

Costs and profitability

UNIT COSTS AND INCOME FROM SELECTED PRODUCTS IN 2016 – RESEARCH RESULTS IN THE AGROKOSZTY SYSTEM

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Abstract

The aim of the paper is to present the economic results of winter wheat, winter rye, winter rape, sweet lupine, fodder peas and pigs for slaughter in 2016 on farms with different production scale. Research was held at commercial farms, which sell their production. These farms are enterprises. The results of products were influenced by production capacity of farms, i.e. resources of land, labour and capital, their quality and the manner of use, but they were also dependent on external conditions (e.g. market, weather).

Diversification of direct and indirect costs and the costs of own factors of production caused the diversity in economic costs. The research showed that the highest economic costs were recorded for large scale of production – winter wheat, winter rape and fodder pea, for medium scale of production – winter rye and sweet lupine, and for small scale – pigs for slaughter. The income from management was provided by all researched plant production products. Whereas the production of pigs for slaughter did not allow to obtain income from management. However, the favourable effect of the scale of production is visible, the loss of producers pigs for slaughter on a large scale – in comparison to small scale – was almost 5 times lower. The results indicate the advantage of a large scale of production, but it was revealed at different levels of economic calculation.

Keywords: unit costs, agricultural products, production scale, production profitability, income from management.

Kody JEL: D24, O13, Q12.

Introduction

Costs are one of the basic economic categories determining production efficiency, therefore, their level should be subject to analysis, as well as detailed planning and control. Farmers¹ should look for solutions that would reduce production costs (while maintaining a certain level of quality of manufactured products). Costs are a category formed within the farm, which is dependent on the decisions made by the farmer. However, their level is also influenced by external (exogenous) factors that have their source in the environment (e.g. prices of means of production). Absence of accurate information about costs formation may lead to a situation where strategic decisions regarding the orientation (specialization) of production activity and subsequent investment decisions will not be correct. Costs must also be taken into account when making tactical decisions related to determining current production tasks, selecting and substituting application of production factors, as well as deciding on how to use production factors while performing current tasks on the farm.

The way of transforming the factors of production into manufactured goods (products) depends on the producer, who determines the amount of exposure of factors ensuring the maximum effect (e.g. specific production volume can be produced in a more labour-intensive or capital-intensive way). Although this decision is made after taking into account information from the market (e.g. about price factors), it is nonetheless autonomous. Thus, a production factor results from the production volume, but also its efficiency, i.e. the productivity of production factors (Rembisz and Sielska, 2011).

Changes occurring on agricultural markets resulting, inter alia, from the growing competition, force farmers to increase both the efficiency of management and the scale of production. The present paper describes production and economic results of winter wheat, winter rye, winter rape, sweet lupine, fodder peas and live pig production on farms of different scale of production of these products in 2016.

Research methodology

Data characterising the production activities, i.e. winter wheat, winter rye, winter rape, sweet lupine, fodder peas and fatteners (live pigs), were collected from individual farms located across the country. These farms were deliberately selected from a representative sample of farms covered by the Polish FADN. The selection of farms for the study of each type of activity was done independently. The condition was the specific scale of production and the farmer's consent to carry out the tests. Data describing the activity (agricultural products²) were collected in

¹ Commercial farm, i.e. those where the products are intended for sale and have the character of an enterprise. An agricultural enterprise is an enterprise focused on the production of agricultural products for sale or providing agricultural services for agriculture, separated in terms of organization (it is a system of three factors: land, labour and capital), economic (expenses covered by own revenues) and legal (it is not only economically but also legally liable for its actions). Farmers are essentially entrepreneurs (Manteuffel, 1984; Ziętara, 1998).

² Depending on the context, the terms "agricultural production activities" and "agricultural products" are used interchangeably, but these terms should be treated as identical.

accordance with the methodology of the AGROKOSZTY system. They were supplemented with data from the Polish FADN database.

The research covered revenues (the value of potential commodity production per 1 hectare of crop and 100 kg of live pigs), costs and economic effects. The effects were measured by income categories (analysed without subsidies and after taking this support into account), i.e. direct surplus, operating income and management income. Calculation method of these categories is presented below:

direct surplus = production value – direct costs,

operating income = Total production value costs (total for direct and indirect),

management income = production value – economic costs.

Support for agricultural producers' incomes includes subsidies (direct payments), calculations cover: single area payment, greening payments and additional payments, and in the case of leguminous plants also payment for protein crops. On the basis of the data regarding the amount of subsidies received for the tested products on the farms in question and the rates of direct payments in 2016 and the rules for granting thereof, maximum amount of subsidies that farmers could receive was met, provided all the required conditions were met. Taking into account the purpose for which the generated information is to be used, additional payments may be included at various levels of the economic calculations, i.e. at the level of direct surplus, operating income and management income. The accounts do not include the amount of input and output VAT.

The production value of agricultural products is the sum of the values of main and by-products in the market. It is determined by the market selling prices or by loco sales price (i.e. within the farm). In the case of plant products, this value depends on the plant yield and the product sale price, and in the case of pigs – sale price. Loss is subtracted from the production value.

The set of **direct costs**, by which the production value is reduced, is different for plant and animal production. Both sets reflect the costs incurred throughout the production cycle and illustrate the current market conditions. Twelve consecutive months of the calendar year were adopted as the accounting period. However, for some plant production activities (mainly applicable to winter crops) incurred expenditures and direct costs reflect the entire production cycle, i.e. all inputs and costs related to production occurring in the year preceding the research, as well as in the year to which the research applies. Information on incurred expenditures and direct costs, in the case of plant production, always refer to the area of the activity under analysis. Components of direct costs coming from outside the farm are determined according to the purchase price, and those generated within the farm (e.g. seed, own fodder from commodity products) – according to loco sales prices. The exception – in the case of animal production – is own fodder from non-commodity products (e.g. silage maize), which are valued at the direct costs incurred to produce them. Individual components of costs are reduced by the subsidies granted.

Classification of specific cost components as direct costs depends on simultaneous fulfilment of three conditions, i.e.:

- costs can be assigned to a specific activity without any doubt,
- their volume is proportional to the scale of production,
- they have a direct impact on the size (*volume and value*) of production.

Direct costs of plant production include:

- seed and planting material (*purchased or produced on the farm*),
- fertilisers purchased³ (*without fertiliser lime*),
- plant protection products,
- growth regulators (*rooting agents, growth substances, defoliants*),
- insurance relating directly to a given activity,
- specialist costs including:
 - specialised expenditure on plant production,
 - specialist services,
 - occasional rental for specialist work.

Direct costs of animal production include:

- cost of animals, in particular activities relating to the replacement of population,
- cost of fodder, which are divided into:
 - cost of fodder from outside the farm (*mainly from purchase*),
 - cost of fodder from own farm, which is divided into:
 - own fodder from potentially commodity products,
 - own fodder from non-commodity products,
- lease fees for the use of leased fodder area, leased for a period shorter than one year (*on UAA and on a surface not included in UAA, e.g. mountain slopes*),
- animal insurance directly related to farm activities (*e.g. cows*),
- medicines and veterinary products (*including semen for insemination*),
- veterinary services (*insemination, castration, protective vaccinations*),
- specialist costs including:
 - specialised expenses relating to animal production,
 - specialist services,
 - occasional rental for specialist work.

Calculations that lead to the determination of the operating income include direct and indirect costs. Direct costs are assigned to products directly, on the basis of relevant source documents. Meanwhile, indirect costs are taken from the Polish FADN database. Indirect costs can be defined as costs of readiness for production, incurred for the operation or only existence of a holding. Indirect costs of an agricultural holding are divided into real and estimated indirect costs (Goraj and Mańko, 2004).

³ Cost of purchased fertilizers also includes specialised fertiliser taxes.

Real indirect costs include:

- general economic costs – electricity, heating, fuel, current repairs, maintenance and inspections, services, insurance (e.g. buildings, property and communication), other costs, e.g. water, telephone,
- taxes – agricultural, forestry, special taxes, real estate and other taxes, e.g. on transport vehicles,
- costs of external factors – cost of hired work, rents and interest.

Indirect cost estimates include depreciation of:

- buildings and structures,
- machines and technical devices,
- means of transport,
- drainage devices,
- orchards and perennial plantations,
- intangible assets,
- completed investments in external fixed assets.

Indirect costs at the time of generation may not be divided into products, they are joint costs for the whole farm, and differentiation keys are used for their distribution. According to the methodology applied here, indirect costs of a farm were divided into activities according to the share of the production value of each of them in the value of total farm production.

The cost of using **own production factors** (i.e. labour, land and capital) is an alternative cost. Alternative cost is the value of the best non-selected alternative, it is assumed that individual goods could be used in a different way, which could bring a greater benefit (income)⁴. According to the adopted methodology (Skarżyńska, 2010), own work was valued at the normative rate, determined on the basis of the average level of remuneration of employees in the entire economy in a given year (according to the Central Statistical Office). It was assumed that one full-time employee works in agriculture for 2120 hours a year. The parity fee calculated for 1 hour of work in 2016 was PLN 15.29. The lease fee was accepted as the measure of the land cost. The applied algorithm takes into account the type and class of land and the tax district in accordance with the rules applicable when calculating agricultural tax⁵. This approach means that the volume of the estimated cost of land, in addition to the bonitation class, depends largely on the regional location of the farms that were included in the research sample for individual types of activity. Lease rent is expressed in natural units, i.e. in dt of wheat. The number of units depends on the soil class and tax district. The value of the rent was determined according to the average price of buying wheat in the country (in 2016 – 62.02 PLN/dt). The cost of operational capital was recognized as the value of expenditures incurred on re-

⁴ This type of alternative costs in monetary terms is often referred to as implicit costs (i.e. presumed costs) as opposed to registered ones, i.e. actual incurred cash expenditures defined as explicit costs (Milewski (ed.), 2008).

⁵ The method of determining the starting amount of the rent was developed using the rules for determining the rent by the Agricultural Property Agency.

volving production means. The cost of capital was estimated basing on the interest rate for deposits in current accounts, the average interest rate as set by commercial banks, in 2016 it was 0.60% annually (according to the Central Statistical Office). It was assumed that the revolving capital involved in the plant production process was frozen for a period of 6 months, and for animal production for 3 months. The cost of fixed capital was calculated based on the current value of the fixed assets involved. It was assumed that the capital was frozen for 1 year, its average interest rate in 2016 was adopted at the level of 1.50% (according to the Central Statistical Office, in commercial banks).

Management income is an economic category cleared of full production costs, which literature lists as economic costs (Samuelson and Nordhaus, 1995). For the farmer this income constitutes a fee for entrepreneurship and undertaking innovative activities as well as use of existing knowledge and organisational skills in managing the production process.

The results of production activities were presented on average for the entire sample of farms and for groups classified according to the scale of production of respective activities. Horizontal analysis was used, comparing the parameters characterizing individual types of activity in separate scale groups. For the analysis, three groups were developed, i.e. small, medium and large scales of production. In the case of fodder pea, due to the rather small sample, it was possible to choose only two groups, i.e. small and large scale. The scale criterion used for plant products was the cultivation area, and for pork livestock – the net production level, measured by the size of the annual weight gain obtained on the herd of fattening pigs. With the division of the research sample of farms conducting individual activities into groups differing in size of the production scale, the size of the sample and the distribution of the characteristic feature – the scale criterion – were taken into account. The assumption was that the number of farms in respective scale groups would be as large as possible, the average level of the feature accepted as the scale criterion was close to the median of this feature and the boundaries of the scale intervals were not tangent. These factors determined the choice of three or two ranges of scale, consequently the number of farms in respective groups does not cover the entire sample.

The size of production scale ranges is relative, which means that the size of the scale group defined as large can be considered small on farms with a different area structure and other production organisation. In addition, due to the deliberate selection of the sample, the test results cannot be statistically generalized to all individual farms in the country. Nevertheless, they are a prerequisite for choosing the size of the scale, which has a chance to ensure a relatively high effectiveness of production. They also allow for the presentation of certain phenomena and dependencies, and in this context provide a basis for formulating conclusions referring not only to the examined sample.

The research results were published (Skarżyńska, Abramczuk and Czułowska, 2017) in a paper which extensively discussed the production and economic situation of the agricultural production activities. In the article, the analysis of results

was included synthetically. The results of calculations (in nominal values) are included in the tables. Due to the electronic technique of data processing, in some cases the sums of components may differ from the given total figures.

Findings

According to the Central Statistical Office (GUS, 2018), 2016 was the fifth year in a row where market conditions of agricultural production were unfavourable for producers. As a result of a stronger decline in prices of agricultural products sold by farmers (by 2.1%) than those purchased by them (by 1.2%), the index of “price scissors” was at an unfavourable level, namely 99.1%. These conditions had an impact on the economic results of the surveyed agricultural products.

In 2016, the cultivation of **winter wheat** allowed to obtain income from activities without subsidies, but its level was not high (Table 1). On average in the sample, when grown on the area of 21.50 ha it amounted to 574 PLN/ha. On farms cultivating wheat at small-scale (3-10 ha), producers obtained PLN 474 from 1 ha, at medium scale (15-30 ha) – PLN 487, and at large scale (40-90 ha) – PLN 694. The increase in the area of wheat cultivation stimulated the successive increase in yield, while the price of grain sale changed in a variety of directions. The amount of income without subsidies was influenced by the production value (revenues), but also by total costs (both direct and indirect). In the case of wheat growing on a medium scale, the growth rate of costs exceeded the revenue growth by 2.2 p.p., while at the scale of high growth rate of revenues it was by 5.3 p.p. stronger than the increase in costs. Winter wheat cultivated on a large scale, in comparison to the remaining ranges, was characterised by:

- Fairly good cost competitiveness – the ratio of direct costs to direct surplus without subsidies was 67.2%. Wheat cultivated on a medium scale more economically competitive – direct costs accounted for 64.2% of the direct surplus. It was similar to the small scale, where the share of costs in the surplus was 64.6%.
- The highest economic efficiency – the profitability index was 122.9%, while at the medium scale – 117.0% and the small one – 119.2%.
- High fee for production factors – the net value added exceeded the cost of production factors by 148.0%, while at the medium scale by 107.2%, and the small one by 77.7%. As a result, the highest income from management without subsidies was ensured by wheat grown on a large scale – 575 PLN/ha; it exceeded the income obtained with the medium scale of cultivation by 43.0%, and small by 113.8% (Table 2).

The income aspect of winter wheat production is also illustrated by the relation of economic costs of production of 1 dt of grain to the price of its sale. When cultivating wheat on a small scale, these costs in the price of grain accounted for 90.8%, while for medium scale – 88.1% and large – 84.6%. The results clearly indicate that an increase in the scale of production would be beneficial.

In 2016, the income situation of **rye** was not good (Table 3). On average, in the sample, the area of rye cultivation was 9.81 ha, and the Operating income less

subsidies was 342 PLN/ha. There is a clear correlation between the amount of income and the scale of rye cultivation, but it was not a one-way relationship. In the case of small scale production (2-4 ha), income without subsidies from 1 ha of rye amounted to PLN 373, medium (6-12 ha) – PLN 203, and large (15-50 ha) – PLN 384. The scale of cultivation had a positive effect on rye production and price performance. Comparing the extreme values, grain yield on a large scale – compared to a small one – was higher by 8.2%, and its sale price – by 1.5%. The income level was influenced by revenues, but also by the costs of cultivation. On farms cultivating rye on a medium scale – in comparison to a small scale – revenues increased by 5.9%, and total costs by 20.4%. Stronger dynamics of costs growth than revenue growth (by 14.5 p.p.) caused a drop in income. However, when cultivating rye on a large scale, in comparison to the medium scale, revenues increased by 5.1%, and costs decreased by 5.6%, which resulted in an increase in income. Although the economic results are not the best, a positive effect of scale is visible. Winter rye grown on a large scale, compared to other scale ranges, was characterised by:

- High cost competitiveness – the ratio of direct costs to direct surplus was 58.5% and was similar to the small scale, which was the most competitive (56.3%). When cultivating rye on a medium scale, direct costs accounted for 71.0% of the surplus produced, which means that rye cost competitiveness was the weakest.
- High economic efficiency – the profitability index was 125.4%, while the medium scale was 112.7% and the small one – 128.1%. The median of profitability index was the highest for large-scale rye cultivation (131.1%).
- High fee for production factors – net added value exceeded the cost of production factors by 138.5%, while with medium scale by 59.8% and small by 82.7%. Income from management without subsidies from the cultivation of rye on a large scale was the highest – it amounted to PLN 312 per ha, it exceeded the level obtained at the medium scale by 155.7%, and the small by 60.0% (Table 4).

Income from management without subsidies was a derivative of the relation of economic costs to the sale price of grain. This relation was the most advantageous when cultivating rye on a large scale – 85.4%. Small scale ranked second – 89.3%, and medium scale ranked last – 95.1%.

In 2016, the income obtained by **winter rapeseed** producers was not high (Table 5). On average, in the research sample of farms, the area of its cultivation amounted to 17.74 ha, and the income without subsidies obtained from 1 ha – PLN 680. The results of small-scale rape production (2-6 ha) were the weakest, and the income was only 425 PLN/ha. However, for the medium (8-16 ha) and large (20-60 ha) cultivation scale, the income was higher and close to each other, amounting to 670 PLN/ha and 652 PLN/ha, respectively. Despite some deviations, the beneficial effect of the scale is visible. This is evidenced by the gradual increase in the seed yield and the sale price of rape, along with the increase in the area of rape cultivation. As a result, revenues from rape cultivation grew steadily, but costs also increased. The level of income was a derivative of the dynamics of change in both these categories. Slightly higher income in rape cultivation on a medium scale resulted from stronger dynamics

of revenue growth by 5.6 p.p. as compared to costs. In the case of large-scale rape cultivation, the situation was reversed. Stronger increase in costs as compared to income by 0.8 p.p. caused a drop in income (by 2.7%). Winter rape cultivated on a large scale, in comparison to the remaining ranges of the scale, was characterised by:

- Fairly high cost competitiveness – the ratio of direct costs to direct surplus was 66.9%. Rape grown on a medium scale (66.0%) was characterised by slightly higher competitiveness, and the lowest competitive position was recorded for rape grown on a small scale (76.7%).
- High economic efficiency – the profitability index was 116.8%, while for the medium scale it was 117.8% and for small scale – 111.8%. The median of profitability index was the highest for large-scale rape cultivation (120.2%).
- The fee for production factors for large-scale production – net added value exceeded the cost of production factors by 179.5%, while with medium scale by 202.1% and small by 61.8%. The highest Management income less subsidies was recorded by rape grown on a medium scale (PLN 722 per ha). It exceeded the level of this income for the large scale by 10.6%, and small by 179.8% (Table 6).

Research shows that the relation of economic costs to the selling price of 1 dt of seeds was the most advantageous in the case of rape cultivation on a medium scale – 83.7%, slightly worse for large-scale production at 85.6%, and the weakest at a small scale – 93.6%.

In 2016, the Operating income less subsidies from the cultivation of **sweet lupine** (Table 7) on average amounted to PLN 176 per ha (crop area – 6.07 ha/farm). Along with the increase in the scale of cultivation, the income level varied in many directions, the highest was obtained by small-scale lupine producers (1-2 ha) – 287 PLN/ha. Lower income was provided by lupine grown on a large scale (8-20 ha) – 112 PLN/ha, and the lowest on the medium scale (4-6 ha) – 90 PLN/ha. Seed yield and the price of their sales also varied in a different direction. The lowest yield of lupine (13.9 dt/ha) was recorded at a small scale of its cultivation, and the highest – at the medium scale (15.8 dt/ha). The price of seeds had a strong influence on the level of revenues. The highest obtained small-scale lupine producers – PLN 98.49 per dt, while the average price was 83.00 PLN/dt, while the large one – PLN 83.05. It is estimated that certain batches of seeds from farms cultivating small-scale lupine found themselves in the marketplace, where prices were higher than in purchasing (according to the Central Statistical Office – 2.1 times). As a result, the highest revenues were obtained by small-scale lupine producers (1336 PLN/ha), they were higher by 4.4% for the medium scale, and by 8.5% for a large. In the case of costs (in total), there was no one-way change in their amount. The lowest ones were recorded in farms cultivating small-scale lupine (PLN 1079/ha), and the highest in the medium scale (PLN 1218/ha). On farms with a medium scale of lupine cultivation, lower income resulted from lower revenue (by 4.2%), but mainly a significant increase in costs (by 12.9%). Whereas growth in income from large-scale lupine cultivation was determined by 2.1 p.p. lower dynamics of revenue drop than costs. The results of the analysis show that the sweet lupine cultivated on a large scale, in comparison to the remaining scale ranges was characterized by:

- High cost competitiveness – the ratio of direct costs to direct surplus was 49.1%, while at a small scale – 54.2%. The weakest competitiveness was characterized by lupine cultivated on a medium scale, direct costs accounted for 87.7% of the surplus produced.
- Moderately high economic efficiency – the profitability index was 109.8%, while at the medium scale – 107.3% and the small one – 126.6%. The median profitability index was the highest for large-scale lupine cultivation (116.3%).
- Moderately high payment for factors of production – net added value exceeded the cost of production factors by 20.4%, while at the medium scale by 11.8%, and small by 35.3%. The highest Management income less subsidies (88 PLN/ha) was obtained by small-scale lupine producers, it exceeded the medium scale level 3.8-fold, and the large one – 2.1-fold (Table 8).

The amount of income was influenced by the relationship between the selling price and the unit economic expense. This relation was the most advantageous for small-scale lupine cultivation, economic costs in the price of seeds constituted 93.5%, while in the case of the medium scale – 98.2%, and large – 96.7%.

In 2016, **fodder pea** producers obtained income from activities without subsidies (Table 9). On average, in a sample of peas growing on an area of 3.68 ha, this income per 1 ha was PLN 559, while on a small scale (1-2 ha) – PLN 880, and large (4-12 ha) – PLN 628. The increase in the area of pea cultivation from small to large scale was associated with a 15.5% increase in yield, but a 15.8% drop in the seed sales price. Small-scale pea producers obtained a very high price (108.50 PLN/dt), it exceeded the purchase price of fodder pea in the country (according to Central Statistical Office – 75.28 PLN/dt) by 44.1%. It is estimated that this phenomenon was based on the diversification of outlets. Part of the crops was sold at a market, and pea market prices (according to Central Statistical Office – 172.38 PLN/dt) were significantly higher than at the buying-in. As a result, the income from 1 ha of peas grown on a large scale – compared to a small scale – was lower by 2.8%, while the costs of cultivation increased by 10.6%. Higher costs and lower revenues caused large-scale pea income to be 28.6% lower than for the small scale production group. The analysis shows that fodder peas cultivated on a large scale, in comparison to the small scale, were characterised by:

- Fairly high cost competitiveness – the ratio of direct costs to the direct surplus without subsidies was 49.6%, while in the case of small-scale pea cultivation – 39.5%. This means that in terms of direct costs, the cultivation of small-scale peas was more competitive.
- Relatively high economic efficiency – the profitability index was 133.3%, while at the small scale – 151.6%.
- Fee for production factors at a lower level – net added value exceeded the cost of production factors by 160.1%, and at a small scale of production by 228.4%. Higher Management income less subsidies was obtained from the cultivation of small-scale fodder pea (PLN 676/ha), it exceeded 36.0% of income (PLN 497 ha) obtained on a large scale (Table 10).

In the case of pea cultivation on a small scale, the economic costs in the price of seeds constituted 73.9%, while on a large scale – 80.2%.

In 2016, the average production of **live pigs** was unprofitable in the sample and in separate scale ranges (Table 11). Revenues did not provide full coverage of the costs incurred. The research results, however, refer to the average annual production and price conditions and do not fully reflect the changes that have occurred in the whole year, for example in the prices of fodder or livestock prices. Therefore, the interpretation of the results cannot be unambiguous, because in the research sample there were individuals in which pig livestock was profitable.

On average, in the sample, the production value realized from 100 kg of livestock covered direct costs, and indirect costs only in 96%. A similar situation occurred in the case of pork production on a small scale (10-40 dt) and medium (60-240 dt) – real indirect costs were covered in 33% and 73% respectively. At a large scale of production (300-1000 dt), the production value ensured full coverage of direct and indirect real costs as well as 11% of the depreciation cost of the fixed assets involved. As a result, the loss of large-scale fattening producers was the smallest, amounting to PLN 41 per 100 kg, while with the medium fattening scale it was PLN 98, and at a small scale PLN 181. Although the income from the production of pigs was negative, the beneficial effect of the scale is visible. This is evidenced, e.g. by the successive increase in the price of livestock sales and the decrease in production costs (including direct and indirect). In the large scale production, compared to the small one, the live price was higher by 11.0% and the lower costs by 15.6%. Production of pigs on a large scale, in comparison to other scale ranges, was characterized by:

- The highest economic efficiency – the profitability index amounted to 91.9%, while at the medium scale – 81.7%, and at the low – 69.8%.
- The highest level of coverage of economic costs – in 88.4%, while in the medium scale it was 73.4%, and the small one – 58.2%. The consequence was the smallest loss on the level of income from management – in comparison to the medium scale, it was lower by 61.4%, and to a small one by 79.7% (Table 12).

In 2016, to obtain full coverage of economic costs it would be necessary to increase the price of live cattle, on average in the sample (production 451.46 dt/farm) by almost 17%. However, on farms producing livestock on a small scale (10-40 dt) by almost 72%, medium (60-240 dt) – by over 36%, and large (300-1000 dt) – by over 13%.

The results of analyses indicate the diversification of costs and economic results of agricultural products under study, depending on the scale of their production. The large-scale advantage was evident, although it manifested itself at various levels of the economic calculation. The production value of potentially commodity from plant products was influenced by production and price results, while in the case of pigs only sales price. Both variables, i.e. yield and price, gradually increased along with the increase in scale, but sometimes their change was not one-way. In the case of yield, assuming that the yield-generating means of production were applied in the optimal quantity, the sensitivity to agrometeorological conditions was revealed,

and in the case of sales price – farmers' management skills, e.g. looking for sales opportunities at a higher price (diversification of outlets – particularly visible in the case of sweet lupine and fodder peas).

The costs were determined by direct and indirect costs, but the impact of these aggregates varied depending on the activity and scale of production. The alternative cost of production factors, i.e. labour, land, capital of almost all activities (the exception was winter wheat and fodder peas) was higher in the case of production on a small scale than on a large scale. This means that the small scale was the most heavily burdened at this cost.

Income from management is one of the criteria for assessing the organization and management of an agricultural holding. It is the farmer's reward for management skills and the risk he took in the production process. Plant production activities, which were included in the study in 2016, provided the producers with a management fee. From among the three ranges of the scale, the highest Management income less subsidies was obtained from cultivation:

- on a large scale of winter wheat and rye,
- on a medium scale of winter rape,
- on a small scale of sweet lupine and fodder pea.

Production of live pigs did not allow to obtain income from management. However, the favourable effect of the scale of production is quite visible – producers' losses on a large scale – in comparison to small scale – were almost 5 times lower.

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Table 1

*Production, costs and revenues obtained from the cultivation of winter wheat in 2016
(actual data)*

Specification		Average on farms cultivating winter wheat	Depending on the scale of cultivation (ha/farm)		
			3-10	15-30	40-90
Number of farms in the study		140	41	39	22
Area of cultivation	(ha)	21.50	5.56	22.21	59.14
Yield of grain	(dt/ha)	59.5	49.5	57.0	62.8
Grain sale price	(PLN/dt)	59.02	59.33	58.84	59.23
Per 1 ha of cultivated area					
Total production value	(PLN)	3514	2936	3359	3719
including: grain		3513	2936	3355	3719
Total direct costs	(PLN)	1391	1152	1313	1495
including: seeding material		216	201	214	234
total mineral fertilisers		777	661	745	829
external organic fertilisers		2	–	2	0
plant protection products		334	256	288	367
growth regulators		48	26	49	49
other		14	8	14	15
Direct margin less subsidies	(PLN)	2123	1784	2046	2224
Real indirect costs ^a	(PLN)	683	649	697	664
Gross value added on activity	(PLN)	1440	1135	1348	1560
Depreciation	(PLN)	591	520	571	598
Net value added on activity	(PLN)	849	615	777	962
Cost of external factors	(PLN)	276	141	290	268
Operating income less subsidies	(PLN)	574	474	487	694
Subsidies ^b	(PLN)	869	902	844	808
Operating income	(PLN)	1443	1376	1332	1502
Total costs	(PLN)	2940	2462	2871	3025
Total labour input	(hours)	8.3	9.3	8.5	7.7
including: own labour input		7.9	9.2	8.0	7.2
Economic efficiency ratios					
Total costs per 1 dt of grain	(PLN)	49.40	49.76	50.36	48.18
Total costs per PLN 1 of operating income less subsidies	(PLN)	5.12	5.20	5.89	4.36
Operating income less subsidies per 1 dt of grain	(PLN)	9.64	9.57	8.55	11.05
Operating income less subsidies per 1 hour of own labour input	(PLN)	72.92	51.54	60.61	96.45
Subsidies per PLN 1 of operating income less subsidies	(PLN)	1.51	1.91	1.73	1.16
Share of subsidies in operating income	(%)	60.2	65.6	63.4	53.8

^a Real indirect costs without the cost of external factors.

^b Subsidies cover single area payment, greening payments and additional payments.

Table 2

Economic costs and income from management depending on the scale of cultivation of winter wheat in 2016 (PLN/ha)

Specification	Average on farms cultivating winter wheat	Depending on the scale of cultivation (ha/farm)		
		3-10	15-30	40-90
Net value added on activity	849	615	777	962
Own labour payments	120	141	123	110
Income from capital involvement and management activities	729	475	654	852
Cost of land	208	184	222	229
Cost of revolving capital and fixed assets	41	21	30	49
Management income less subsidies	481	269	402	575
Subsidies	869	902	844	808
Management income	1350	1171	1246	1383
Costs of own means of production	369	346	375	388
Economic costs	3033	2667	2956	3145
Share of the costs of own means of production in economic costs (%)	12.2	13.0	12.7	12.3
Costs of own means of production per 1 dt of grain (PLN)	6.20	6.99	6.58	6.18
Economic costs per 1 dt of grain (PLN)	50.96	53.89	51.85	50.09
Relation between economic costs of production of 1 dt of grain and the sale price (%)	86.3	90.8	88.1	84.6

Table 3

*Production, costs and revenues obtained from the cultivation of winter rye in 2016
(actual data)*

Specification	Average on farms cultivating winter rye	Depending on the scale of cultivation (ha/farm)		
		2-4	6-12	15-50
Number of farms in the study	119	41	22	26
Area of cultivation (ha)	9.81	2.80	9.30	23.60
Yield of grain (dt/ha)	38.1	35.5	37.1	38.4
Grain sale price (PLN/dt)	48.22	47.55	47.61	48.24
Per 1 ha od cultivated area				
Total production value (PLN)	1870	1702	1802	1894
including: grain	1836	1687	1766	1852
Total direct costs (PLN)	707	613	748	699
including: seeding material	170	139	158	179
total mineral fertilisers	423	340	454	407
external organic fertilisers	1	10	–	–
plant protection products	98	92	112	100
growth regulators	12	6	20	12
other	4	25	5	1
Direct margin less subsidies (PLN)	1163	1089	1054	1194
Real indirect costs ^a (PLN)	364	393	400	350
Gross value added on activity (PLN)	799	696	653	845
Depreciation (PLN)	325	264	327	306
Net value added on activity (PLN)	474	433	326	539
Cost of external factors (PLN)	132	60	123	155
Operating income less subsidies (PLN)	342	373	203	384
Subsidies ^b (PLN)	881	897	858	819
Operating income (PLN)	1223	1270	1061	1203
Total costs (PLN)	1528	1329	1599	1510
Total labour input (hours)	7.4	9.5	7.6	7.1
including: own labour input	7.2	9.2	7.5	7.0
Economic efficiency ratios				
Total costs per 1 dt of grain (PLN)	40.15	37.45	43.11	39.33
Total costs per PLN 1 of operating income less subsidies (PLN)	4.47	3.56	7.88	3.93
Operating income less subsidies per 1 dt of grain (PLN)	8.98	10.51	5.47	10.00
Operating income less subsidies per 1 hour of own labour input (PLN)	47.54	40.67	27.20	54.80
Subsidies per PLN 1 of operating income less subsidies (PLN)	2.58	2.40	4.23	2.13
Share of subsidies in operating income (%)	72.0	70.6	80.9	68.1

^a Real indirect costs without the cost of external factors.

^b Subsidies cover single area payment, greening payments and additional payments.

[–] – means that none of the above apply.

Table 4

Economic costs and income from management depending on the scale of cultivation of winter rye in 2016 (PLN/ha)

Specification	Average on farms cultivating winter rye	Depending on the scale of cultivation (ha/farm)		
		2-4	6-12	15-50
Net value added on activity	474	433	326	539
Own labour payments	110	140	114	107
Income from capital involvement and management activities	364	292	212	432
Cost of land	90	89	81	105
Cost of revolving capital and fixed assets	13	8	9	14
Management income less subsidies	261	195	122	312
Subsidies	881	897	858	819
Management income	1142	1092	980	1131
Costs of own means of production	213	237	204	226
Economic costs	1609	1507	1680	1582
Share of the costs of own means of production in economic costs (%)	13.2	15.7	12.1	14.3
Costs of own means of production per 1 dt of grain (PLN)	5.60	6.68	5.50	5.89
Economic costs per 1 dt of grain (PLN)	42.27	42.48	45.29	41.22
Relation between economic costs of production of 1 dt of grain and the sale price (%)	87.7	89.3	95.1	85.4

Table 5

*Production, costs and revenues obtained from the cultivation of winter rape in 2016
(actual data)*

Specification		Average on farms cultivating winter rape	Depending on the scale of cultivation (ha/farm)		
			2-6	8-16	20-60
Number of farms in the study		140	31	45	49
Area of cultivation	(ha)	17.74	4.04	11.41	33.24
Seed yield	(dt/ha)	28.4	25.8	28.3	28.6
Seed sale price	(PLN/dt)	157.86	155.91	156.78	158.28
Per 1 ha od cultivated area					
Total production value	(PLN)	4479	4019	4436	4524
including: seeds		4479	4019	4436	4524
Total direct costs	(PLN)	1804	1745	1763	1813
including: seeding material		225	212	249	213
total mineral fertilisers		1033	969	1006	1044
external organic fertilisers		4	–	–	6
plant protection products		451	451	440	455
growth regulators		32	49	29	32
other		59	64	39	64
Direct margin less subsidies	(PLN)	2675	2274	2673	2711
Real indirect costs ^a	(PLN)	848	888	859	849
Gross value added on activity	(PLN)	1828	1386	1814	1863
Depreciation	(PLN)	788	709	735	845
Net value added on activity	(PLN)	1039	676	1079	1017
Cost of external factors	(PLN)	359	252	408	365
Operating income less subsidies	(PLN)	680	425	670	652
Subsidies ^b	(PLN)	878	889	843	808
Operating income	(PLN)	1558	1313	1513	1460
Total costs	(PLN)	3799	3594	3766	3872
Total labour input	(hours)	8.5	11.0	8.3	8.3
including: own labour input		8.3	10.7	8.0	8.1
Economic efficiency ratios					
Total costs per 1 dt of seed	(PLN)	133.89	139.44	133.09	135.45
Total costs per PLN 1 of operating income less subsidies	(PLN)	5.59	8.47	5.62	5.94
Operating income less subsidies per 1 dt of seed	(PLN)	23.97	16.47	23.69	22.82
Operating income less subsidies per 1 hour of own labour input	(PLN)	82.01	39.80	83.28	80.93
Subsidies per PLN 1 of operating income less subsidies	(PLN)	1.29	2.09	1.26	1.24
Share of subsidies in operating income (%)		56.3	67.7	55.7	55.3

^a Real indirect costs without the cost of external factors.

^b Subsidies cover single area payment, greening payments and additional payments.

[–] – means that none of the above apply.

Table 6

Economic costs and income from management depending on the scale of cultivation of winter rape in 2016 (PLN/ha)

Specification	Average on farms cultivating winter rape	Depending on the scale of cultivation (ha/farm)		
		2-6	8-16	20-60
Net value added on activity	1039	676	1079	1017
Own labour payments	127	163	123	123
Income from capital involvement and management activities	913	513	956	894
Cost of land	207	220	201	194
Cost of revolving capital and fixed assets	43	35	33	47
Management income less subsidies	663	258	722	653
Subsidies	878	889	843	808
Management income	1541	1147	1565	1461
Costs of own means of production	377	418	357	364
Economic costs	3816	3761	3714	3871
Share of the costs of own means of production in economic costs (%)	9.9	11.1	9.6	9.4
Costs of own means of production per 1 dt of seed (PLN)	13.27	16.22	12.62	12.73
Economic costs per 1 dt of seed (PLN)	134.48	145.90	131.27	135.42
Relation between economic costs of production of 1 dt of seed and the sale price (%)	85.2	93.6	83.7	85.6

Table 7

*Production, costs and revenues obtained from the cultivation of sweet lupine in 2016
(actual data)*

Specification	Average on farms cultivating sweet lupine	Depending on the scale of cultivation (ha/farm)		
		1-2	4-6	8-20
Number of farms in the study	115	33	18	19
Area of cultivation (ha)	6.07	1.58	4.70	14.17
Seed yield (dt/ha)	15.9	13.9	15.8	15.2
Seed sale price (PLN/dt)	86.34	98.49	83.00	83.05
Per 1 ha od cultivated area				
Total production value (PLN)	1376	1366	1308	1259
including: seeds	1376	1366	1308	1259
Total direct costs (PLN)	447	480	611	414
including: seeding material	224	229	245	221
total mineral fertilisers	119	149	160	103
external organic fertilisers	3	–	28	–
plant protection products	87	83	140	82
growth regulators	10	18	34	6
other	4	0	4	1
Direct margin less subsidies (PLN)	928	886	697	844
Real indirect costs ^a (PLN)	329	353	286	334
Gross value added on activity (PLN)	599	533	411	510
Depreciation (PLN)	303	196	183	268
Net value added on activity (PLN)	297	337	228	242
Cost of external factors (PLN)	120	50	138	130
Operating income less subsidies (PLN)	176	287	90	112
Subsidies ^b (PLN)	1264	1326	1284	1246
Operating income (PLN)	1440	1613	1374	1358
Total costs (PLN)	1199	1079	1218	1147
Total labour input (hours)	5.5	8.6	6.1	5.2
including: own labour input	5.4	8.5	5.8	5.1
Economic efficiency ratios				
Total costs per 1 dt of seed (PLN)	75.27	77.81	77.32	75.67
Total costs per PLN 1 of operating income less subsidies (PLN)	6.80	3.76	13.61	10.25
Operating income less subsidies per 1 dt of seed (PLN)	11.07	20.69	5.68	7.38
Operating income less subsidies per 1 hour of own labour input (PLN)	32.94	33.79	15.48	22.12
Subsidies per PLN 1 of operating income less subsidies (PLN)	7.17	4.62	14.34	11.13
Share of subsidies in operating income (%)	87.8	82.2	93.5	91.8

^a Real indirect costs without the cost of external factors.

^b Subsidies cover payments for protein crops, single area payments, greening payments and additional payments. [–] – means that none of the above apply.

Table 8

Economic costs and income from management depending on the scale of cultivation of sweet lupine in 2016 (PLN/ha)

Specification	Average on farms cultivating sweet lupine	Depending on the scale of cultivation (ha/farm)		
		1-2	4-6	8-20
Net value added on activity	297	337	228	242
Own labour payments	82	130	88	77
Income from capital involvement and management activities	215	207	139	165
Cost of land	120	115	111	115
Cost of revolving capital and fixed assets	8	4	5	9
Management income less subsidies	88	88	23	42
Total subsidies	1264	1326	1284	1246
Management income	1352	1414	1307	1288
Costs of own means of production	210	249	204	201
Economic costs	1288	1277	1284	1217
Share of the costs of own means of production in economic costs (%)	16.3	19.5	15.9	16.5
Costs of own means of production per 1 dt of seed (PLN)	13.18	17.96	12.95	13.26
Economic costs per 1 dt of seed (PLN)	80.84	92.11	81.49	80.31
Relation between economic costs of production of 1 dt of seed and the sale price (%)	93.6	93.5	98.2	96.7

Table 9

*Production, costs and revenues obtained from the cultivation of fodder pea in 2016
(actual data)*

Specification		Average on farms cultivating fodder pea	Depending on the scale of cultivation (ha/farm)	
			1-2	4-12
Number of farms in the study		81	32	20
Area of cultivation	(ha)	3.68	1.48	6.24
Seed yield	(dt/ha)	25.0	23.8	27.5
Seed sale price	(PLN/dt)	95.78	108.50	91.36
Per 1 ha od cultivated area				
Total production value	(PLN)	2397	2587	2515
including: seeds		2397	2587	2515
Total direct costs	(PLN)	814	732	834
including: seeding material		318	287	321
total mineral fertilisers		290	292	266
external organic fertilisers		10	–	6
plant protection products		175	141	213
growth regulators		7	2	9
other		14	10	20
Direct margin less subsidies	(PLN)	1583	1855	1682
Real indirect costs ^a	(PLN)	436	496	457
Gross value added on activity	(PLN)	1147	1360	1225
Depreciation	(PLN)	390	388	416
Net value added on activity		756	972	809
Cost of external factors	(PLN)	197	92	181
Operating income less subsidies	(PLN)	559	880	628
Subsidies ^b	(PLN)	1274	1298	1228
Operating income	(PLN)	1834	2178	1855
Total costs	(PLN)	1837	1707	1888
Total labour input	(hours)	6.3	7.0	5.4
including: own labour input		6.0	6.9	4.8
Economic efficiency ratios				
Total costs per 1 dt of seed	(PLN)	73.43	71.59	68.56
Total costs per PLN 1 of operating income less subsidies	(PLN)	3.29	1.94	3.01
Operating income less subsidies per 1 dt of seed	(PLN)	22.35	36.91	22.80
Operating income less subsidies per 1 hour of own labour input	(PLN)	93.09	128.23	130.93
Subsidies per PLN 1 of operating income less subsidies	(PLN)	2.28	1.47	1.96
Share of subsidies in operating income	(%)	69.5	59.6	66.2

^a Real indirect costs without the cost of external factors.

^b Subsidies cover payments for protein crops, single area payments, greening payments and additional payments.
[-] – means that none of the above apply.

Table 10

Economic costs and income from management depending on the scale of cultivation of fodder pea in 2016 (PLN/ha)

Specification	Average on farms cultivating fodder pea	Depending on the scale of cultivation (ha/farm)	
		1-2	4-12
Net value added on activity	756	972	809
Own labour payments	92	105	73
Income from capital involvement and management activities	665	867	736
Cost of land	200	182	229
Cost of revolving capital and fixed assets	10	9	9
Management income less subsidies	454	676	497
Total subsidies	1274	1298	1228
Management income	1728	1974	1725
Costs of own means of production	302	296	311
Economic costs	1942	1911	2018
Share of the costs of own means of production in economic costs (%)	15.6	15.5	15.4
Costs of own means of production per 1 dt of seed (PLN)	12.07	12.41	11.30
Economic costs per 1 dt of seed (PLN)	77.61	80.14	73.30
Relation between economic costs of production of 1 dt of seed and the sale price (%)	81.0	73.9	80.2

Table 11

*Production, costs and revenues obtained from the cultivation of live pigs in 2016
(actual data)*

Specification	Average of farms producing live pigs	Depending on the scale of net production (ha/farm)		
		10-40	60-240	300-1000
Number of farms in the study	120	22	42	28
Net live pigs production (increase) ^a (dt/farm)	253.66	23.35	107.42	524.32
Gross live pigs production ^b (dt/farm)	451.46	38.88	187.29	930.01
Average annual sale price of live pigs (PLN/kg)	4.66	4.17	4.38	4.63
Per 100 kg of live animals, gross				
Production value (PLN)	466	417	438	463
Total direct costs (PLN)	423	381	382	419
including: stock rotation	269	208	226	260
external fodder	98	64	72	103
own fodder	50	101	79	49
other	6	8	5	7
Direct margin less subsidies (PLN)	43	36	56	44
Real indirect costs ^c (PLN)	45	108	77	40
Gross value added on activity (PLN)	-2	-72	-21	4
Depreciation (PLN)	41	94	64	35
Net value added on activity (PLN)	-44	-166	-85	-31
Cost of external factors (PLN)	11	14	13	10
Operating income less subsidies (PLN)	-55	-181	-98	-41
Subsidies (PLN)	–	–	–	–
Operating income (PLN)	-55	-181	-98	-41
Total costs (PLN)	520	597	536	504
Total labour input (hours)	2.2	8.3	4.4	1.9
including: own labour input	2.1	8.3	4.4	1.7
Economic efficiency ratios				
Cost of fodder in total in direct costs (%)	35.1	43.5	39.5	36.4
Cost of external fodder in total cost of fodder (%)	66.1	38.9	48.0	67.7
Direct margin less subsidies per 1 hour of work in total (PLN)	19.38	4.32	12.81	23.68
Total costs of production of PLN 1 of production value (PLN)	1.12	1.43	1.22	1.09

^a Net live pigs production is the annual weight growth obtained in a herd of pigs for fattening.

^b Increase + weight of animals at purchase.

^c Real indirect costs without the cost of external factors.

[–] – means that none of the above apply.

Table 12

Economic costs and income from management depending on the scale of production of live pigs in 2016 (PLN/ha)

Specification	Average on farms producing live pigs	Depending on the scale of net production (ha/farm)		
		10-40	60-240	300-1000
Net value added on activity	-44	-166	-85	-31
Own labour payments	32	128	67	26
Income from capital involvement and management activities	-75	-294	-152	-57
Cost of land	–	–	–	–
Cost of revolving capital and fixed assets	4	6	6	4
Management income less subsidies	-80	-300	-158	-61
Total subsidies	–	–	–	–
Management income	-80	-300	-158	-61
Costs of own means of production	36	134	73	30
Economic costs	545	717	597	524
Share of the costs of own means of production in economic costs (%)	6.7	18.7	12.3	5.7
Costs of own means of production per 1 dt of live animals (PLN)	0.36	1.34	0.73	0.30
Economic costs per 1 kg of livestock (PLN)	5.45	7.17	5.97	5.24
Relation between economic costs of production of 1 kg of livestock and the sale price (%)	117.1	172.1	136.2	113.1

KOSZTY JEDNOSTKOWE I DOCHODY WYBRANYCH PRODUKTÓW W 2016 ROKU – WYNIKI BADAŃ W SYSTEMIE AGROKOSZTY

Abstract

Celem artykułu jest prezentacja wyników ekonomicznych pszenicy ozimej, żyta ozimego, rzepaku ozimego, łubinu słodkiego, grochu pastewnego i żywca wieprzowego w 2016 roku w gospodarstwach o różnej skali ich produkcji. Badania przeprowadzono w gospodarstwach towarowych, czyli takich, które swoją produkcję przeznaczają na sprzedaż. Jednostki te mają charakter przedsiębiorstw. Na wyniki badanych produktów wpływ miał potencjał produkcyjny gospodarstw, czyli zasoby ziemi, pracy i kapitału, ich jakość oraz sposób wykorzystania, ale były także uzależnione od warunków zewnętrznych (np. rynkowych, pogodowych).

Następstwem zróżnicowania kosztów bezpośrednich i pośrednich oraz kosztu własnych czynników wytwórczych jest zróżnicowanie kosztów ekonomicznych. Z badań wynika, że najwyższe odnotowano w przypadku produkcji na skalę dużą – pszenicy ozimej, rzepaku ozimego i grochu pastewnego, na skalę średnią – żyta i łubinu słodkiego, a na małą – żywca wieprzowego. Dochód z zarządzania zapewniły wszystkie badane działalności produkcji roślinnej. Natomiast produkcja żywca wieprzowego nie pozwoliła na uzyskanie dochodu z zarządzania. Korzystny efekt skali produkcji jest jednak widoczny, strata producentów przy dużej skali – w porównaniu do małej – była prawie 5-krotnie mniejsza. Wyniki badań wskazują na przewagę dużej skali, chociaż ujawniała się ona na różnych poziomach rachunku ekonomicznego.

Słowa kluczowe: koszty jednostkowe, produkty rolnicze, skala produkcji, opłacalność produkcji, dochód z zarządzania.

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