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## **Economic Results of Winter Wheat and Winter Rye Production in Organic Farms – a Case Study**

**Abstract.** Studies on the economics of agricultural production in organic farms are carried out on a small scale but deliver important information about the situation of organic agricultural producers. The aim of this paper is to examine the economic and production results of organic farms cultivating winter wheat and winter rye in relation to the results of conventional farms (by way of case study). The paper used actual accounting data collected in the Agrokoszy system and Polish FADN and direct interviews with organic farmers. For detailed comparison of the economic results the methodology of calculating gross margin was used. When compared to conventional farms, the winter wheat and winter rye production results were weaker in organic farms, and a lower yield of grain was demonstrated. The selling price of organic grain was more favourable only for winter wheat. The surveyed farmers indicate the will to continue organic production. However, it is necessary to develop the organic product market and for further financial support for this production sector.

**Key words:** organic production, direct costs, profitability, Poland

**JEL Classification:** Q12, D24

### **Introduction**

Organic production in the European Union in 2016 occupied 11.9 million ha of utilised agricultural area. The majority this area was located in Spain, Italy, France, Germany (EUROSTAT, 2017). In 2016, in the EU-28 countries, the total production of cereals accounted for 36% of the area of all arable land on organic farms. The largest producers of organic cereals were Italy, Germany, France and Spain. According to the Eurostat statistical data (2017), 38.6% of cereals cultivated in organic farms were from wheat, mainly located in Italy, France and Germany. On the other hand, the cultivation of rye accounted for 7.9% of all cereal crops in the EU-28 countries, and the leading rye producers were Germany, Poland, Denmark and Austria.

In Poland, according to the statistical data in 2016, the area of utilised agricultural area where organic production was conducted accounted for about 3.7% of the total area and was 536,579 ha (GIJHARS, 2017). In 2016, in the national structure of utilised agricultural area, cereal cultivation accounted for 18.9% of total utilised agricultural area in organic farms (based on the GIJHARS data, 2017). It is worth stressing that the cultivation of cereals in organic farms is concentrated in two agricultural regions in Poland, i.e. Pomorze and Mazury and Mazowsze and Podlasie. In 2016, the total area of cereals cultivated in these regions accounted for more than 74% of the overall area in the country. Cereals produced on organic farms as a raw material should go to appropriate processing plants. According to GIJHARS (2017), in 2016, 17.2% of all organic processing plants operated in

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the sector “processing of cereal milling products”. In 2016, the volume of milling of cereals originating in organic farms was 8.9 thousand tones.

Agricultural production on organic farms, in addition to environmental importance, should also be a source of income for the farmer. In the case of cereal production, the major commodity is grain (it happens that sometimes also straw is sold in the market). Therefore, the obtained production value is determined by two factors: yield and grain selling price.

The yield of crops on organic farms, when compared to conventional farms, is usually at a much lower level. With respect to cereals, in making such a comparison we should bear in mind many factors, i.e. varietal diversification of cereals, form of the cultivated cereal (winter, spring), place of cultivation and specific growing season. Nevertheless, the studies conducted in the Central and Western European countries show that the average yield level of cereals on organic farms can be 20-40% lower than on conventional farms (Stanhill, 1990; Padel, Lampkin, 1994; Offermann, Nieberg, 2000; Seufert, Ramankutty, Foley, 2012). As suggested by Ponti and Rijk (2012), greater differences in the yield of organic cereals can be observed in countries (mainly of Western Europe) where the more intense crop production is conducted on conventional farms. The results of the studies conducted among leading organic producers of wheat in the EU point to the yields of wheat grain at the level of 2.5 tones/ha in Germany, 3.3 tones/ha in Italy, about 3 tones/ha in Romania and 3.2 tones/ha in Ukraine (Schott, Sanders, 2017). The same studies point to regional diversification of yield for wheat in the analysed EU countries.

Another important component of cereal production value is the grain selling price, which is mainly shaped by the supply of products on the market and the direction of sale. The sale of organic products straight from the farm or in a marketplace often entails higher prices when compared to products originating on conventional farms. As reported by Offermann and Nieberg (2000), in relation to cereal grain in the European market, this difference may be from 30% to 200% or more. Selling prices of products produced on organic farms may be rewarded by their organic quality, if customers are organic processing plants. As provided by Tudisca et al. in their studies (2014), the selling price of wheat grain from organic farms was EUR 26-28/q, while conventional farms received EUR 20-22/q. Similar information comes from the studies by Acs et. al. (2007) where the farmers received higher prices for wheat grain from organic farms, despite clearly lower yields when compared to conventional farms.

As shown by the studies conducted by the IAFE-NRI in the AGROKOSZTY system, on organic farms the agricultural production entails a lower level (when compared to conventional farms) of direct costs. Mainly thanks to this, organic farms are able to obtain good results at the level of gross margin despite much weaker production results (weaker yields). Also, farmers can expect additional support in the form of payments from agri-environmental programs. The above conclusions confirm the studies by Tudisca et al. (2014). Building on the case study of durum wheat cultivation, they indicate that at the level of gross margin, organic farms were able to compete with conventional farms thanks to lower direct costs and significant income support in the form of subsidies. This type of support has a significant impact on the level of revenues from agricultural activities. As shown by studies of the European wheat market, subsidies for organic farms help compensate for losses related to weaker production results (David et al., 2012).

## **The aim and research method**

Farmers who manage organic farms, while meeting all environmental requirements set for organic production, also seek to obtain income from this production. Studying the economic profitability of agricultural production in these entities can provide valuable information, especially with regard to the production of the conventional farms.

The aim of this study was to examine whether the production of cereals (winter wheat and winter rye) on organic farms meets its economic objective i.e. if sufficient incomes are generated from this activity. The considerations have been carried out as a case study with respect to the selected market-oriented conventional farms producing winter wheat and winter rye.

The decision to carry out a case study was caused by a small number of the analysed organic farms in the AGROKOSZTY system. In order to illustrate the diversity of economic results (also the level of production costs incurred), we selected just one organic farm cultivating winter wheat and one farm with winter rye, and, as a reference, the conventional farms in the corresponding scale of production of these cereals (what was taken into account was the cultivation area and the location of farms in the same agricultural regions). Of course, in the case of publishing data from individual farms, it was necessary to obtain farmers' consent, and full anonymity has been kept. For the purposes of the study, they have been defined as: in the case of cultivating winter wheat Organic Farm Wheat (the organic farm) and Conventional Farm Wheat (the conventional farm) and in the case of cultivating winter rye – Organic Farm Rye (the organic farm) and Conventional Farm Rye (the conventional farm).

For this study, we used the actual accounting data, which was collected in 2016 according to the methodological assumptions of the AGROKOSZTY Agricultural Products Data Collection system. With regard to analysed activities (winter wheat and winter rye), we used the methodology of calculating gross margin (Augustyńska-Grzymek et al., 2000). This is a very useful and adequate method to compare the first income category (the gross margin), the calculation of which is derived by deducting direct costs from the production value. In the case of crop production (wheat and winter rye), the production value is calculated per hectare. To evaluate the production value, average annual grain selling prices are used.

Direct costs in the case of crop production are: the cost of seed and planting material, purchased fertilisers (without costs of lime fertilisation), plant protection agents, growth promoters, insurance on the given activity, specialist costs. Also, the records of all unpaid and paid labour inputs incurred in work related directly to the pursued activity, are kept.

Keeping an account of income from activity, information (e.g. indirect costs) from the accounting data collected for the same farm for Polish FADN was also collected. Indirect costs incurred under operating activities of the farm were distributed between activities conducted on the farm, according to the share of the production value of each in the total production value of the farm (Skarżyńska, 2017).

Organic farmers could expect financial support for income obtained from the production of winter wheat and winter rye. The account included subsidies which in 2016 could be granted for cereal production on organic farms, such as: the single area payment, payment for greening, additional payment and ecological payment.

Based on the obtained accounting data, it is also possible to determine the profitability of production as a ratio of the production value to total costs in percentage terms (Skarżyńska, 2011).

The method to calculate other income categories for agricultural production activities is as follows:

- Production value
- Direct costs
- = Gross margin without subsidies
- Indirect costs (actual costs, costs of depreciation and of external factors)
- = Income from activities without subsidies
- + Subsidies
- = Income from activities

In order to supplement the accounting data collected, simple PAPI surveys were conducted among the participating organic farmers (for each organic farm only), on the selection of organic methods of farming and opinion on participation in the organic farming system.

## Results

The studies show that the cereal yield levels on organic farms was clearly lower than for conventional farms. In the organic farm cultivating winter wheat, the grain yield was 20.6 dt/ha and was lower 2.9 times than that of the conventional farm. In the case of cultivating winter rye, the grain yield on the organic farm was 8.9 dt/ha, which was more than 4 times lower than for the conventional farm (Table 1).

Table 1. Specification of studied organic and conventional farms with winter wheat and winter rye production in 2016 (a case study)

Specification	Organic Farm Wheat	Conventional Farm Wheat	Organic Farm Rye	Conventional Farm Rye
Utilised agricultural area [ha]	39.7	67.0	185.9	228.1
Crop area [ha]	11.6	11.0	40.6	30.8
Soil valuation index	0.52	1.18	0.67	0.66
Yield of grain [dt/ha]	20.6	60.0	8.9	37.0
Annual selling price [PLN/dt]	112.15	56.00	47.62	47.76

Source: AGROKOSZTY database (2016), own calculations.

According to the public statistical data (CSO, 2017) yields obtained in 2016 on average in the country by individual farms were, respectively, for winter wheat – 44.9 dt/ha and for winter rye – 28.4 dt/ha. The diversity of the yield level of analysed cereals is shown in studies by David et al. (2012). On the organic farms in France the minimum wheat yields were 25q/ha, maximum 50q/ha; in Denmark, they were respectively 10-40 q/ha; in Austria – 30-55 q/ha; in Italy – 35-60q/ha. The wheat yields on the conventional farms were, for comparison, from 60 to 82 q/ha, depending on the analysed country. Other studies by Tudisca et al. (2014) also confirm the lower yield of wheat on organic farms (25-29 q/ha) when compared to conventional farms (34-45 q/ha).

Price conditions of grain sales in the analysed farms were varied. In the case of winter wheat, the price in the Organic Farm Wheat was PLN 112.15/q and was two times higher than the average wheat buying-in price of the conventional farm; on the other hand, the reported grain selling price for rye was at a similar level in both analysed farms (PLN 47.62-47.76/q). The above-cited studies of the European market conducted by David et al.

(2012) indicate that organic farms receive higher prices of wheat than conventional farms. In Austria and France the prices are higher by 150%, in Italy by 80%, in Switzerland by 50%, and in Denmark the difference in favour of organic wheat grain was 30-40%.

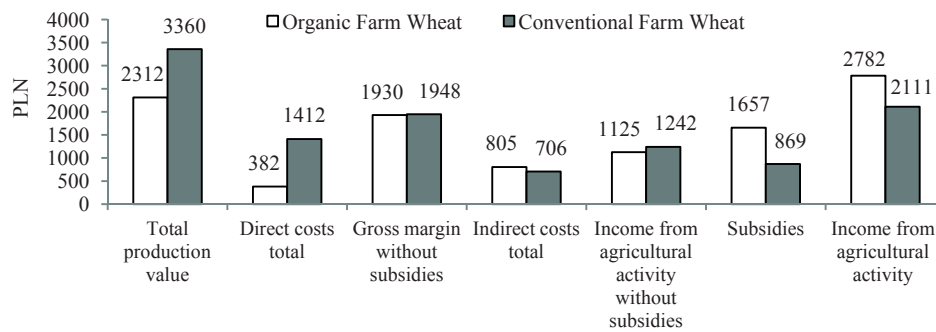


Fig. 1. Income from winter wheat production on organic and conventional farms in 2016.

Source: own presentation based on AGROKOSZTY system database (2016).

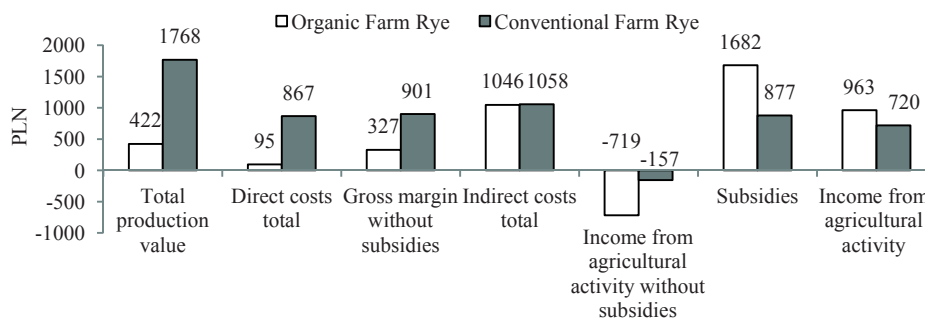


Fig. 2. Income from winter rye production on organic and conventional farms in 2016.

Source: own presentation based on AGROKOSZTY system database (2016).

As it results from the studies conducted, the grain yield and its selling price determined the level of the production value of the cultivation of winter wheat and winter rye in the analysed farms. The Organic Farm Wheat received PLN 2,312 from 1 ha winter wheat (conventional farm – PLN 3,360), while the Organic Farm Rye for 1 ha rye received only PLN 442 (conventional farm – PLN 1,768) – Fig.1 and Fig.2. The production value is a major factor determining the amount of gross margin, but we must also pay attention to the level of costs incurred for production. Per 1 ha wheat, direct costs of the Organic Farm Wheat were PLN 382 (i.e. they were 3.7 times lower than in the case of the conventional farm), and direct costs of the Organic Farm Rye for the organic production of 1 ha rye – PLN 95 (9.1 times lower than in the conventional farm). For both these cereals, on the organic farms the only component of direct costs was the cost of seed material. The studies by Tudisca et al. (2014) also indicate that the main component of variable costs of wheat production was the cost of seed material, as the organic farms did not bear any cost of

fertilisation and use of plant protection products. The same studies indicate that the level of variable costs incurred for wheat production on the organic farms was lower, on average, by 30% compared to the conventional farms (slightly different items of variable costs were taken into account). Generally speaking, the reduction in variable costs results mainly from significant restrictions (or even prohibition) to apply purchased fertilisers and plant protection products which are replaced with on-farm products, as for example, the use of manure and nitrogen-fixing plants in crop rotation (David et al., 2012).

Gross margin without subsidies obtained from the cultivation of 1 ha winter wheat on the Organic Farm Wheat was PLN 1,930 (on the conventional farm – PLN 1,948) and, in the case of winter rye – on the Organic Farm Rye this was PLN 327 when compared to PLN 901 for the conventional farm. The level of indirect costs must be regarded as similar in the analysed farms (only in the case of wheat, indirect costs were higher on the organic farm). Finally, the level of income from activity without subsidies from 1 ha wheat was PLN 1,125 on the Organic Farm Wheat (on the conventional – PLN 1,242). In the case of winter rye, in both analysed farms a loss was suffered at this level of income – on the Organic Farm Rye it was PLN -719/ha while on the Conventional Farm Rye the loss was PLN -157/ha.

Table 2. Results of PAPI interview with studied organic farms with winter wheat and winter rye production in 2016

Question	Organic Farm Wheat	Organic Farm Rye
Why did the farmer choose organic methods of production?	The continuation of organic production, the ideological view of producing the healthy food, but also economic reasons	The farm is optimal regarding the balance between costs and profits (the economic reason)
For what purpose are the cereals produced on the farm?	Organic products market (organic processing), also self-subsistence	Organic products market, mainly as an organic seed material
What about training and affiliation to organizations of organic producers?	Active participation in trainings and membership of Ekoland	Participation in trainings only, without membership in organizations
What is the vision of the organic farm?	Continuation and development of organic production and strengthening the farm position (locally already known as an organic producer)	Continuation of organic production only in case of further financial support (subsidies)
What are the barriers to further development of organic farming in Poland (from the farmer's point of view)?	Low awareness of adjacent conventional farmers, the organic farm's production is too small regarding large orders of products	Unstable organic products market and problems with fair trade (relations with the customers)

Source: own PAPI interview (2016).

Financial support in the form of subsidies per 1 ha wheat and rye on the organic farms was similar – respectively, PLN 1,657 and 1,682. When compared to the conventional farms, this support was almost two times higher (mainly due to including agri-environmental payments). Also, the studies by Tudisca et al. (2014) indicate a significant impact of subsidies on income from the wheat production on the organic farms. However, in the case of the analysed organic farm the impact of subsidies on the amount of income was much greater. This is evidenced by the share of subsidies in income from activity, which, in the case of wheat on the organic farm was 60.0% (on the conventional farm – 41.2%) and, in the case of winter rye in both analysed farms subsidies covered losses (Fig. 1 and Fig. 2).

A measure to evaluate the economic efficiency of winter wheat and winter rye production in the analysed farms was the direct profitability index (ratio of the production

value to direct costs, expressed in percentage terms). On the organic farm cultivating winter wheat, this index was 194.8% (on the conventional farm – 158.6%), i.e., all production costs were covered and the wheat production was profitable. In the case of rye, the profitability index was 37.0% on the organic farm and 91.8% on the conventional farm, which shows that in both cases the production was below the threshold of profitability.

Direct interviews were carried out using the PAPI technique (Paper and Pencil Interview) among the surveyed organic farmers (only for the organic farm with winter wheat and the organic farm with winter rye cultivation). The answers to the questions are shown in Table 2. The survey was to learn the opinions and motivations of the farmer managing the organic farms.

As seen from the answers, a factor highlighted in choosing organic production methods was for economic reasons. In both cases, produced cereals were placed on the market of organic products, although in the case of rye mainly on the market of organic seeds. The farmers pointed to participation in training courses on organic farming, which also indicated the will to continue managing the farm using organic methods. The main barriers to the further development of organic farming, from the point of view of the farmers, were problems with the market of organic products (unstable, too low supply of products) as well as problems with adjacent conventional farms and problems in the outlet market (problematic relationships with customers). Similar results of these surveys (on the larger population of organic farmers) were presented in the report by the Institute of Rural and Agricultural Development of the Polish Academy of Sciences (2017), where the most frequent reason for starting organic activity was a possibility of obtaining subsidies. The farmers most often sold their products straight from the farm, and the customers to a lesser extent were processing plants, wholesalers or local shops or marketplaces. The vast majority (75%) of the farmers surveyed during this study confirmed the will to continue managing the organic farm. Nevertheless, the main problems they indicated were: the lack of an outlet market for products; complicated documentation and regulations; and the lack of understanding the needs of organic farming within the institutional environment.

## **Conclusions**

Answering the study question of this paper, it can be concluded that the analysed organic farms fulfilled the economic target of production of analysed cereals but that income was strongly dependent on subsidies. The diversified level of income (compared to the results of the analysed conventional farms) was due to the relationship between revenues and costs incurred in total. The organic farms producing winter wheat and winter rye had much weaker production results, and grain selling prices only in the case of winter wheat were higher than on the conventional farm (winter rye prices were at similar levels in the analysed farms). The main factor positively affecting the level of income from activity was the significantly lower total costs of production on the organic farms, mainly due to significantly lower direct costs (3.7 times lower in the case of wheat, 9.1 times lower in the case of rye) compared to costs of the conventional farms. The calculated profitability index clearly indicated that revenues from the winter wheat production greatly exceeded direct costs incurred (in the case of the organic farm 194.8%, in the case of the conventional farm – 158.6%). For the winter rye production, unfortunately we could not talk about the profitability of production, since in both analysed farms the production costs exceeded revenues. Financial support in the form of subsidies was more important for income from

activity in the case of organic farms, and, in the case of winter rye, income was positive only thanks to these subsidies.

Due to the purposeful selection of farms, the case study results may not constitute a basis for far-reaching generalisations. The study results are primarily cognitive; they indicate the differences in the profitability of cultivating wheat and rye on the organic farms in relation to the production of these crops on the conventional farms. Nevertheless, a number of studies indicate the possibility of obtaining higher income from production (also of cereals) on organic farms and the higher production profitability when compared to conventional farms (Acs et al., 2007). However, the studies of economics of organic production are still carried out on a small scale and there is no possibility of a proper reference, often due to the differences in the methodology of studies conducted.

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