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ORGANIC FARMING AS A PART OF THE SUSTAINABLE DEVELOPMENT OF AGRICULTURE

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The paper presents the relationships of organic farming with sustainable development of agriculture and rural areas. The promotion of environmentally friendly agriculture and environmental protection are implemented within agri-environmental programs. The aim of these programs is to achieve sustainable rural development and preserve biodiversity.
The goal of studies was to assess the sustainability of ecological agriculture at the level of an agricultural holding. Organic farming is perceived as a system that is most favorable from the perspective of environmental protection. Analysis was conducted on the basis of data from ecological farms in the Podlaskie voivodeship registered in the FADN system in 2014. Ecological indicators (share of cereals in crops, vegetation coverage of the soil throughout the year, stocking density, balance of organic substances, agricultural and environmental actions taken) as well as economic indicators: land profitability and productivity and profitability of labor, were accounted for. It was determined that the conditions of environmental sustainability were met with regard to the majority of ecological indicators. From the perspective of economic effects, organic farming achieved a positive financial result, but it was lower than in conventional farms. This result was achieved thanks to public subsidies for ecological production.

Keywords: agriculture, ecological indicators, organic farming, sustainability

INTRODUCTION

Rural and agricultural development are strictly related to the issues of the natural environment and sustainable development. Many arguments speak in favor of such development, including environmental threats and marginalization of large rural areas. The need to promote environmental protection measures has thus become the most important task facing the modern world. Sustainable development is based on integrating measures oriented towards searching for solutions intended to conserve the features of the natural environment while allowing for the achievement of economic objectives. Sustainable agriculture provides these capabilities and is intended to link economic development to protection of natural resources and the global equilibrium of ecosystems. According to G. Benckiser (2010) about 60% of global ecosystems are not used sustainably.

Agriculture is ascribed a special role in the concept of sustainable development, as it has the closest relationships to the natural environment. Globalization processes are a particular challenge to agriculture and rural areas. In addition, social expectations of agriculture are very high. Agriculture is responsible for production of healthy food, therefore it must meet high expectations with regard to both the quantity and quality of produced food and protection of natural resources.

Organic farming is perceived as the system of management that is most favorable for environmental protection and compliant with the principles of sustainable development, although equating sustainable development only with this method of farming is an overly simplistic approach (Baum, Śleszyński, 2008). Nevertheless, there are many lines of reasoning that speak in favor of organic farming. Organic farming, as a form of sustainable agriculture, receives financial support within the framework of agricultural policy. Subsidization of organic production certainly encourages the transition from traditional to organic production, which is why growth of the number of organic farms in all EU member states has been observed for over a decade. In 2015, over 271.5 thousand agricultural producers conducted organic farming activity in EU countries, including 22.2 thousand in Poland (Report…, 2017).

Studies indicate that organic farming subsidies contributed to growth of farmers' income. In Western Europe, this growth was 10-30%, and in Eastern Europe, after accession into the EU, it even reached up to ¾ in certain countries (Zander et al, 2008). The results largely depend on the size of the farm. Studies conducted in Poland show that subsidies had the largest impact on improving the profitability of organic farms with a surface area above 20 ha (Koloszko-Chomentowska, 2015).

However, growth of organic production should not be sought solely in rising subsidies, and effective methods of management should also be looked to, e.g. limiting market barriers (Brzezina et al, 2017). Despite the fact that demand for organic products is growing, the higher prices of these products still remain a barrier for many consumers. Most consumers accept a price higher by no more than 10% in comparison to traditional food (Zámková, Blašková, 2013).

Promotion of environment-friendly agriculture and environmental protection measures are implemented as part of agricultural and environmental programs. The goal of these programs is to achieve sustainable development of rural areas and to preserve biodiversity. Programs for the protection of ecosystems are a part of the Rural Development Programme (RDP) for the years 2014-2020. Agricultural, environmental and climate measures are a part of these programs and serve to support sustainable development of rural areas and satisfy society's demand for environmental services. This is also organic farming. It is a continuation of package 2, implemented within the framework of the agri-environmental programme of RDP 2007-2013. This package is based on the implementation in agricultural holdings of the principles of agricultural practice employing the best agricultural knowledge and culture, with care for the condition of the environment. As a form of sustainable agriculture, organic farming receives financial support within the framework of agricultural policy for its contribution to environmental protection, preservation of biodiversity and protection of the cultural landscape. This is a form of compensation for limitations in agricultural production that are intended to support agricultural income. Hence, support for agri-environmental measures combines such fields as environmental protection and economics, which is consistent with the assumptions of sustainable development.

Studies conducted in Italy indicate that organic farming is low-emissions farming and brings many benefits to the climate (Chiriaco et al, 2017). However, as the authors of the report observe, reduction of greenhouse gas emissions per 1 ha can be less perceivable to the growing surface of organic crops. Organic farming also plays an important social role in the development of rural areas by increasing employment, linking producers to consumers and reinforcing ties to the local economy (Lobley et al., 2009, O'Hara and Parsons 2013). The object of research was activities of agricultural organic farms-holdings in Poland. **The goal of studies** was to assess the sustainability of organic farming at the level of a single agricultural holding. Analysis was conducted using the author's own studies, conducted in Poland, as an example.

MATERIAL AND METHODOLOGY

The research problem was addressed on the basis of organic farms from the Podlaskie voivodeship. Their location within the Green Lungs of Poland region fosters development of organic production. Data was obtained from the FADN system, and this data is available from the Institute of Agricultural and Food Economics in Warsaw. In 2014, there were 34 organic farms.

Different agriecological indices are applicable to assessment of environmental sustainability (Belanger et al, 2012, 2015; Harasim, 2013, Lebacq et al, 2013). The selection of indicators should consider the comparsion of indicators based on various criteria, mainly data availability (Lebacq et al, 2013). Selected agro-ecological indicators were applied for environmental sustainability assessment, and they included: share of permanent grassland (meadows and pastures) in the area of farmland (%), share of cereals in crops (%), soil coverage with vegetation throughout the year (%), number of livestock ($LU \cdot ha^{-1}$), balance of fertilizer ingredients ($kg \cdot ha^{-1}$) (Harasim, 2013). Agriecological assessment was supplemented by material pressure indices characterizing the burden on the environment caused by production resources (Piekut, Machnacki, 2011). These are: indirect consumption, value of mineral fertilizers and plant protection products, value of purchased feed, and energy consumption. These indices indicate the intensity of agricultural management. The index of costs sustained for purchasing mineral fertilizers and plant protection products is of limited value in the assessment of holding sustainability, however it can be of diagnostic value and serve as a criterion in trend assessment (Sobczyński, 2008).

Land profitability and productivity of labor, understood as the total net added value per fully employed person (SE415/SE010), and profitability of labor, or the value of income from a family-owned agricultural holding per fully employed family member (SE430=SE420/SE015), were accounted for in economic sustainability assessment. Profitability of labor was corrected by the balance of subsidies and taxes (SE600) to provide a complete picture of the economic situation of agricultural holdings. Organic farms were compared with conventional farms.

RESULTS

The studied farms constitute a very diverse group in terms of factors of production, as confirmed by coefficients of variation (tab. 1). Both holdings with slightly over 6 ha and holdings with nearly 77 ha of arable land are found in this group. This variation arises from the fact that the group contains large farms, with typical cultivation of field plants, and small farms, which are concerned with garden crops, usually cultivated over a much smaller surface area. However, it should be noted that 50% of these farms have an area of arable land that is half of the mean value (median=19.4). The coefficient of variation for total assets and fixed assets ranged from 62.25 to 69.11%. Holdings mainly employed family labor, and hired labor only made up a slight supplement to this labor, although in individual cases, hired labor played an important role in labor organization on the farm (max. 9.94 AWU). The lowest variation occurred in the case of the labor of the farmer and their family (V=28.24%).

There are clear differences in the size of the animal herd. In certain holdings, only plant or vegetable production is conducted, but there are also holdings with relatively high stocking density, and these are farms specializing in cattle breeding.

Table 1. Selected data of organic farmers

Specification	average	min.	max.	median	coefficient of variation (%)
Utilised agricultural area (ha)	22.68	6.03	76.68	19.40	70.76
Total labour input (AWU[1])	1.71	0.71	9.94	1.52	88.47
Family labour input (FWU[2])	1.47	0.71	2.45	1.52	28.24
Total assets (thousand PLN·farm[1])	709.26	197.25	2 977.68	541.73	69.11
Fixed assets (thousand PLN·farm[1])	644.14	175.15	2 337.39	512.96	62.25
Number of livestock (LU·farm[1])	9.96	0.0	36.65	7.94	85.81

1 - Annual Work Unit, 2- Family Work Unit
Source: own calculation based on FADN data

The structure of land use is typical for holdings in the Podlaskie voivodeship (tab. 2). The studied farms are characterized, above all, by a high share of permanent grasslands (over 30%). This is the foundation for organizing animal production. These are beneficial practices from the perspective of environmental impact. Permanent grasslands perform various ecological functions, and their greater share in the farmland structure means that the holding's pressure on the environment is low.

Crop structure is the basic determinant of the organization of plant production. It is decisive to the production and economic effects, besides the level of fertilization and harvested crops. According to the principles of good agricultural practice, a share of cereals greater than 66% in the crop structure should be avoided (Duer et al, 2002). In both groups, the share of cereals in the crop structure was lower than the maximum value. In organic farms, this arises from the high share of leguminous plants (50.5%). Meanwhile, in conventional farms specializing in cattle breeding, there is lower demand for cereals due to the nature of production. This situation is rather typical for holdings with this direction of production. Cattle breeding holdings are most frequently located in areas with a large share of permanent grasslands. This is a natural feed base for ruminants. Moreover, these holdings cultivate a large amount of corn (34.81%) for green forage, which is used to feed animals. These factors result in reduction of demand for cereals.

An important aspect of the sustainability of holdings is keeping the soil surface of arable land under vegetation cover for as long as possible. According to the principles of good agricultural practice, approx. 60% of the surface of arable land in flatlands, and at least 75% of the surface of grounds threatened by erosion, should remain under vegetation cover throughout the whole year (Duer et al, 2002). In organic farms, these environmental sustainability conditions were met. In comparison, the index of soil vegetation coverage in conventional holdings was lower than recommended. This is due to the large share of corn in the crop structure.

Proper management of organic matter is an important part of environmental protection and limitation of the greenhouse effect. In agricultural practice, at least a zero balance of organic matter in the soil should be maintained. The soil organic matter balance was positive in both groups, which should be considered correct.

Organization of livestock production is assessed from the perspective of use of produced manure. The number of animals on a holding and their stocking density are both important. In both cases, mean stocking density in holdings did not pose a threat to the natural environment because it did not exceed the maximum level of 1.5 LU·ha^{-1} (Duer et al, 2002). However at the level of a single holding, such threats are present due to high stocking density, e.g. in organic farms, the maximum stocking density was 2 livestock units, while conventional farms reached a value of as much as 12.7 LU.

Table 2. Agri-ecological assessment indexes and material pressure indexes

Specification	Organic farms	Conventional farms
Utilised Agricultural Area - UAA(ha)	22.68	33.18
including:: permanent grasslands (%)	35.70	31.08
Share of cereals in sowing (%)	42.80	46.07
Soil coverage with vegetation (% arable land)	74.21	59.46
Organic matter balance (t·ha^{-1})	0.43	0.94
Number of livestock - stocking density (LU·ha^{-1})	0.44	1.26
Total intermediate consumption (PLN·ha^{-1})	1 552.14	5 118.86
Mineral fertilizers (PLN·ha^{-1})	51.15	598.73
Plant protection products (PLN·ha^{-1})	0.0	192.41
Value of purchased feed (PLN·ha^{-1})	164.29	517.84
Energy consumption (PLN·ha^{-1})	382.01	641.13

Source: own calculation based on FADN data

Total intermediate consumption per 1 ha of farmland is a general indicator of material pressure on the environment. It encompasses direct costs and general holding costs related to the operations of the agricultural holding. Conventional holdings were characterized by the highest intensity of production mainly due to high costs of energy and mineral fertilizers (tab. 2). Thus, these holdings exerted greater pressure on the environment.

The principles of sustainable growth of rural areas and preservation of biodiversity are implemented through agri-environmental programs. Farmers' involvement in these programs is an expression of their active attitude towards environmental protection. Measures to protect the environment, including organic farming and agricultural, environmental and climate measures, are financed within the framework of the Rural Development Programme 2014-2020. In organic farms, the value of agri-environmental subsidies was over 60% greater than in conventional farms (tab.3). Subsidies for

organic production had the largest share (85.7%), and moreover, these farms also implement other environmental protection programs. Conventional holdings also realize agri-environmental programs, but to a much lesser extent.

Profitability of land and profitability of labor are among the basic indexes of economic effectiveness, because they determine the degree in which basic production factors are used. The income of a holding changes depending on, above all, production value and sustained costs.

The data presented in table 4 shows that the production and economic results of organic farms were less favorable. Their value of production made up only 40% of the value of conventional farms' production. This is quite understandable since the productivity of production factors is low in farms that employ extensive forms of management (as is the case in organic farms). In the structure of organic farms' production, 50.5% was animal production, 43.3% plant production, and 6.2% was revenue from rendered services and agritourism. In the case of conventional farms, animal production was decidedly dominant – 79.1%, plant production made up 20.1%, and revenue from other production was of negligible significance (0.8%).

Table 3. Total subsidies and agri-environment grants

Specification	Organic farms	Conventional farms
Total subsidies (PLN·ha^{-1})	1 493.09	917.02
including: agri-environment grants (PLN·ha^{-1})	615.58	36.28
- organic farming (%)	85.7	0.0
- nature 2000 (%)	5.0	12.7
- conservation of plant genetic resources (%)	0.0	6.0
- conservation of animal genetic resources (%)	0.0	15.3
- other (%)	9.3	66.0

Source: own calculation based on FADN data

The goal of an agricultural holding's activity is to achieve income that, under the specific conditions of agricultural policy, should afford the farming family an acceptable social level and capital accumulation. The level of income obtained from agricultural activity is dependent on many factors but largely depends on the use of production factors and their productivity. The effectiveness of farming, measured as the level of income obtained, was lower in organic farms (tab. 4). Land profitability was lower by 58.8% and labor profitability (income per 1 FWU) by 60%. There are at least several reasons for this situation. This largely depends on production capacity, which was decidedly lower in organic farms than in conventional ones. This lower capacity should be compensated for by higher sale prices of organic products. However, in practice, a higher price is a barrier and limits demand for organic products. This is why subsidies for organic production play such an important role in shaping the financial situation of organic farms. Without subsidies, it would be impossible for them to achieve a positive financial result. EU subsidies also play an important role in the profitability of conventional farms. In 2014, the share of subsidies in the income of a conventional family-owned agricultural holding amounted to 37.2%, and 65% when calculated per family member working on the farm. Therefore, subsidies play a very important role in the economic sustainability of agricultural holdings.

Table 4. Economic assessment characterizing studied farms

Specification	Organic farms	Conventional farms
Production value (PLN·ha^{-1})	1 844	8 454
Net value added (PLN·AWU^{-1})	21 885	55 030
Family farm income (PLN·ha^{-1})	1 260	3 059
Family farm income (PLN·FWU^{-1})	20 819	52 435
Family farm income corrected (PLN·FWU^{-1})	-7 368	34 113

Source: own calculation based on FADN data

CONCLUSION

The values of the natural environment and cultural values are two of the basic endogenic factors of agricultural development and growth of rural areas. At the same time, they require special protection against improper and excessive exploitation. Organic farms play an important role in implementing the concept of sustainable development in agriculture, but they also face different social expectations. These farms not only produce food of high quality but also render services to the benefit of the environment, such as: increasing biodiversity, protecting genetic resources, improving the well-being of animals, etc. The work performed by these farms to the benefit of the environment is financed by public funds. The Podlaskie voivodeship is distinguished by exceptional natural diversity, and financing any activities that would protect these resources is entirely justified.

The analysis conducted indicates that the studied organic farms realize measures that protect the environment and thus contribute to implementation of the concept of sustainable agriculture. Calculated ecological assessment indicators (crop structure, share of permanent grasslands, soil vegetation coverage index, organic matter balance) indicate that environmental sustainability conditions were met. The indicator of livestock headcount in farms is debatable. Mean stocking density did not pose a threat to the natural environment, but such threats were present in the case of individual holdings. The standards defined in the code of good agricultural practice were exceeded significantly. The implementation of other agri-environmental programs indicates the involvement of organic farms in production that is consistent with the

principles of environmental protection. From the perspective of economic results, organic farms achieved lower indicators than conventional farms. This is mainly due to the lower capacity of organic production. However public subsidies played an important role. They constitute the main source of subsistence for agricultural families performing many tasks to the benefit of the environment and its protection. Funds transferred by programs supporting such activities do not constitute direct support of agricultural income but rather gratification for activities protecting the environment. As it turns out in practice, however, they constitute material indemnity for agricultural families. Improvement of organic farms' profitability would occur in the event of increased demand for organic products, and this depends on the affluency of society.

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