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CHANGES IN THE PROFITABILITY OF PRODUCTION OF INDUSTRIAL POTATOES IN POLAND – A CASE STUDY

Key words: potatoes, production, profitability, gross margin

ABSTRACT. This paper assesses the profitability of industrial potato production in Poland. The studies indicated changes on the market concerning industrial potatoes and involved an assessment of the area of cultivation and level of production achieved in comparison to other EU countries. Farm profitability is determined based on the calculated gross margin from which its agricultural income was estimated. An analysis of the profitability of assets and sales was also prepared. Changes in potato production and crop yield as well as the general situation on the potato market were analysed. It was shown that the purchase price of potatoes and potato crop cultivation materials are the most important factors contributing to the profitability of potato production. Research was carried out at a specifically selected family farm specializing in potato production. It was observed that the farmer did not pursue drastic reductions in production costs, as this would have led to a decrease in income and profitability. However, their strategy did allow for a sufficiently high gross margin to be obtained. The gross margin from potato production that was obtained in 2014-2018 was positive, and higher than the average in their province.

INTRODUCTION

The potato market in Poland has been affected by numerous changes in both structure and quality of produce. Changes pertaining to potato-growing areas (due to agro-climatic conditions) and production costs have also taken place. These changes stem from the changing dietary habits of Poles [Bernat 2002], amongst others.

During the production process, a potato's intended purpose has to be considered. Factors here include edibility, starchiness, and whether or not these potatoes are used for further seeding or food processing [Tuka 2016]. When deciding which kind of crop to grow, the potato farmer most often makes the decision based on sales opportunities [Chotkowski 2012]. Potato production is highly profitable although, as indicated by Jacek Chotkowski, it is still an expensive crop to cultivate in comparison to other types of agricultural plants. Despite their popularity and significance in the 60s and 70s, current downward trends in their cultivation area and production can now be observed in Poland. This decline actually began about 40 years ago, and in no other European country has it taken place to such an extent [Plichta 2014]. Figure 1 presents a list of EU countries with the largest changes in potato production volume in 2000-2018. The results show a significant decrease in

Figure 1. Changes in potato production in selected EU countries, 2000-2018

Source: own calculations based on Eurostat data

Figure 2. Changes in the amount of land used for potato crops in selected EU countries, 2000-2018

Source: own calculations based on Eurostat data

Potato yields [t/ha]

■ above 35
 ■ 30.0-34.9
 ■ 25.0-29.9
 ■ 22.0-24.9

Figure 3. Potato yield by province, 2016

Source: [GUS 2018a]

production in Poland, with a more than three-fold reduction in potato harvests. This is mainly due to a decrease in areas of land dedicated to potato cultivation. The data presented in Figure 2 clearly show that the largest reduction in the area of land used for potato cultivation is in Poland. According to Szymon Tarant, this process began much earlier and continued into the 1990s in Poland [Tarant 2002].

This is also suggested by Wojciech Nowacki [2015] and Wiesław Dzwonkowski [2017], who state that the decline in demand for potatoes (mainly fodder potatoes) in Poland has been accompanied by a sharp decrease in their cultivation area. This has, however, been partially compensated for by increased crop yield. The reason for this phenomenon lies primarily in the decreased use of potatoes as fodder (including their reduced use in pig feed), the high cultivation costs of potato crops as well as export restrictions [Ginter, Niewęłowski 2009]. Significant differences in the efficiency of potato cultivation in Poland can be seen on a region-by-region basis (Figure 3).

The highest potato yield was obtained by farms in the Dolnośląskie and Opole provinces. However, the highest production levels were recorded in Łódź, Mazovia and Wielkopolska. Changes in harvests (Figure 4) indicate that potato production depends on climatic conditions as much as profitability. In most provinces, there were significant differences in production in different years. Only in Małopolska and Świętokrzyskie did production oscillate around similar levels.

It is estimated that average potato yield in 2018 amounted to 2.48 tons/ha, which is approx. 11% less than in 2017. Poland's total 2018 potato harvest is estimated at approx. 7.4 million tons, which is 19% less than 2017's total yield [GUS 2018b]. This state of affairs remains unchanged in Poland, despite the fact that the gross margin obtained in potato cultivation is much higher than from other plants. According to the PODR (Pomeranian Agricultural Advisory Center) in Minikowo, in 2017, the value of gross margins of industrially-produced potatoes, by intensity of production, was in the range of PLN 3000-4353. As pointed out by J. Chotkowski [2010], this is strongly related to whether production is carried out using an intensive or extensive system. In the last decade, the global potato market has not been subject to any major changes. Europe and Asia claimed about 80% of the world's potato production between them, mainly due to favourable conditions for potato cultivation on these continents. In this period, China should be considered the largest potato producer, bringing in 99,205 tons in 2017 [FAOSTAT, <http://www.fao.org>]. In comparison, in 2017, Europe produced a total of 12 171 tons of potatoes. In Europe, Germany is one of the largest producers (8,920. tons – in 2018). Within Europe, France came second producing 13.4%, and the Netherlands third with production of 12.5% of the total.

The share of potato production in Poland accounted for 11.6% of EU production, making it the fourth most prolific potato producer [Eurostat 2018]. The vast majority of pota-

Figure 4. Changes in potato harvests by province

Source: [GUS 2017]

toes produced (in the EU) are intended either for food processing or direct consumption. In 2018, the area of potato cultivation decreased in the European Union to 1.74 million ha, which was about 1% smaller than in the previous year. Yield also decreased by about 11%, due to very unfavourable agrometeorological conditions during the growing season. As a result, the harvest was about 12% lower than in 2017 [Dzwonkowski (ed.) 2018].

Despite the increased amount of potatoes produced in Poland, partly due to there being increasing numbers of crops, there is no greater consumption and the upward trend in production is actually declining. In 2005, consumers were buying 126 kg of potatoes per capita, while in 2016 this constituted 97 kg. Despite this decline in consumption per capita, the majority of potato sales are still made for direct consumption (about 3 million tonnes). In 2016, 402,000 tons potatoes were used for industrial processing [GUS 2017].

On the other hand, the economic results obtained from potato production are strongly correlated with the relationship between income and production costs. The profitability of this agricultural activity for farmers results not only from the sales possibilities of the raw material produced, but mainly from production volume, intended usage [Chotkowski 2000], and production technology used. According to Iwona Mystkowska et al. [2016], proper agro-technical measures – especially effective, uniform fertilization, and protection against weeds, pests and diseases – affect the economic results achieved by potato farmers.

MATERIAL AND RESEARCH METHODS

The paper evaluates the profitability of potato production using, in addition to mass statistical data, information collected directly from a family farm selected for the research, specialising in the industrial production of potatoes. In 2014-2018, 150 ha of fields were given over to potato production on this farm, in 4-year crop rotation cycles with winter wheat, winter rape, and spring barley. Of the total space used for potatoes, 120 ha were allocated to cultivating potatoes for French fries, with the remaining 30 ha for seed potatoes to be planted on the farm the following year. The farm is located in Krępa Kaszubska, in the northern part of the Nowa Wieś Lęborska Commune, in the Lębork Poviát, in the Pomeranian province. The area of arable land of the farm amounts to 580 ha, all of which is owned directly by the farmer, with a yield of around 45 tons of produce – much higher than the Polish average of 22.4 tons/ha. This high yield is made possible by, amongst others, the use of high-quality seed potatoes, produced by the farm itself. The data for the calculations presented in this paper come from actual farm documentation, kindly made available by the owner. Every potato transport from the field to the farm building is weighed to determine production volume. The farm's profitability is determined on the basis of calculated gross margin, from which its agricultural income was estimated. Direct costs of potato crops include: the production of seed potato material; fertilizers; plant protection products and various specialized services. Indirect costs included: depreciation; taxes; insurance; fuel; repairs and renovation, as well as the cost of work contracted out. Depreciation costs did not change during the period under research, while the largest fluctuations were noticeable in the purchase of fuel, influenced by changes in fuel prices. The gross margin and income from the crops was calculated using the Farm Accountancy Data Network (FADN) methodology.

RESULTS

The industrial production of potatoes can be profitable. Income can be made stable by signing contracts for several years. This also guarantees the timely collection of produce. As such, when a farmer decides to enter into industrial production of potatoes, it very often affects the location of farms in the immediate vicinity of the relevant processing plant. Despite the often lower contract prices, farmers are willing to enter into such deals to avoid the uncertainty of being able to sell all produce [Klepacki, Gołębiewska 2002]. The prices offered by the retail market significantly differ from those obtained on the wholesale market. This is proven by the fact that in 2014-2018, the average price per 1 kg of potatoes on the retail market ranged from 0.72 to 1.15 PLN/kg. On the wholesale market, however, prices ranged from 0.42 to 1.02 PLN/kg. Potato prices are primarily influenced by fluctuations on the market. As indicated by Aleksander Mach [2015], while potato production in Polish agriculture is profitable, crops must be sown over a large area, and the fields regularly irrigated to ensure their independence from local weather conditions.

The industrial production of potatoes incurs various costs. At the farm researched for this paper, planting materials were most costly. Therefore, they were produced on the farm itself. This involved purchasing macro bulbs, which were then planted in the fields. The seed potatoes thus obtained with the saleable harvest were then sent to specialized storage rooms until spring. As a result, the farm was able to save on seed potato costs, although these were still quite high.

The research period at the farm was characterized by numerous changes in the cost of cultivation materials (Table 1). In order to keep these costs down, the farmer decided to

Table 1. Average production costs for industrial potato crops at the researched farm, 2014-2018

Specification	Cost [PLN]				
	2014	2015	2016	2017	2018
Indirect costs, including:	1,113,400	1,177,880	1,109,220	1,135,200	1,114,000
– potato seeds	492,000	532,000	472,000	498,000	459,000
– fertilizers	249,000	254,000	244,000	255,000	238,000
– plant protection products	367,000	384,900	387,720	375,000	365,000
– specialized services	5,400	6,980	5,500	7,200	52,000
Direct costs, including:	570,910	531,560	556,260	572,440	553,740
– depreciation	210,000	210,000	210,000	210,000	210,000
– taxes	18,640	18,640	18,640	18,640	18,640
– insurance	21,000	21,000	21,000	21,000	21,000
– fuel	128,400	110,920	105,720	134,900	121,400
– ongoing repairs and renovation	39,870	22,000	47,900	28,900	27,700
– contracted work	153,000	149,000	153,000	159,000	155,000
Total costs	1,684,310	1,709,440	1,665,480	1,707,640	1,667,740

Source: own study

reduce costs not only by growing own seed potatoes directly at the farm, but also through the wholesale purchase of fertilizers and plant protection products. It is worth noting that the farmer did not cut back on the actual quantity of fertilizer or protection treatments, as this could cause an excessive drop in yield.

The greatest expense, at nearly 50% of all direct costs, were of the seed potato material, which constituted just over 25% of total direct and indirect costs. Specialized services formed the smallest portion of the farm's indirect costs, at 0.5% less than all direct costs. At the researched farm, these costs covered, for example, disinfection of the storage hall. The most significant indirect costs included financial depreciation, contracted work and fuel. In the individual years of the period analysed, the costs incurred as a result of agricultural activity were subject to slight fluctuations (Table 2). The highest average costs occurred in 2014, 2015 and 2018, while the lowest in 2016, undoubtedly influenced by favourable weather that year. The prices offered by the processing plant to which the farmer sells raw material were in the range of PLN 0.54-0.62 per kg. Their main goal was to produce raw material with the highest possible quality parameters, thus commanding higher purchase prices.

Table 2. Comparison of production value and production costs for industrial potatoes

Specification	2014	2015	2016	2017	2018
The amount of production [kg/farm]	5,400,000	5,500,000	6,600,000	5,700,000	5,200,000
Total costs [PLN/farm]	1,684,310	1,709,440	1,665,480	1,707,640	1,667,740
Average cost of production of 1 kg of potatoes [PLN/kg]	0.31	0.31	0.25	0.30	0.32

Source: own study

The production value of the potatoes produced on the farm exceeded PLN 3 million (Figure 5). It is worth noting that in 2016, despite the largest amount of potatoes produced and the lowest average production cost, the highest value was still not achieved. This was due to the overproduction of potatoes in Poland that year, which meant that the farmer was forced to export the raw material for the production of French fries. In spite of the benefits of doing so, this entailed high costs.

In 2014, 5,400,000 kg of potatoes were sold for food processing at an average price of 0.62 PLN/kg. 2015 saw a small increase in yield, with a concomitant slight average increase in prices of 0.01 PLN. The weather conditions in 2016 were also more favourable for potato production, thanks to which there was another increase in production. However, a clearly lower production value was obtained. This was clearly influenced by excessive amounts of raw material on the market, resulting in increased competitiveness and a price drop to 0.49 PLN/kg. 2017 saw excessive rainfall, which caused some limitation on production. However, yield remained at a satisfactory level, and the relatively high price of 0.56 PLN/kg compensated for the higher expenditures incurred.

The last year of on-site research, 2018, was characterized by a lingering drought that found reflection in prices – with an insufficient amount of potatoes on the Polish market, the farmer obtained a high gross margin, and as a result planned to expand on farming equipment in 2019 with a self-propelled potato harvester. A calculation of the gross margin and agricultural income in the analysed period is presented in Table 3.

Figure 5. Potato production value, 2014-2018

Source: own study

Table 3. Gross margin and agricultural income on the farm studied, 2014-2018

Specification	2014	2015	2016	2017	2018
Total output [PLN]	3,348,000	3,465,000	3,234,000	3,192,000	3,172,000
Price [PLN/kg]	0.62	0.63	0.49	0.56	0.61
Direct costs [PLN]	1,113,400	1,177,880	1,109,220	1,135,200	1,114,000
Gross margin [PLN/farm]	2,234,600	2,287,120	2,124,780	2,056,800	2,058,000
Gross margin [PLN/ha]	18,621	19,059	17,706	17,140	17,150
Gross margin per specific costs PLN 1	2.01	1.94	1.92	1.81	1.85
Indirect costs [PLN]	570,910	531,560	556,260	572,440	553,740
Family farm income [PLN]	1,663,690	1,755,560	1,568,520	1,484,360	1,504,260

Source: own study

The gross margin created at the farm in 2018 was quite high, compared to the highest value reported by the PODR for that year. For a traditional, medium-intensity and intensive production system these amounted to: 4,047.24 PLN/ha; 10,637.51 PLN/ha, and 15,198.29 PLN/ha, respectively. In the analysed period, the gross margin, which amounted to PLN 1 of variable costs, stood at a level of about PLN 2 and decreased in each subsequent year. Agricultural income at a level of about PLN 1.5 million allowed for new investments in the farm, including some of the latest technological solutions. These were allotted to the modernization of farming machinery, including the purchase of a self-loading digger worth PLN 750,000, and various items of storage equipment. It also contributed to raising the quality of potatoes, which then allowed for extra money selling basic amounts.

The conducted ratio analysis (Table 4) indicates low asset profitability. This unfavourable ratio is caused by the high value of the farm's currently cultivated land. However, it should be taken into account that the land was purchased several dozen years ago, when it was not worth as much.

Table 4. Profitability indicator analysis for the studied farm

Indicators	2014	2015	2016	2017	2018
	%				
Return on assets (ROA)	5.16	5.45	4.87	4.61	4.67
Return on equity (ROE)	5.16	5.45	4.87	5.45	4.87
Return on sales (ROS)	49.69	50.67	48.50	46.50	47.42
Profitability of production	1.99	2.03	1.94	1.87	1.90

Source: own study

On the basis of the conducted research, it can be concluded that the results obtained by the producer are satisfactory to them. Additionally, they saw high production profitability, and their sales profitability can also be positively assessed, as it fluctuated at 50% in the analysed period. Not many farms achieve these kinds of results.

SUMMARY

As with all farming activity, the conditions for the industrial production of potatoes are influenced by prevalent weather conditions, as well as changes in market prices. Agro-chemical conditions are a basic factor affecting potato yield, which then affect the prices offered by buyers and processors. This has a direct impact on the income obtained by the farmers. The profitability of potato production fluctuates at a high level, but changes in the use of potatoes have led to a significant reduction in both their crop area and production level. In these matters, particularly significant changes have occurred in Poland compared to other EU countries.

In the farm analysed for this paper, it was found that the producer did not try to excessively reduce production costs, which could have resulted in an uncontrolled decline in yield and a subsequent decline in income. The gross margin from potato production obtained in 2014-2018 was positive, and higher than the average for their province. The farm owner made investments that contributed to the modernization of farming machinery, which led to higher-quality potatoes. They also invested in new storage equipment, which reduced losses of potato mass.

BIBLIOGRAPHY

- Bernat Edward. 2002. Agrotechnika i mechanizacja produkcji ziemniaków jadalnych. [W] *Produkcja i rynek ziemniaków jadalnych* (Agrotechnika and mechanization of edible potatoes production). [In] *Production and market of edible potatoes*, ed. J. Chotkowski, 101-113. Warszawa, Wieś Jutra.
- Chotkowski Jacek. 2000. Technologiczne i rynkowe czynniki produkcji ziemniaków (Technological and market factors in potato production). *Zagadnienia Ekonomiki Rolnej* 2-3, 48-59.
- Chotkowski Jacek. 2010. Ekonomiczne i regulacyjne problemy rynku skrobi ziemniaczanej w Polsce (Economic and regulatory problems in potato starch market in Poland). *Zagadnienia Ekonomiki Rolnej* 4: 87-103.

- Chotkowski Jacek. 2012. *Produkcja i rynek ziemniaka* (Potato production and market). Warszawa: Wieś Jutra.
- Dzwonkowski Wiesław. 2017. Ewolucja produkcji ziemniaków w Polsce i UE. *Zeszyty Naukowe Szkoły Głównej Gospodarstwa Wiejskiego w Warszawie, Problemy Rolnictwa Światowego* 17 (3): 71-80. DOI: 10.22630/PRS.2017.17.3.54.
- Dzwonkowski Wiesław (ed.). 2018. *Rynek Ziemniaka. Stan i Perspektywy* (Potato Market. Status and Perspectives) 45: 1-40.
- Eurostat. 2018. *Rolnictwo* (Agriculture), http://ec.europa.eu/eurostat/statistics-explained/index.php/Agricultural_products, access: 29.10.2018.
- FAOSTAT. <http://www.fao.org/FAOSTAT/en>, access: 20.03.2019.
- Ginter Agnieszka, Marek Niewęglowski. 2009. Wpływ płatności uzupełniających na opłacalność produkcji ziemniaków skrobiowych (Influence of Completed Payment on Production Profitability of Starch Potatoes). *Journal of Agribusiness and Rural Development* 2 (12), 45-51.
- GUS (CSO). 2017. *Rocznik statystyczny rolnictwa* (Statistical Yearbook of Agriculture). Warszawa: GUS.
- GUS (CSO). 2018a. *Produkcja roślinna w 2017 roku* (Crop production in 2017). Warszawa: GUS.
- GUS (CSO). 2018b. Przedwiniowy szacunek głównych ziemioplodów rolnych i ogrodniczych w 2018 r. Informacje sygnałowe (Pre-trial estimate of the main agricultural and horticultural crops in 2018. Signal information). Warszawa: GUS.
- Klepacz Bogdan, Barbara Gołębiewska. 2002. Opłacalność produkcji ziemniaków jadalnych. [W] *Produkcja i rynek ziemniaków jadalnych* (The profitability of the production of edible potatoes. [In] Production and market of edible potatoes), ed. J. Chotkowski, 40-49. Warszawa: Wieś Jutra.
- KPODR. 2017. *Kalkulacje rolnicze nadwyżek bezpośrednich i dochodu rolniczego netto. Ziemniaki przemysłowe. kalkulacja uprawy 1 ha przy różnych poziomach intensywności* (Agricultural calculations of direct surpluses and net agricultural income. Industrial potatoes. calculation of 1 ha cultivation at different intensity levels), Minikowo: Kujawsko-Pomorski Ośrodek Doradztwa Rolniczego, <http://www.ekonomika.kpodr.pl>, access: 24.03.2019.
- Mach Aleksander. 2015. Czy uprawa ziemniaków się opłaca? (Is growing potatoes profitable?) *Dziennik Bałtycki, Strefa Agr*, 16 września 2015.
- Mystkowska Iwona, Alicja Baranowska, Krystyna Zarzecka, Marek Gugala, Marcin Lipiecki. 2016. Opłacalność produkcji ziemniaka dla przemysłu skrobiowego w gospodarstwie indywidualnym (Profitability of starch potato cultivation for the agri-food industry in an individual holding). *Zeszyty Naukowe Uniwersytetu Przyrodniczo-Humanistycznego w Siedlcach. Administracja i Zarządzanie* 110: 103-112.
- Nowacki Wojciech. 2015. Szanse i zagrożenia rynku ziemniaka w Polsce (Opportunities and threats of potato market in Poland). *Roczniki Naukowe SERiA XVII* (2): 169-175.
- Plichta Tadeusz. 2014. *Rynek ziemniaka. Stan i perspektywy* (Potato market. Status and perspectives), <http://podr.pl/wp-content/uploads/2014/11/rynek-ziemniaka-stan-i-perspektywy.pdf>, access: 23.03.2019.
- PODR. 2018. *Przykładowa kalkulacja dochodu rolniczego z 1 ha uprawy przy różnych poziomach intensywności produkcji. Uprawa: ziemniaki przemysłowe na cele spożywcze* (Example calculation of agricultural income from 1 ha of cultivation at different levels of production intensity. Cultivation: industrial potatoes for food), <http://podr.pl/doradztwo/kalkulacje-rolnicze-produkcja-roslinna>, access: 24.03.2019.
- Tarant Szymon. 2002. Analiza tendencji w produkcji ziemniaków w Polsce w latach dziewięćdziesiątych (Analysis of development tendency in potato production in Poland in the nineties). *Roczniki Akademii Rolniczej w Poznaniu. Ekonomia CCCXLIII* (1): 193-203.
- Tuka Paulina. 2016. Zmiany powierzchni uprawy a opłacalność produkcji ziemniaków w Polsce (Changes in the production area vs. profitability of potatoes in Poland). *Roczniki Naukowe SERiA XVIII* (3): 12-13.

ZMIANY OPLACALNOŚCI PRODUKCJI ZIEMNIAKÓW PRZEMYSŁOWYCH W POLSCE – CASE STUDY

Słowa kluczowe: ziemniaki, produkcja, opłacalność produkcji, nadwyżka bezpośrednia

ABSTRAKT

W pracy podjęto zagadnienie oceny opłacalności produkcji ziemniaków przemysłowych w Polsce. Wskazano na zmiany sytuacji na rynku ziemniaków przemysłowych, dokonując oceny w porównaniu do innych krajów Unii Europejskiej w zakresie powierzchni uprawy oraz poziomu uzyskiwanej produkcji. Opłacalność prowadzonej produkcji w gospodarstwie określono w oparciu o obliczoną nadwyżkę bezpośrednią, a następnie oszacowano uzyskiwany dochód rolniczy. Sporządzono także analizę rentowności majątku i sprzedaży. Dokonano również analizy zmian w zakresie produkcji i uzyskiwanych wydajności, a także sytuacji na rynku ziemniaków. Wykazano, że najbardziej istotnymi czynnikami warunkującymi opłacalność produkcji ziemniaków są ceny sprzedaży ziemniaków oraz koszt materiału nasadzeniowego. Przeprowadzono badania własne w celowo wybranym gospodarstwie rodzinnym wyspecjalizowanym w zakresie produkcji ziemniaków. Producent nie zdecydował się na maksymalną obniżkę kosztów produkcji, gdyż zgodnie z jego strategią mogłoby to doprowadzić do spadku opłacalności produkcji. Takie działania pozwoliły na uzyskanie odpowiednio wysokiej nadwyżki bezpośredniej. Nadwyżka bezpośrednia z produkcji ziemniaków, którą uzyskano w latach 2014-2018, była dodatnia i wyższa niż średnia w województwie.

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