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PROFITABILITY OF EDIBLE POTATO PRODUCTION – ANALYSIS ON THE PLANTATION LEVEL

RENTOWNOŚĆ PRODUKCJI ZIEMNIAKÓW JADALNYCH – ANALIZA NA POZIOMIE PLANTACJI

Key words: potato, profitability of cultivation, Gross Margin

Słowa kluczowe: ziemniak, opłacalność uprawy, Nadwyżka Bezpośrednia

JEL codes: Q1, Q14

Abstract. The purpose of the paper was to identify the economic efficiency of edible potato cultivation on the basis of the Gross Margin. Data concerning cultivation of the Owacja cultivar of potato came from a farm located in the Biała Podlaska Commune in the Lubelskie Voivodship. Potatoes were grown in 2015-2016 on a production plantation with the surface area of 1.6 ha, on a good rye complex soil. The evaluation of economic potato production included direct costs, value of harvested crop and gross margin. It was observed that potato production in 2015-2016 was profitable. The value of production of the Owacja cultivar of edible potato amounted to PLN 16,370.00/ha on average, while the value of gross margin PLN 5,851.50/ha. The greatest share in the structure of incurred costs was held by specific costs (42.02%), seed-potatoes (34.46%), natural fertilization (manure) (11.88%), followed by costs of plant pesticides (6.09%), as well as mineral fertilizers (5.55%).

Introduction

The Lublin region is one of the largest agricultural regions in our country. Favorable conditions for the development of agriculture are determined, above all, by beneficial climate and soil factors, as well as a large percentage of arable lands. The surface area of the Lubelskie Voivodeship in 2016 amounted to 2 512 246 ha. The surface area of arable land was 1 415 500 ha, whereas the surface area of arable land in individual farms amounted to 1 380 100 ha. In the Lubelskie Voivodeship, arable lands occupied 87.7% of the total surface area of arable lands. In 2016, it had 177.9 farms, including 177.7 thousand individual farms. The average surface area of an individual agricultural farm amounted to 8.0 ha, and this area increased as compared with 2015 by 0.1 ha and as compared to 2010 – by 0.8 ha. The Lublin region is an important producer of potatoes. In 2016, the Lubelskie Voivodeship held the fifth place in the country in terms of production of this plant. Potato crops in 2016 amounted to ca. 663.7 thousand tons and were higher by 40.2% than the crops from 2015. Potato yield amounted to 29.98 t/ha on average [Statistical Office 2017].

Potato is a plant that is difficult to cultivate, especially the cultivation of edible potato involves significant production risk, and quality requirements for profit crops of tubers are increasing [Nowacki 2010]. Furthermore, potato cultivation is labour-consuming and requires high outlays per area unit. The problem of producers also involves identification of selling prices in particular years of cultivation, since – in the case of edible potato cultivation – they vary, are determined on free-market terms and depend on supply and demand. Furthermore, prices of agricultural products are shaped as a result of not only the relations between demand and supply in a particular country, but also the impact of situations on world markets [Chotkowski 2010].

An important issue on the potato market in Poland is production profitability, which results from relations between costs incurred by potato producers and the values obtained from sale of crops [Nowacki 2016]. It becomes necessary to know the needs of the market and the subject of economic account. Furthermore, due to the variability of prices of production measures and harvested crops, economic analysis of potato cultivation should be carried out systematically. Therefore, the purpose of the paper was to identify production profitability of the Owacja cultivar of edible potato in two subsequent years of cultivation, on the basis of the Standard Gross Margin (SGM).

Material and research methodology

The data come from a farm, where edible potatoes of the Owacja cultivar were grown in 2015-2016. The farm is located in the Biała Podlaska Commune in the Lubelskie Voivodship. The plantation with total surface area of 1.6 ha was established on a good rye complex soil. The Owacja cultivar belongs to the group of early cultivars. Tubers are characterized by light-yellow flesh color and yellow peel colour. They are of all-purpose eating type. It is a fruitful variety with a big share in general yield of profit fraction tubers. It has average soil requirements. It is recommended for cultivation in the Lubelskie Voivodeship [Plant Breeding and Acclimatization Institute – National Research Institute 2015].

In autumn of each year prior to the establishment of the experiment, manure was applied at a dose of 25 t/ha, and phosphorus fertilization at 44.0 kg P/ha (triple superphosphate 46%) and potassium fertilization at 124.5 kg K/ha (potassium salt 60%), and during spring – nitrogen fertilization (ammonium nitrate 34%) at a dose of 100 kg N/ha. Potato tubers were planted in rows spaced 75.0 cm apart, every 30.0 cm in a row. Until the sprouting of potato plants, mechanical treatment was used (double ridging and one-time ridging combined with harrowing). The plantation was protected against weeds by spraying with the Avatar 293 ZC herbicide (1.5 l/ha). During the potato vegetation period, the plantation was sprayed twice with insecticides: Apacz 50 WG at a dose of 0.04 kg/ha and Mospilan 20 SP at a dose of 0.08 kg/ha. The plantation was protected against fungal diseases by spraying twice with fungicides: Ridomil Gold MZ Pepite 67.8 WG at a dose of 2.5 kg/ha and Dithane Neo Tec 75 WG at a dose of 2.0 kg/ha. Harvest was performed in the period of technological maturity of tubers.

According to the Regulation of the Minister of Agriculture and Rural Development, the general crop was assumed to be the mass of tubers harvested from the surface area of 1 ha. The profit crop was the mass of tubers with the diameter of > 35 mm without contamination, external and internal damage, while the secondary crop constituted small tubers with the diameter of < 35 mm, as well as tubers with defects and mechanical damage [Journal of Laws Dz.U. 2003, no. 194, item 1899, 1900].

Economic calculations covered direct costs, which included: costs of seed-potatoes, natural and mineral fertilizers, plant pesticides, as well as specific costs, which included: costs of operation of machines and equipment, labour, transport and purchase of packaging. Average prices of materials and crops were adopted according to the actual purchase and sale prices from 2015-2016.

In the presented economic analysis, the average profit crop of the Owacja cultivar of edible potato harvested from 1 hectare amounted to 310.0 dt/ha, and the average secondary crop – 220.0 dt/ha. The average price of edible potato amounted to PLN 45.0/dt, and the secondary crop – PLN 11.0/dt. The value of production was calculated on the basis of a product of the harvested crop (profit and secondary) and selling prices. The measure of the evaluation of the economic efficiency of edible potato cultivation was assumed to be the Standard Gross Margin (SGM), constituting the difference between the value of harvested crops and direct costs (without uniform area payment) [Augustyńska-Grzymek et al. 2008].

Research findings

The profitability of potato cultivation depends on the size and quality of the harvested crop, as well as on production costs and selling prices of tubers. In Poland, costs of potato cultivation are high and, depending on the direction of production, amount to PLN 8.5 thousand to nearly PLN 17 thousand/ha [Chotkowski 2011].

Wojciech Nowacki [2013, 2016] stresses in his studies that the amount of edible potato prices depends on the place where the product is being sold. The lowest prices are obtained by farmers who sell potatoes in wholesale quantities directly from their farms to trade intermediaries. The research of W. Nowacki [2016] also demonstrated that Poland has very high variability of prices of edible potato in particular years of cultivation.

In the opinion of Stanisław Krasowicz and W. Nowacki [2005], the efficiency of potato production can be affected by shaping the level and structure of costs, which reflect the incurred outlays and their prices.

The presented economic analysis of edible potato production includes direct costs, value of harvested crop and the standard gross margin (tab. 1). In the original study, potato production costs were at the level of PLN 10 518.50/ha on average. When analyzing direct costs, it was observed that relatively the highest position in the joint system of potato cultivation costs was held by specific costs (42.02% of cultivation costs) (tab. 1). They included labour costs and costs of machine operation, transport and purchase of packaging. Also, in the opinion of W. Nowacki [2013, 2016], Paulina Tuka [2016], Zbigniew Gołaś [2016], root plant production is a business

Table 1. Costs and profitability of cultivation of 1 ha of the Owacja cultivar of edible potato (average from 2015-2016)

Tabela 1. Koszty i opłacalność uprawy 1 ha ziemniaków jadalnych odmiany Owacja (średnia z lat 2015-2016)

Specification/*Wyszczególnienie*	Units/ *Jednostki miary*	Number/ *Number*	Price per unit/ *Cena jedn. [PLN]*	Value/ *Wartość [PLN]*	Cost structure/ *Struktura kosztów* [%]
Direct costs/*Koszty bezpośrednie:*					
Seed potatoes/*Sadzeniaki*	t/ha	2.5	1 450.0	3 625.0	34.46
Manure/*Obornik*	t/ha	25.0	50.0	1 250.0	11.88
Total fertilizers, of which/*Razem nawozy mineralne, w tym:* 583.50					5.55
– Nitrogen/*Azotowe*	kg/ha	100.0	159.0	159.0	1.51
– Phosphorus/*Fosforowe*		100.0	172.5	172.5	1.64
– Potassium /*Potasowe*		150.0	168.0	252.0	2.40
Total pesticides, of wchich/*Razem środki ochrony roślin, w tym:* 640.00					6.09
Fungicides/*Fungicydy*	kg/ha	4.5	-	250.0	2.38
Insecticides/*Insektycydy*		0.24	-	234.0	2.23
Herbicides/*Herbicydy*	l/ha	1.5	104	156.0	1.48
Crop specific costs/*Koszty specjalistyczne*	PLN/ha	-	-	4 420.0	42.02
Total direct costs per 1 ha/*Ogółem koszty bezpośrednie na 1 ha*		-	-	10 518.5	100.00
Value of total yield/*Wartość całkowita plonu*		-	-	16 370.0	-
Value of market field/*Wartość plonu handlowego*		-	-	13 950.0	-
Value of side yield/*Wartość plonu ubocznego*		-	-	2 420.0	-
Gross margin/*Nadwyżka bezpośrednia*		-	-	5 851.5	-

Source: own study

Źródło: opracowanie własne

requiring high labour input (of the farmer or hired workforce). Currently, in the European Union Member States, labour input of hired workforce in root plant production constitutes as much as 64.2% of total labor input. In Poland, high labor-intensity of potato cultivation largely depends on technologies used, mainly related to the use of modern agricultural equipment. Introduction of modern potato harvesters reduces work intensity of potato harvest as much as 4 times. A factor hindering mechanization of works in the potato production technology process is the size of plantation, which on average in Poland amounts to 0.50 ha. Currently, it is estimated that more than 35% potato plantations in Poland harvest using diggers with a digging reel, vibrating diggers or conveyor diggers. The share of harvester use is assessed to be ca. 65% [Jabłoński 2009].

Significant share in the conducted experiment was also held by the costs of seed-potatoes, which constituted 34.46% of the total cost structure (tab. 1). In the research of Marek Gugała and Krystyna Zrzecka [2008], Irena Augustyńska-Grzymek et al. [2008], the cost of seed-potatoes was also one of the more expensive expenditures in the entire potato production.

When analyzing the original research results, it was observed that the purchase of plant pesticides constituted 6.09% of the structure of direct costs of potato cultivation. The double use of fungicides was the most expensive (Ridomil Gold MZ Pepite 67.8 WG at a dose of 2.5 kg/ha and Dithane Neo Tec 75 WG at a dose of 2.0 kg/ha) (tab. 1).

The original study indicated that an important position within the structure of costs of potato cultivation was also held by natural fertilization, which amounted to 11.88%, while mineral fertilization constituted 5.55% of the cost structure. Potassium fertilization was the most expensive (potassium salt 60% at a dose of 150 kg/ha) (tab. 1). Similar research findings were obtained by K. Zarzecka et al. [2016], while in the research of Aldona Skarżyńska [2010], the share of fertilization and plant pesticides within the structure of direct costs was greater and amounted to, respectively, 20.5% to 22.4% (mineral fertilization), and from 16.1 to 21.6% (plant pesticides). Jacek Chotkowski [2011] points out in his studies that costs of fertilization and plant pesticides depend on the direction of use of potatoes and are the greatest in the case of production of potatoes for French fries and chips.

In the original study, the value of production of the Owacja cultivar of edible potato amounted to PLN 16 370.00 per ha on average, while the value of gross margin PLN 5 851.50/ha (without Single Area Payment (Scheme) (tab. 1). The presented economic analysis shows that the production of the Owacja cultivar of edible potato in 2015-2016 was profitable.

Conclusions

According to data presented by the Food and Agriculture Organization of the United Nations, potato (*Solanum tuberosum* L.) is one of the main plants grown in the world and constitutes the basis for everyday diet of many inhabitants of not only European countries, but also other regions of the world [Flis et al. 2012]. Despite the decreasing acreage of cultivation, this plant still occupies a very important spot in Polish agriculture, and the Lubelskie Voivodeship is one of the vital potato producers in Poland.

However, potato is a plant that is difficult to cultivate; in the conditions of Polish agriculture, potato cultivation is labor-consuming and requires high outlays per area unit. The large fragmentation of potato plantations and low degree of mechanization of works also remains a problem. Furthermore, prices of agricultural products and prices of purchased means of production in Poland constitute a variable value, which the farmer often cannot influence. An important issue of potato production profitability is to define the intensity and scale of production as well as the direction of use of tubers and their selling prices. Furthermore, statistical data from analyses conducted under the "Agrokoszty" Data Collection System on Agricultural Products indicate an obvious advantage of large-scale potato production profitability [Skarżyńska 2010, 2016].

The original study demonstrated that production of edible potato may be a profitable section of plant production, however, its economic justification is based mostly on the size and quality of the obtained crops and its value. Additionally, in conditions of the Polish agriculture, potato producers should analyze direct costs incurred for production in detail and minimize some of them, which will contribute to higher profitability of potato cultivation.

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Streszczenie

Celem pracy było określenie efektywności ekonomicznej uprawy ziemniaków jadalnych na podstawie Nadwyżki Bezpośredniej. Dane dotyczące uprawy ziemniaków odmiany Owacja pochodziły z gospodarstwa rolnego położonego w gminie Biała Podlaska, w województwie lubelskim. Ziemniaki uprawiano w latach 2015-2016 na plantacji produkcyjnej o powierzchni 1,6 ha, na glebie kompleksu żytniego dobrego. W ocenie ekonomicznej produkcji ziemniaków ujęto koszty bezpośrednie, wartość zebranego plonu oraz nadwyżkę bezpośrednią. Stwierdzono, że produkcja ziemniaków w latach 2015-2016 była opłacalna. Wartość produkcji ziemniaków jadalnych odmiany Owacja wynosiła średnio 16 370 zł/ha, natomiast nadwyżki bezpośredniej 5851,5 zł/ha. Największy udział w strukturze poniesionych kosztów stanowiły koszty specjalistyczne (42,02%), sadzeniaków (34,46%), nawożenia naturalnego (obornik) (11,88%), a następnie koszty środków ochrony roślin (6,09%) oraz nawozów mineralnych (5,55%).

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