: own elaboration based on farm data
Źródło: opracowanie własne na podstawie danych z gospodarstwa

The findings of production cost (net cost) examinations (Fig. 2) suggest that the net cost of oil pumpkin, just like all the other production costs, exceed that of other cultivated crops. In the first studied year it was 760,000 HUF/t higher than the crop with the lowest net cost, due to the impact of 2010 (low yields and high production costs, irrespectively of yields).

Cost structure analysis

Characteristically, material costs account for the majority of costs in the crop production sectors. This was true of all the studied crop cultures. Regarding the distributions, the rate of material costs was about 80% (204,000 HUF per ha) for pumpkin, 85% for sunflower and maize and about 70% for wheat. Personnel costs, with the exception of pumpkin, were uniformly low for all the crops. The manual workforce demand of oil pumpkin harvesting and the following activities is high, increasing this cost type considerably. Its rate within the total costs is 8-9%. In the studied years, the personnel costs of pumpkin production varied between 18,000-28,000 HUF, which represents radically higher values as compared to cereals or sunflower with fully automated production technologies. The other cost types failed to show such considerable differences. Depreciation is also the highest for oil pumpkin, as its technology requires special equipment, differently from other crops. The establishment of oil pumpkin production saw its onset in 2010 and since then developments have been continuous. Within material costs, raw materials account for the largest proportion. Within the material costs of oil pumpkin production, as a result of the operation of the privately owned washer-drier plant, energy costs (gasoline and overheads) are much higher than for other crops. With other crop cultures such as maize, producers use custom work if needed.

Revenues

With the exception of oil pumpkin, selling prices fluctuated during the 5 years under review and pumpkin sales featured the lowest fluctuations and risks. The impact of the given year (2014) works better in market prices, as European and global prices spread into domestic purchase prices. The oil pumpkin market is smaller and quantitative fluctuations influence purchases to a lesser extent. For oil pumpkin, deviation from the average was merely 10.56% in the average of the five examined years. Oil pumpkin sale prices show an increasing growth year to year, whereas the other three crops showed much higher price fluctuations in terms of output. The largest change was revealed in the case of maize, where deviation from average was 24.86%. In 2012 the sales price of maize was outstandingly high as compared to the previous years, when it was only 63,000 HUF/t, whereas it was only 45,200 HUF/t in 2010 and 23,000 HUF/t in 2009. From 2013 sales prices dropped again.

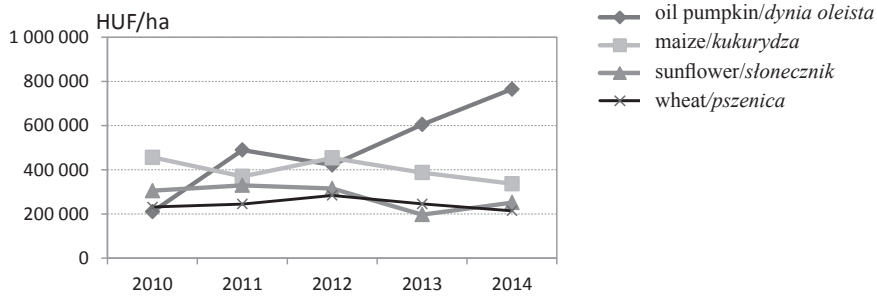

Figure 3. Net revenue from sales in 2010-2014
Rysunek 3. Przychody netto ze sprzedaży w latach 2010-2014
Source: own elaboration based on farm data
Źródło: opracowanie własne na podstawie danych z gospodarstwa

This considerable price fluctuation makes the sales revenues uncertain, making profitability planning difficult in maize production.

Our analysis in the studied period revealed price stability and safe market conditions in terms of oil pumpkin profitability. The years under review proved to be characteristic in relation to the safe and outstandingly high revenue from pumpkin sales in the given crop structure (Fig. 3). In 2014 the net revenue from pumpkin sales was 765,000 HUF/ha, which is also a positive result compared to the average revenue of arable crops. In the given year it was partly due to impact of the particular vintage and the low yields produced in rival countries of pumpkin production. In 2010, the "learning year" the production parameters of pumpkin production were especially poor, as in this year high precipitation slashed the yield and the sowing area was also minimal. 2012 was a droughty year and as a result of maize shortage, the price of fodder maize was exceedingly high, whereas the specific yield of oil pumpkin was low. It also manifested in the revenues. As for wheat and sunflower, revenues tended to be low due to the limited nature of yield growth and the development of prices.

As an average of several years, income analysis shows that oil pumpkin production is more costly than production in other sectors, but its consistent price growth is more favourable than that of other classical arable crops (Fig. 4).

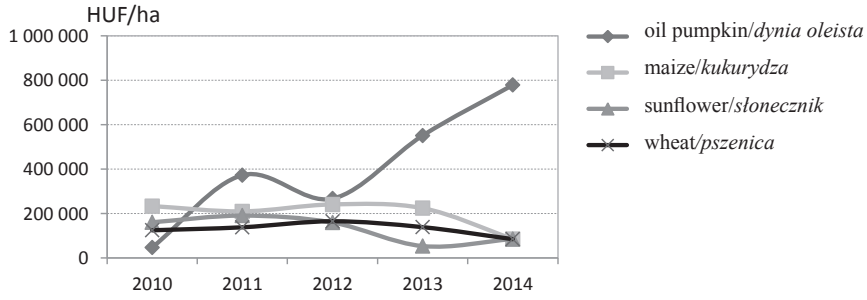

Figure 4. Development of net income growth in 2010-2014
Rysunek 4. Wzrost dochodów netto w latach 2010-2014
Source: own elaboration based on farm data
Źródło: opracowanie własne na podstawie danych z gospodarstwa

Summary and conclusions

The studied enterprise served as a good example for the above mentioned. In addition, as it is stipulated by the support system of the new budgetary period, oil pumpkin can play a considerable part in economy of medium and large farms. Its economy is a significant positive aspect. As a result of the selling process of traditional arable crops (selling time, no reverse charge applied), oil pumpkin is also a key product in the financial management of the farm. Similarly important is the fact that if pumpkin is calculated as a by-product, it can also be used as mass fodder for silage, releasing lands for cash crops. After the harvest, its crushed parts and trailers are immediately mixed into the soil by heavy disks and its beneficial effects are higher than that of sown green manure. The disadvantages of oil pumpkin production include weather and vintage hazards, its investment costs require special equipment. On the other hand, it has numerous advantages: the "custom work" type integration of producers improve the exploitation of capacities and provides fast returns. Moreover, higher commodity stocks and better bargaining positions also enhance the strategic significance of cooperation. Under favourable conditions its production is safe and its price fluctuations are moderate.

Bibliography

Madai H. *2008: A funkcionális élelmiszerek elő*állítása, fogyasztása és piaca, [w:] J. Nagy, J. Schmidt, A. Jávor (eds.), *A jövő élelmiszerei és az egészség*, Center-Print Debrece, 198-202, ISBN 978-963-9732-36-0.

Pumpkin Seed Oil – the "Green Gold of Styria", an Austrian Specialty. 2004: GAIN, USDA,Foreign Agricultural Service Global Agriculture Information Network Report Number AU4011, 2pp. [online], http://www.australianoilseeds.com/data/assets/pdf_file/0014/7025/bavec,franc00220.pdf.

http://www.whfoods.com/genpage.php?tname=foodspice&dbid=82.

http://www.agrarbazis.hu/index.php?option=com_content&view=article&id=1240:agroselect-kft-&catid=217:noevenynemesitesrl.

http://www.biokontroll.hu/cms/index.php?option=com_content&view=article&id=1217%3Aamit-a-hejnelkueli-olajtoekrl-tudni-erdemes&catid=278%3Anovenytermesztes&Itemid=127&lang=hu.

http://www.tafco.com.au/images/pdfdocs/pumpkinseedrirdcpublishedreport.pdf.

http://trebag.hu/tudasbazis_cikk/71/maghej_nelkuli_tok_termesztes.

www.ksh.hu.

www.mvh.gov.hu.

Summary

Przeprowadzono analizę ekonomiczną opłacalności produkcji oleju z nasion dyni uprawianej na powierzchni ponad 100 ha. Uprawa dyni na nasiona z przeznaczeniem na produkcję oleju została wprowadzona jako dywersyfikacja produkcji w ramach wymagań zazieleniania wspólnej polityki rolnej. Analizy dotyczyły danych za 5 lat i objęły lata 2010-2014.

Coresspondence address
András Nábrádi professor, Madai Hajnalka (PhD) assistant professor
Universityof Debrecen, Faculty of Economics and Business, Institute of Applied Economics
H-4032 Debrecen, Böszörményi u. 138
e-mail: nabradi.andras@econ.unideb.hu, madai.hajnalka@econ.unideb.hu

Miklós Lapis director
Rural-Nord Ltd
H-4032 Debrecen Böszörményi u.49 3/14
e-mail: lapismiklos@gmail.com