p-ISSN 0044-1600
e-ISSN 2392-3458

Zagadnienia Ekonomiki Rolnej

www.zer.waw.pl

2(351) 2017, 3-31

Articles

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DOI: 10.30858/zer/83018

FARMS' PRODUCTION AND ECONOMIC RESULTS DIFFERENCE IN THE ENVIRONMENTAL PRESSURE

Abstract

The main purpose of agricultural activity, which also applies to other economic activities, is to obtain economic benefits. Economic outcome of agricultural activity is a result of the production potential of the farms, organisation of agricultural production as well as various types of financial support to agricultural producers. At the same time, farm's organisation determines its scope and scale of natural environment effect. The aim of the article is to establish the diversification of the changes in production potential and production and economic results of farms that affect to varying degrees the natural environment. The research covers the period between 2004 and 2013.

Keywords: production and economic results, natural environment, agricultural type of a farm, farming system, Common Agricultural Policy, subsidies, FADN.

JEL codes: Q12, Q18, Q01.

Introduction

Each economic activity should result in measurable production and economic effects. The farming outcome is a measurable result of undertaken activity stimulating its continuation and further development. These regularities concern also agricultural activities (Ziętara, 1998; Zegar, 2008; Harasim, 2006). The level of economic benefits of farmers mainly derives from the production potential of farms and agricultural production organisation. Other factors that should be indicated in this context are external transfers, in the form of various payments, whose impact on the economic situation of farms is growing (Zegar, 2008, 2009). These payments are presently an important component of farm income (Góral, 2016).

Apart from farm economics, a vital element in the assessment of their operations is the scale and scope of their impact on the natural environment. The relations between the economy and the environment derive from agricultural practices. The use of agricultural practices fostering environmental sustainability of farms results not only from the level of environmental awareness of agricultural producers but also from financial incentives offered under governmental programmes (Perepeczko, 2011a, 2011b). Conditional support to farms obligates to implement agri-environmental practices. The scope of these practices directly determines the level of environmental sustainability of farms and indirectly – the scope of knowledge and awareness of an agricultural producer (Wrzaszcz, 2012).

Farms have varied impact on the natural environment. The farming type and the farming system play a major role in this respect (Wrzaszcz, 2016). Both these features stem from production organisation on a farm (Goraj and Mańko, 2009), which in turn results from the impact of different forces, including the so-called integrating forces – resulting directly from internal relations between different agricultural production activities and also differentiating forces – dictated by the environment in which the farm functions (Ziętara, 2014). The integrating forces incline to multidirectional agricultural production on a farm, while differentiating forces head towards specialisation. Specialisation of farms, which ensures higher economic benefits compared to multidirectional production, may simultaneously result in environmental external costs, e.g. due to a growth in production intensity (Kośmicki, 1993; Kuś, 2012; Zegar, 2012; Zimny, 2014).

The aim of the article is to establish the diversification of the changes in production potential and production and economic results of farms that affect, to varying degrees, the natural environment. Farms were divided into organic, non-specialised bidirectional and specialised animal farms. The research period covered the years between 2004 and 2013, which enabled to present the role of external transfers (payments) in the economic results of researched groups of farms.

Research subject and method

The research covered individual farms conducting continuous farm accountancy between 2004 and 2013 under the FADN (Farm Accountancy Data Network). This panel covered approx. 4.5 thousand farms, which accounted for about 40% of the groups of farms conducting average annual farm accountancy. Such approach enabled assessment of the production and economic situation of a fixed group of farms in the analysed period, eliminating the potential impact of the "new" farms which were added to the FADN group in respective years.

The long analysis period allowed also to capture the impact of financial resources transfer under the Common Agricultural Policy (CAP) on the condition of the researched farms. The first year of this period presented a situation in which the effects of implemented CAP mechanisms was minor, because the agriculture support programmes were at the stage of preparation and only few measures were launched. At this time, the impact of subsidies on the functioning and economic results of farms was insubstantial[1]. Whereas in the final year of the adopted research period, the implemented measures were reflected in the account of the agricultural producer. This was also a time of high activity of agricultural producers as regards acquiring support in the form of various types of payments linked to agricultural and non-agricultural activity under the implemented Rural Development Programme 2007-2013[2].

Three groups of farms were separated from the panel of FADN farms, namely: organic, non-specialised (bidirectional) and specialised animal. These groups may be treated as examples of farms that differ as regards the extent of their impact on the natural environment (Toczyński, Wrzaszcz and Zegar, 2013). Farms eligible for these groups were farms that both in 2004 and 2013 were run in line with the adopted farming system or were eligible for the same farming type. Selection of fixed groups of farms enabled monitoring of (organisational, production and economic) changes occurring in them, eliminating simultaneously the impact of these farms which in the meantime significantly changed their agricultural production profile[3].

The research covered **organic farms** (certified and during reorganisation), which are considered as a form of sustainable agriculture (Lampkin, 1994; Alteri, 1995). Organic farms are an example of economic operators, which exercise a positive impact on the natural environment and also provide numer-

[1] In 2004, only some part of the measures of the Rural Development Plan for 2004-2006 were launched, which was also manifested in the stream of support to agricultural producers.

[2] See e.g. Czubak et al. (2016).

[3] The results for all organic, non-specialised farms with plant and animal production and specialised animal farms, covered by the accountancy system in 2004 and 2013 were presented in the publication by Wrzaszcz and Zegar (2016).

ous benefits to the society. In the last dozen or so years the number of organic farms rapidly grew both in Poland and worldwide (Kuś, 2014). In line with legal regulations agricultural production on these farms should be based on the use of natural ecosystem processes and minimum use of industrial means of agricultural production[4].

The organic production methods aim at environmental protection and maintaining welfare of farm animals, avoiding or significantly reducing the use of synthetic chemicals at one go (European Commission, 2005). The organic farming system activates natural production mechanisms by using natural technologically unprocessed means, thus ensuring sustainable soil fertility and healthiness of animals and high biological quality of agricultural products (Sołtysiak, 1995). The characteristics of this farming system include preserving and enriching soil fertility, selecting plant and animal species resistant to diseases, using closed circulation of fertilising substances and components on a farm, ensuring feed and fertiliser balance and subordinating to the rhythm of processes taking place in nature which has a positive impact on sustaining ecological balance (Kośmicki, 1993; Zimny, 2003). This direction of agriculture is based on natural energy resources, production processes run in line with the laws of nature, limited human interference in the ecosystem and protection of components of the natural environment, which in turn favours preservation of genetic diversity of organisms, including protection of wild plant and animal species (biodiversity) as well as formation and conservation of rich agricultural landscape (Tyburski and Żakowska-Biemans, 2007; Zimny, 2014).

The organic food quality preconditions the significance of the organic farming system for the society. The consumers are the driving force behind this type of farming, because the demand for organic products dynamically grows (Zegar, 2012)[5]. The increasing environmental awareness, the will to prevent progressively more common lifestyle diseases (allergies), the growth in the level of welfare or the need to protect the environment – these are all factors shaping demand for organic food (Bołtromiuk, 1999; European Commission, 2004). Consumers more and more often pay attention not only to the price of food products but also to their quality. Organic farming is distinguished by special attention to food quality that results from the need to observe restrictive legal requirements covering e.g. a ban on the use of synthetic fertilisers, plant protection products, GMOs, most of

[4] See http://www.minrol.gov.pl/Jakosc-zywnosci/Rolnictwo-ekologiczne.

[5] "It is estimated that the organic food market in Poland in 2015 achieved the value of PLN 800 million, and in 2017 it has the opportunity to exceed PLN 1 billion. The organic UAA in Poland is approx. 580 thousand ha. The number of registered organic farms in 2016 was 24 276 (…). Demand for organic food grows at a rate of approx. 20 per cent annually." Retrieved from: www.agronews.com.pl/pl/0,58,21378,zbliza_sie_worldfood_warsaw_sektor_eco_ma_byc_hitem.html (access date: 18.01.2017).

the food additives as well as controversial methods of food preservation, such as radiation (Tyburski and Żakowska-Biemans, 2007; Tyburski (ed.), 2013).

Another researched group were **non-specialised farms with mixed plant and animal production (bidirectional)**[6]. In the light of environmental requirements, farms which run both production directions are the most desired group. For multidirectional farms, keeping environmental balance is, undoubtedly, much easier (Zegar, 2012). These farms potentially are in better circumstances for environmental sustainability than others (Toczyński, Wrzaszcz and Zegar, 2013). Multidirectional farms, because of internal "integrating forces"[7] drive at keeping balance in the production, economic and also environmental area (Ziętara, 2014).

The linkage between plant and animal production on mixed farms is much stronger than on other types of farms (Wrzaszcz, 2012). Two elements play here a major part, namely: adjustment of the field crop structure to the nutritional requirements of animals as well as the use of produced fertilisers in the fertilisation of cultivated plants. These connections reduce the dependence of farms on external entities both as regards purchase of feed and chemical fertilisers. Multidirectional agricultural production enables efficient circulation of nutrients in the system: fertilisers – soil – plant. The use of natural fertilisers and rather low inputs of industrial means are reflected also in the quality of manufactured agricultural products on these farms. Lower stocking density on non-specialised farms against those specialising in animal production, also means reduced risk of local water and soil pollution as a result of using (and storing) natural fertilisers (Kopiński, 2010). Empirical research also confirms more favourable results of fertiliser balance in case of mixed farms (Kopiński, 2006).

Rich structure of crops and use of natural fertilisers are also determinants of keeping the production potential of soil on mixed farms. Keeping the production

[6] This group is formed of farms from the farming type 8 (according to GTF classification). The FADN system, according to the GTF classification, differentiates the following types of farms (the so-called general): specialised in field crops (type 1), specialised in horticultural crops (type 2), specialised in permanent crops (type 3), specialised in breeding grazing livestock – herbivores (type 4), specialised in breeding livestock fed with concentrates – granivores (type 5), mixed crops (type 6), mixed animals (type 7), mixed crops and animals (type 8) (Goraj and Mańko, 2009). This classification relies on the structure of plant and animal production on farms.

[7] The issue of "forces" having impact on a farm was noted by Brinkmann. He separated "differentiating forces" and "integrating forces". The former are found in the farm surrounding and follow from the market mechanism, while the latter are within a farm. The differentiating forces prompt farms to reduce the range of production, extend the scale of production of specific agricultural products, thus they induce specialisation of farms. The integrating forces prod to multidirectional agricultural production to fully and equally use factors of production: land, labour and capital (Ziętara, 2014).

potential of soil is one of the prerequisites of sustainable agriculture (Krasowicz, 2005; Kuś, Krasowicz and Kopiński, 2008). Preventing soil degradation and ultimately increasing its fertility (in other words ensuring sustainable biomass production capacity) is the fundament of environmental practices (van Loon, Patil and Hugar, 2005). Mixed farms keeping cattle stand out in this respect, as they are characterised by cultivation of structure-forming plants, mainly intended for feed. Higher level of crop diversity will have a beneficial impact on the ecosystem (Niezgoda, 2005).

Multidirectional farms fulfil different functions – production, environmental and social. They generate both market and non-market goods. In this respect, non-specialised farms have an advantage over specialised farms (Zegar, 2012). Non-market goods, although they do not have a price (and farmer is not remunerated for them), are valuable for the society and the environment. Multidirectional production is conductive to biodiversity preservation, soil, water and air protection (the result of proper circulation of matter and macroelements) or formation and protection of the agricultural landscape (Zimny, 2014). Another manifestation of multifunctionality of multidirectional farms is parallel starting of non-agricultural activity, based on farm assets (Czarnota, 2013).

The third group encompassed **specialist animal farms**. These farms were considered as a contrasting example to multidirectional (non-specialised) and organic farms in terms of their environmental impact[8]. Specialised animal farms, given the restrictions in plant production and inclination towards animal production, may generate higher environmental external costs. Production specialisation is the effect of "differentiating" forces in the environment of farms, mainly in the market mechanism (Ziętara, 2014). Higher farm specialisation is most often linked to a growth in the production intensity level which, as a result, may lead to a harmful burden on the environment (Ziętara, 2014, as in: Zegar, 2012; Harasim, Krasowicz and Madej, 2014)[9].

[8] Separation of one group of farms specialising in animal production should be considered as a simplification, because depending on the agricultural activity (breeding and rearing of cattle, poultry, pigs) the environmental pressure of a specific agricultural activity may greatly differ. This group was separated because of the major impact of the specialist animal production on the volume of gas emissions, high risk of pollution of the components of the natural environment as a result of storing and using significant amounts of natural fertilisers on these farms as well as weaker links between plant and animal production.

[9] The correlations between the level of specialisation and intensity of agricultural production and impact on the natural environment are complex (multidirectional). Depending on the local economic conditions, current organisation of agricultural production and current level of production specialisation and intensity, the further process of specialisation and intensification may have varied effects on the environment (Wrzaszcz, 2016).

In case of specialised animal farms, fertilisation management is of special importance (Romaniuk et al., 2009). It covers the issues of production, storage and consumption of manufactured natural fertilisers. Undoubtedly, natural fertilisers are a very valuable source of nutrients for plants, but also a crucial factor making up soil fertility. Animal production is even necessary to correctly balance macroelements and humus in the soil. However, the quantity of fertilisers manufactured on specialised farms requires a relevant adjustment of infrastructure intended for its storage and also planning its management on- and off-farm. Imprecise definition of nutritional needs of plants may result in creation of surpluses of macroelements in soils and water pollution. Additionally, surplus nitrogen escapes into the atmosphere (Harasim, 2013; Kopiński, 2007).

The issue of environmental pollution with natural fertilisers may, in particular, concern farms with high stocking density to utilised agricultural area (Majewski, 2002). The stocking density ratio shows the scale of burden for the natural environment which results from the possibility to exceed absorption of animal faeces by the agrosystem (Kuś, 2006; Faber et al., 2010). Higher intensity of stocking density is typical for specialised animal farms (Kopiński, 2013).

Specialised animal farms more often note the phenomenon of "loosening" links between plant and animal production as compared to non-specialised farms. This follows from the animal feeding system (ensuring greater productivity of animals) largely based on feed from purchase, which is a characteristic feature of farms specialised in breeding granivores[10]. Such relations between plant and animal production on specialised farms often result in simplification of the structure of sowing or even resignation from plant production. There also emerges a problem of management of natural fertilisers. In case of high concentration of animal population, which takes place at poultry farms, what is also questioned is the quality of offered animal products due to the need to use steroids and antibiotics (Toczyński, Wrzaszcz and Zegar, 2013).

The aforementioned organisational characteristics of farms specialised in animal production translate into the problem of balancing nutrients and also the condition of soil. Research shows that balance surplus of nitrogen and phosphorus more often happens on specialised animal farms (cattle and pig) (Kopiński, 2006; Kopiński, 2013; Kuś, 2006; Harasim et al., 2014).

[10] In case of farms specialising in breeding ruminants of moderate stocking density, the issue of simplified structure of crops is rare and the cultivated field crops are matched to the conducted direction of production (Wrzaszcz, 2012).

Gas emissions are another problem linked to animal production. Animal breeding accounts for 18% of global emissions of greenhouse gasses[11] from human activity. Methane and nitrogen monoxide are two gasses produced in the greatest quantity. Animal production accounts for 37% of total methane emissions, 65% of nitrogen monoxide emissions and 9% of carbon dioxide emissions[12]. It is also the source of 64% of ammonia emissions[13] (Kwasek and Obiedzińska, 2013; as in: Compassion in World Farming, 2009). Additionally, there is the problem of odours. Odour emissions around the emission source are a serious problem most often of local character (CDR, 2006). The air in the livestock building is filled also with: hydrogen sulphide, acetone and volatile fatty acids, phenols, indoles and methylamines. As much as 164 gas substances were identified that are generated during the breeding process (Herbut et al., 2010). Most of these gasses have a negative impact on the ecosystem, while because due to the odour – they are also cumbersome to the local communities (Jugowar, Rzeźnik and Mielcarek, 2015).

The selected farms were researched against the background of all panel farms. The focus was on their production potential, results and the level of subsidies which they obtained under the CAP mechanisms. To determine the scale and scope of changes taking place on such farms, the comparison covers their results for 2004 and 2013. The adopted comparison system enabled definition of differentiation of selected groups of farms at the background of all the researched farms both in statistical and dynamic terms. The analysis uses nominal values.

[11] GHG in CO_2 equivalent.

[12] "Methane emitted from agriculture is a gas generated in the digestive tract of ruminants (intestinal fermentation) and in the conditions of anaerobic decomposition of faeces. Emission from agricultural sources account for 28% of the total national methane emission. Methane, following carbon dioxide, has the largest share in magnifying the greenhouse effect (approx. 16%). Average lifespan of methane in the atmosphere is 12 years. Methane penetrating into the stratosphere indirectly participates in catalytic ozone depletion, thus contributing to the creation of the so-called ozone hole." (Jugowar, Rzeźnik and Mielcarek, 2015).
"Emission of nitrogen monoxide from agricultural production has its main source in the soil fertilised with mineral and organic fertilisers. It also accompanies the emission of ammonia in livestock buildings. As much as 85% of nitrogen monoxide emission in Poland comes from agricultural production. Nitrogen monoxide is a greenhouse gas that has a very high global warming potential of its molecules and very long lifespan in the atmosphere, which largely contributes to increasing the greenhouse effect. Growth in the nitrogen monoxide concentration in the stratosphere may indirectly strengthen the process of ozone layer degradation." (Jugowar, Rzeźnik and Mielcarek, 2015).

[13] "Ammonia is formed by bacterial and enzymatic processes in the faeces of animals. It is the product of decomposition of urea, which is found in urine, catalysed by urease from faeces. In Poland, emission of ammonia (…) from agriculture is 98%, out of which 66% from animal production, 34% from the consumption of nitrogen fertilisers. Ammonia is not a greenhouse gas, but it takes part in acidification of rain. Settling on the Earth's surface it oxidises into nitric acid and contributes to acidification of soil." (Jugowar, Rzeźnik and Mielcarek, 2015). Ammonia is an important factor of eutrophication of ecosystems (Bieńkowski, 2010; Sapek, 2013).

The research considered both the average results of farms (average per farm) and unit results, indicating the level of productivity and profitability of selected factors of production – land and labour – in the researched farm groups, which are the basic indicators of economic efficiency of farms (Zegar, 1986). These ratios considered selected categories of production and economic account, i.e. production value per farms, gross added value and farm income[14].

Production potential and results of farms

In the analysed period, the number of organic, bidirectional and animal farms changed significantly (Fig. 1). Over nine years, the number of organic farms grew by 122% and of animal farms by 28%, while the population of bidirectional farms noted a drop by 21%. Changes in the population of these farm groups give evidence of dynamic growth in the population of organic farms, which should be emphasised and appreciated in the context of the need to implement agri-environmental practices, but they still constitute a minor part of the population of farms (respectively, in 2004 and 2013 it was 1.3% and 2.9%; taking as 100% the number of the panel FADN farms). Taking into account the number of bidirectional farms, it can be assumed that they have a greater impact on the natural environment. It should be emphasised that this group of farms decreased over the last years (their share was 34% in 2004, and 27% in 2013). At the same time, the number of farms specialised in animal production increased (in this case their share grew from 26% to 34%).

Changes in the population of researched groups point to progressing specialisation of farms towards animal production. This process is linked to growing dependence of agricultural production on the feed industry, increasing risk of pollution of respective components of the natural environment and higher consumption of natural resources by the agricultural sector. Progressing specialisation of farms undoubtedly fosters better economic results, but it is also linked to generation of higher external environmental costs (Ziętara, 2014, as in: Zegar, 2012; Harasim, Krasowicz and Madej, 2014). Because of a minor share of

[14] The production value of farms – is the basic production and economic category pointing to the farming result. It is the result of a sum of plant, animal and other production value.
The gross value added (GVA) of a farm – is a production and economic category determined on the basis of a difference between the value of farm production and indirect consumption, corrected with the result of balance of current subsidies and taxes (covering subsidies and VAT balance to operating activities, and also other taxes, e.g. agricultural, forestry, property). This value indirectly enables to verify the impact of farming efficiency – manifested both in the level of costs incurred on agricultural activity and activity of farm manager in the field of winning external sources of financing – on the value of farm production. Therefore, it is an adequate parameter to compare farms of different ownership structure (Bocian and Malanowska, 2014).
Family farm income – is the key economic goal of farmer operations and it is an important determinant of the level of life of a farming family, thus, it may be a vital indicator of farm efficiency in agriculture (Wrzaszcz and Zegar, 2014).

organic farms and also decreasing fraction of bidirectional farms, animal farms have increasingly stronger impact on the condition of the natural environment.

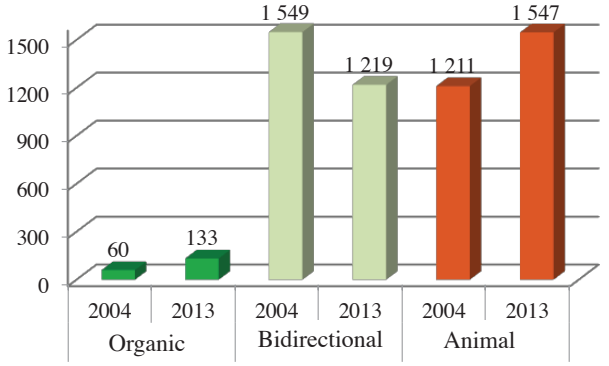

Fig. 1. The number of organic, bidirectional and animal farms in the panel of FADN farms in 2004 and 2013.

Source: own calculations based on FADN data.

To capture the production and economic changes taking place on farms, further analysis was carried out on a fixed panel of organic, bidirectional and animal farms for the adopted research period. Such an approach enabled to eliminate the impact of "new" farms, which were entered into the FADN group in respective years. Table 1 presents a synthetic characteristic of these groups. In the researched period, the characteristics of the **average FADN farm** changed significantly. It should be noted that despite a major growth in the average farm area and population of farm animals, labour inputs changed to a minor degree. The average area increased by 19%, animal population[15] by 9%, and labour inputs were comparable[16]. The value of assets (total assets) increased by 165%[17], and this change refers mainly to fixed assets (machinery, buildings and structures, land), whose share in the balance of assets grew form 82% to 89%. Multiplication of farm assets was a result of both production changes and support in the form of a wide range of subsidies offered under the instruments of the Common Agricultural Policy[18]. Averaged data for all farms may be a point of reference for the assessment of the production and economic situation of the panel group of farms.

[15] Animal population was expressed in Livestock Units (LU), where 1 LU is an animal weighting 500 kg.

[16] Labour inputs were expressed in Annual Work Units (AWU), where 1 AWU is an equivalent of a full-time employment of own and hired labour force, i.e. 2120 hours of work per year. Labour inputs may be also expressed in Family Work Units (FWU) which is an equivalent of full-time employment only of family members.

[17] All value categories were captured in current prices.

[18] This topic is elaborated upon in the further part of the paper.

Increase in the production potential resulted in better results of farms. Comparing the results of an average farm in 2013 with those for 2004, it can be stated that they were much higher (basing on current values). For production categories of farms, this difference amounted to 77%, gross and net value added doubled, while income grew to even greater extent (by 114%). A derivative of changes in the production potential of these farms and their results was a growth in investment activity (gross investments changed *in plus* by 161%).

Table 1

Population and selected characteristics of researched farms in 2004 and 2013 (average value per farm; fixed panel of farms in groups)

No.	Specification	Total		Organic		Bidirectional		Animal	
		2004	2013	2004	2013	2004	2013	2004	2013
1	Population	4579	4579	42	42	844	844	1006	1006
2	UAA (ha)	30.38	36.02	19.88	22.54	27.86	32.42	27.00	33.02
3	Working people (AWU)	2.04	2.08	1.97	1.99	1.86	1.88	2.01	2.16
4	Animals (LU)	27.72	30.20	9.44	10.94	22.66	24.09	52.16	64.96
5	Total assets (PLN million)	0.48	1.28	0.30	0.60	0.41	1.07	0.56	1.41
6	Standard gross margin (PLN thousand)	104.99	119.19	46.31	43.08	91.96	97.63	125.89	159.81
7	Standard output (EUR thousand)	44.44	49.38	21.71	21.72	36.59	39.01	57.82	70.39
8	Production per farm (PLN thousand)	159.83	282.73	56.41	81.15	128.55	211.22	210.38	420.29
9	Gross value added (PLN thousand)	73.52	143.75	38.15	81.16	59.09	106.22	90.70	180.21
10	Net value added (PLN thousand)	54.07	109.03	25.09	60.28	42.45	79.46	71.04	139.33
11	Income per farm (PLN thousand)	46.16	98.84	18.57	53.90	38.27	73.25	63.30	130.68
12	Gross value of investments (PLN thousand)	21.03	54.83	12.13	18.52	13.20	38.66	25.50	57.76
13	Net value of investments (PLN thousand)	1.58	20.11	-0.93	-2.36	-3.44	11.90	5.84	16.88

Source: own calculations based on FADN data.

Among **organic farms**, covered by the farm accountancy system in 2004, most farms was still run in line with these rules in 2013 (precisely 70%). Comparing both the production potential and results of organic farms to all researched farms accordingly in 2004 and 2013, there is a clear advantage of the latter. Organic farms are distinctly smaller and their production and economic results as well as investment activity stand out *in minus* from the averages. For example, in 2013 organic farms were characterised by smaller UAA, smaller cattle population and lower value of assets (the differences amounted, respectively, to 37%, 64%, 53%), and a much lower production value, gross and net value added, lower level of income and lower value

of investments (in this case the differences were at the level of 71%, 44% and 45%, 45%, 66%) against the results of an average researched farm.

In the researched period, most of the constituents of the production potential of organic farms changed to a lesser degree compared to average farms. Organic farms increased their UAA by 13%, they doubled their assets and labour inputs remained at a stable level. It should be emphasised that organic farms increased their livestock population density by 16%, i.e. much above the level noted for average farms. Organic farms, by their nature, should be based on balance of plant and animal production, thus proportional increase in the animal population in proportion to the changes in UAA will enable fertilisation of soils with natural fertilisers, improvement in the soil conditions and it will have a beneficial impact on the production possibilities of field crops in subsequent years.

Increase in the production value of organic farms was much lower compared to average farms, while organic farms dominated as regards dynamics of changes in the economic results. In case of production value (comparing 2013 to 2004), organic farms noted a growth at the level of 44%, while the value added was multiplied (gross category increased by 113% and the net category by 140%). Although the income on organic farms tripled, its level is still rather low and much deviates from the results of other groups of farms. A factor much affecting a change in the economic results were external transfers in the form of various types of subsidies targeted at farms. Despite a much multiplied economic result, the gross value of investments increased by 53%.

It might be, thus, concluded that despite a much worse economic condition of organic farms, most of them still continue this farming system. A question still open for deliberations is: why is that so? Was this caused by economic reasons (subsidies), environmental reasons (a will to protect the environment) or maybe social reasons (greater possibilities to involve family labour forces and conduct additional types of non-agricultural activity based on the assets of a farm)? It seems justified to continue the support for these farms both in the form of subsides and in a non-monetary form. The support to organic farms is justified by the relatively low level of production intensity and specialisation (determining their worse competitive position) and generation of benefits for the environment and the society (Wrzaszcz, 2012; Tyburski and Żakowska-Biemans, 2007; Kwiatkowski, Harasim and Maziarz, 2013).

Another group covered by research were **non-specialised farms conducting mixed production**. Taking into account the population of these farms at the initial and final stage of research, it may be concluded that over half of them consistently continued the mixed agricultural production. The remaining part of units started the process of production specialisation[19]. The values presented in Table 1 for average farms and bidirectional farms indicate that the latter are

[19] These issues were presented in a publication by Wrzaszcz and Zegar (2016).

characterised by lower production potential and worse results. These difference were not as significant as the gap between organic and average farms. However, bidirectional farms were characterised by much smaller animal population, and lower value of assets (respectively, by 20% and 16%), while their production and economic results, depending on the category, differed by 25-27% (in 2013). The value of implemented investments at these farms was below the average (a difference of 29%).

A change in the production potential of bidirectional farms was comparable to the average. Bidirectional farms increased their UAA (by 16%), at the same time, slightly enlarging their animal population (by 6%), while to the greatest degree they multiplied their assets (by 163%). As regards improvement in the production and economic results, the bidirectional farms did not match the average farms. Over the years covered by the analysis, the production value rose by 64%, gross and net value added changed by 80% and 87%, while income almost doubled. The greatest dynamics of change concerned gross investments which nearly tripled compared to the initial period.

The last among the specified groups were **farms specialised in animal production**. The number of panel animal farms amounted to 83% of all farms in this specialisation in the first year of the research, i.e. in 2004. Animal farms were characterised by similar production potential (measured with UAA, labour inputs and also value of assets) to average farms (Table 1). Considering their production specificity, these farms had high population density of animals (over twice higher than the average in 2013). The results of specialist farms were much higher than the values corresponding to average farms (in 2013 these differences ranged from 25% to 49% depending on the production and economic category).

Changes in the production potential of farms specialising in animal production were comparable to those which took place at average farms, overlooking the animal population. In case of animal farms, this population increased by as much as one-fourth in the researched period. These figures confirmed the progressing process of production specialisation on animal farms, and a major production growth was its derivative. In the researched period, the production value of these farms almost doubled, much exceeding the growth scale of average farms. The economic results of these farms also doubled and the growth rate of changes corresponded to average farms. These results indirectly point to the significance of payments in the economic account of the producer which is much lower in case of specialised farms. The dynamics of these changes as regards gross investments on animal farms was also lower than that of average researched farms. There appears a question about the reasons for this investment activity of specialised farms. Animal farms are entities characterised by high value of assets, obligated to observe numerous environmental and animal welfare standards which also require investments.

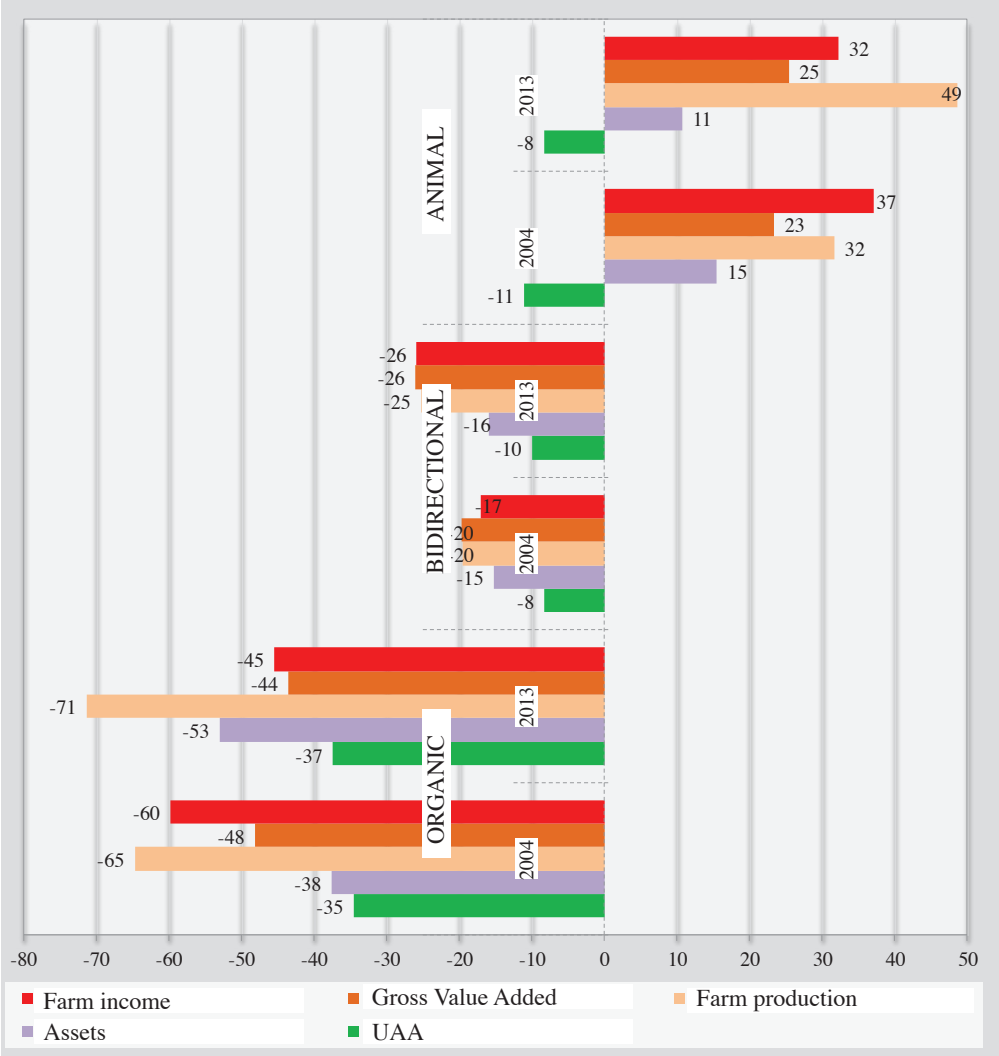

Fig. 2. A relative difference (%) between the researched groups of farms and the average results in 2004 and 2013.

Note: sign "-" before the number indicates that a given group obtained a result lower by "x%" than the average.

Source: own calculations based on FADN data.

The differences between the analysed three groups of farms at the background of the total panel in the field of the production potential, level of results and also scale of their changes allowed for assessment of their differentiation both in static and dynamic terms. Figure 2 presents a relative difference between organic, bidirectional and animal farms, and average farms (i.e. the average for the researched panel of farms covered by farm accountancy). The illustration points to a great advantage of the **animal farms** over the average as regards the assets and production and economic results. In the analysed period the animal farms increased their advantage in assets and production, while they slightly decreased their income advantage.

Contrary to the animal farms, bidirectional and organic farms were characterised by both lower production potential and economic results against the average. However, the major differences concerned **organic farms**. In this case, both as regards the production potential and the analysed result categories, organic farms were divided by a gap of several dozen per cent to an average researched farm. The highest differences concerned the value of production and income. In the considered period, the gaps in the production potential and agricultural production values strengthened, while for economic results they were partially offset. Closing the economic gap was, undoubtedly, the result of payments which went to the organic producers. Over several years, the differences in the value of assets considerably increased to the determinant of organic farms. The economic situation of organic farms prevents multiplication of assets at a proportional rate to average farms. The level of economic results restricted the scope of economic investments. Based on the presented results, it is difficult to assess the actual investment needs of these farms.

Taking into account the differences that separated the animal and organic farms from average farms, **bidirectional farms** were characterised by much smaller gap as regards production potential, although it was also significant. Bidirectional farms achieved much lower results against the average farm. As far as for production potential these differences were at the level of few/several per cent, for result categories they reached over 25%. In the 2004-2013 period, the differences between bidirectional and average farms deepened both as regards the elements of the production potential (UAA and assets) and production and economic results.

Productivity and profitability of factors of production

Land productivity measured by the relationship of production value to the UAA for an average researched farm was at the level of PLN 5.3 thousand per ha in 2004 and in 2013 its level amounted to PLN 7.8 thousand per ha. The difference in nominal values was almost 50% (Table 2). Assessing on this background, the land productivity in respective groups of farms, it should be stated that organic farms as well as bidirectional farms much differ *in minus*, and

changes in land productivity in the analysed period failed to match the average. The presented figures point to deepening distance in this scope between organic and bidirectional farms and all farms. The situation of organic farms was especially unfavourable.

Specialised animal farms differed by the highest land productivity result and also dynamics of the change. These farms increased their advantage over the average farms, the more over organic and bidirectional farms. But it needs to be underlined that the link between plant and animal production on specialised animal farms is weaker than that on mixed production farms.

On average, in the researched population the gross value per area unit increased by 65% in 2004-2013. Organic farms were characterised by more favourable changes which was largely the effect of obtained payments. These changes contributed to a decrease in the distance between organic and average farms (the difference was 10% in 2013). The unspecialised farms failed to match the average farms in this scope and the gap that divided them broadened. But specialised animal farms improved their results at a proportional rate to all farms, keeping a 40% advantage.

Table 2

Productivity and profitability of land in researched groups of farms in 2004 and 2013

No.	Specification	Total		Organic		Bidirectional		Animal	
		2004	2013	2004	2013	2004	2013	2004	2013
1	**Production (PLN thousand/ha)**	**5.26**	**7.85**	**2.84**	**3.60**	**4.61**	**6.52**	**7.79**	**12.73**
2	Production (change, %)	x	49.20	x	26.85	x	41.21	x	63.31
3	Production (a relative difference against farms in total, %)	100	100	-46.07	-54.15	-12.30	-16.99	48.11	62.13
4	**GVA (PLN thousand/ha)**	**2.42**	**3.99**	**1.92**	**3.60**	**2.12**	**3.28**	**3.36**	**5.46**
5	GVA (change, %)	x	64.90	x	87.58	x	54.48	x	62.42
6	GVA (a relative difference against farms in total, %)	100	100	-20.71	-9.80	-12.37	-17.90	38.81	36.72
7	**Income (PLN thousand/ha)**	**1.52**	**2.74**	**0.93**	**2.39**	**1.37**	**2.26**	**2.34**	**3.96**
8	Income (change, %)	x	80.57	x	155.97	x	64.49	x	68.76
9	Income (a relative difference against farms in total, %)	100	100	-38.53	-12.87	-9.60	-17.65	54.29	44.19

Source: own calculations based on FADN data.

Table 3

Productivity and profitability of labour in researched groups of farms in 2004 and 2013

No.	Specification	Total		Organic		Bidirectional		Animal	
		2004	2013	2004	2013	2004	2013	2004	2013
1	**Production (PLN thousand/AWU)**	**78.52**	**136.01**	**28.69**	**40.87**	**69.26**	**112.12**	**104.61**	**194.46**
2	Production (change, %)	x	73.22	x	42.48	x	61.88	x	85.88
3	Production (a relative difference against farms in total, %).	100	100	-63.47	-69.95	-11.79	-17.56	33.24	42.98
4	**GVA (PLN thousand/AWU)**	**36.12**	**69.15**	**19.40**	**40.87**	**31.84**	**56.38**	**45.10**	**83.38**
5	GVA (change, %)	x	91.45	x	110.70	x	77.10	x	84.86
6	GVA (a relative difference against farms in total, %)	100	100	-46.29	-40.89	-11.86	-18.46	24.87	20.58
7	**Income (PLN thousand/FWU)**	**26.52**	**56.47**	**11.03**	**31.65**	**21.92**	**41.66**	**34.59**	**68.63**
8	Income (change, %)	x	112.92	x	187.05	x	90.10	x	98.39
9	Income (a relative difference against farms in total, %).	100	100	-58.42	-43.95	-17.36	-26.21	30.44	21.54

Source: own calculations based on FADN data.

The value of **land productivity** ratio even more highlighted the differences between the considered groups of farms. Organic farms improved the result by two and a half times, significantly exceeding the rate of changes on average farms. Because of such dynamics, their land productivity differed *in minus* by only several per cent from the average value in 2013. The results of bidirectional farms changed at a much lower rate against the average which resulted in growing gaps between them. Specialist animal farms, despite moderate changes in land productivity, generated the best results, much exceeding the values for all of the researched farms.

Labour productivity on an average farm increased by 73%, from PLN 79 thousand per AWU to PLN 136 thousand per AWU in 2004-2013 (Table 3). Similarly as in the case of land productivity, organic and bidirectional farms did not match the average farms, while specialised animal farms were characterised by the highest labour productivity. The most profitable changes occurred on specialised farms and the case for organic farms was quite the opposite. The differences between organic and bidirectional, and average farms deepened, while specialised units strengthened their advantage.

Organic farms were marked by the highest increase in the gross value added ratio as regards the labour inputs (as it happened in relation of the value to land

inputs), which resulted in narrowing down the gap between organic farms and all farms. In case of bidirectional farms this gap broadened. Whereas the advantage of farms, decreased in the last years. The above-described relations between the researched groups of farms were highlighted for **labour productivity**. Despite a relatively unfavourable economic situation of organic farms the gap between them and all farms narrowed down. The scale of these changes was basically dictated by the size of external support, mainly linked to the conducted economic activity.

Payments

Payments are a significant determinant of farm organisation, which further translates into the scale of its impact on the natural environment and economic results. Conditional subsidisation of agriculture is linked to observance of specific environmental agricultural practices as well as adjustment of specific organisational guidelines of agricultural production. Depending on the type of support, potential beneficiaries have to meet different scopes of obligatory criteria[20].

In 2004, **an average farm** received payments amounting to PLN 5.6 thousand (Table 4). All these payments concerned operating activities (at this time, measures supporting investment activity were at a preparation phase). This value was created mostly by direct payments (nearly 3/4), while the other part fell to transfers linked to implementation of measures under the Rural Development Plan for 2004-2006. In 2004, some part of agri-environmental programme packages were introduced to organic farms as well as support to location of farms in less-favoured areas (LFA). Agri-environmental programmes may be considered as basic RDP measures promoting sustainable agricultural production practices, while support on account of location on LFA is to sustain agricultural activity on these areas, ensuring protection of soil and biodiversity, preservation of agricultural landscape and viability of rural areas.

In 2004, the ratio of payments to production was only 3.5% which points to low revenue of farms on that account, compared to proceeds obtained from generated production (Fig. 3). The value of subsidies and taxes balance to farm income was approx. 8%, i.e. the stream was an insignificant factor deciding on the level of their economic results.

Over the last years the support to farms in the form of various types of payments changed considerably – both in value and generic terms. A broad range of government programmes prompted agricultural producers to take up economic

[20] See detailed description of producer support instruments complete with obligatory environmental and organisational requirements on: www.minrol.gov.pl/Wsparcie-rolnictwa.

initiatives, including investment initiatives, all at once observing the environmental obligations. An average farm received PLN 47 thousand in 2013, i.e. it was a value nearly 8.5 times higher than the one in 2004 (Table 4). A major part of these transfers were direct payments, while support to rural development covered various measures which constituted 35% of the total value of payments. It may be considered that farmers showed interest in taking up measures having a beneficial effect on the natural environment which was evidenced by high share of payments transferred to farmers on account of implementation of agri--environmental projects – 24%, while 18% of funds was used by the agricultural producers in relation to location of farms in LFA (assuming that 100% is the total of RDP transfers).

Table 4

Payments in researched groups of farms in 2004 and 2013 (PLN thousand/farm)

No.	Specification	Total		Organic		Bidirectional		Animal	
		2004	2013	2004	2013	2004	2013	2004	2013
1	Total payments	5.63	47.41	5.26	43.36	5.69	42.94	4.58	43.05
2	- including: payments to operating activities	5.63	42.78	5.26	41.48	5.69	39.78	4.58	36.16
3	- including: payments to investment activities	0.00	4.63	0.00	1.89	0.00	3.15	0.00	6.90
4	Direct payments	4.09	30.95	1.95	21.64	4.70	27.90	2.27	27.51
5	Payments under RDP	1.54	16.46	3.31	21.72	0.99	15.04	2.31	15.54
6	- including: agri-environmental	0.02	4.02	2.01	14.16	0.01	3.98	0.01	2.35
7	- including: organic	0.02	0.47	1.58	11.48	0.00	0.27	0.01	0.34
8	- including: concerning LFA	0.19	3.03	0.18	3.87	0.17	2.45	0.28	4.09

Source: own calculations based on FADN data.

The value of the ratio of payments to production and economic results highlights their increasingly more prominent role in formation of the economic situation of farms (Fig. 3). In 2013, the balance of payments and total taxes to farm income was 36%, meaning that over one-third of income of farmers was external support. It is difficult to clearly interpret these results. On the one hand, the prepared government programmes were tasked with providing support to farms simultaneously taking up agri-environmental practices, on the other, growing dependence of the economic condition of farms on payments gives raise to some concerns about their further economic existence in case of a change in the principles of support to agriculture from the EU budget. There remains the question about a safe level of payments to production value of

farms, and also the scope and manner of considering the generated external effects in this subsidisation.

Both in 2004 and 2013 the average value of subsidies that were obtained by **an organic farm** was comparable to transfers, which went to an average farm (Table 4). Most of the payments was dependant on the UAA. The average farms received PLN 185 per ha and PLN 1316 per ha at two extreme time points of the research, while organic farms received more by 43% and 46%, accordingly (PLN 265 per ha and PLN 1923 per ha).

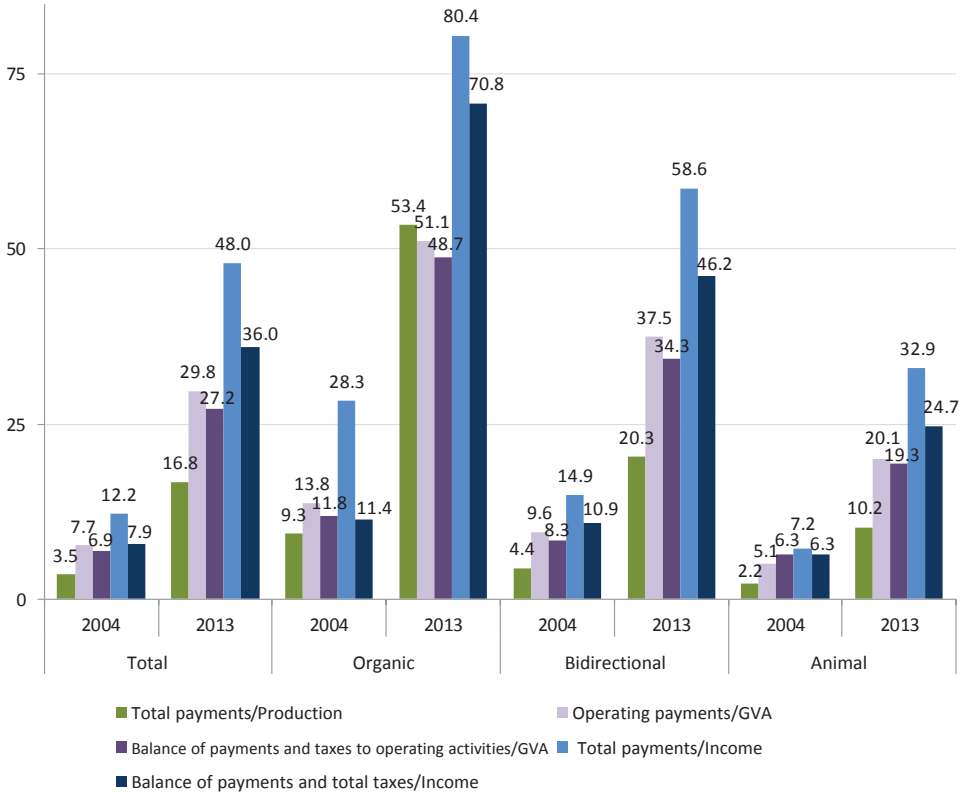

Fig. 3. The ratios of payments to selected result categories for the researched groups of farms in 2004 and 2013.

Source: own calculations based on FADN data.

The generic structure of payments much differentiated organic farms from average farms (Table 4). The former were characterised by much lower investment support. This was the effect of limited investment activity. In 2013, the value of direct support and support involved in implementation of RDP measures that were received by organic farms was comparable, which differed them from average farms. These farms were covered by the agri-environmental programme, including payments dedicated to certified units and at the stage of reorganisation into the organic farming system. The amount of secured payments on this account was as much as 65% of total RDP transfers.

The ratios of payments to economic results of organic farms point to a much more significant role of external transfers in the shaping of the economic situation as regards all farms. The changes in the values of these ratios in 2004-2013 were especially clear for organic farms. In 2013, over two-third of their income was a derivative of the received subsidies. This is a result of both larger stream of support and low production results of organic farms.

As regards the scale of support, the case for **bidirectional farms** was not far from the average. This is evidenced by both the average values per farm and values referred to UAA. The generic structure of obtained payments was also similar in case of bidirectional farms and all farms. Taking into account the specificity of production on non-specialised farms, it can be assumed that they will participate in the agri-environmental measures to a greater extent, but the research results did not confirm that. The ratios of payments to results of bidirectional farms in 2004 and 2013 much exceeded those for all researched farms. Such values of the ratio were the effect of production value on bidirectional farms.

The total value of payments that was obtained by **an average specialised animal farm** was equal to the average (both in terms of average values per farm and with reference to UAA). The relations concerned also direct support and support considered in the RDP measures. Specialised animal farms, which participated in these measures were also obligated to meet them. Doubts may be raised by the scope of environmental principles, difficulties in their observance and efficiency in the conditions of access to the subsidised measures. Among the considered groups of farms, farms specialised in animal production obtained also the largest stream of support to investment activity. More beneficial economic situation of specialised farms created greater investment opportunities.

Entities specialised in animal production participated to a much lesser extent in the environmental measures as regards the average (in 2013 – 15% of the value of RDP payments originated from this category, while on an average farm this was 24%). Execution of the agri-environmental programme compared to other RDP measures is linked to the strictest agri-environmental obligations. Because of a relatively high profitability of specialist animal production, re-

organisation of these farms via agri-environmental payments is not a lucrative economic alternative.

Specialised animal farms were simultaneously characterised by higher absorption of funds linked to their location on LFA as regards average farms (in 2013 – 26% of total RDP payments concerned support to farming in LFA, while on average this value was 18%). These results indirectly point to regionalisation of specialist animal production – their more common incidence on areas characterised by limits in the field of plant production.

Basing on the values of ratios considering relations of payments to selected result categories, leads to a conclusion that the economic condition of animal farms is to a lesser extent determined by external support than the condition of all farms as well as other analysed groups. Because of the fact that the stream of transfers, which goes to entities specialised in animal production, is comparable to the one targeted to average farms, the value of ratios was the effect of very high production value of the former.

Conclusions

The paper presents results of farms differing in terms of the scale of impact on the natural environment. The analysis was based on FADN data for the period between 2004 and 2013 for a fixed panel of farms. In this group the following were identified: organic farms, non-specialised plant and animal farms, and specialised animal farms. The results of the three groups of farms and changes in them in the considered period were assessed at the background of agricultural farms. The key conclusions from the research are presented below:

- Both production direction and organisation predetermine the scale of impact of a farm on the natural environment.
- The most in line with the concept of sustainable development are farms with multiple types of agricultural production – including also organic farms – providing external benefits and exercising a rather low environmental pressure.
- Specialised animal farms may be treated as an example of farms on the opposite end of the spectrum to the multidirectional farms, both as regards economic conditions and potential environmental pressure.
- The last years witnessed the most notable changes in the number of specialised animal farms, and multidirectional farms, which points to their specialisation.
- Given the growing number of animal farms, what also grows is their scale of impact on the natural environment. This justifies the need for identification of agricultural practices limiting their environmental pressure, including emission of greenhouse gasses and ammonia.

- Organic farms, despite a much worse production and economic situation, are a more and more popular form of agricultural activity, although they are still a minor part of the population of farms.
- Organic farms and bidirectional farms increase the gap in the field of productivity of factors of production as regards specialised animal farms which achieve the most beneficial results.
- What grows is the significance of payments in the shaping of economic results of farms, in particular organic farms, to which the agri-environmental programme is addressed.
- The economic situation of organic farms should be considered as much less favourable than that of bidirectional farms and specialised animal farms.
- Organic farms narrow down the gap in the field of profitability of factors of production as regards average farms which is the effect of absorption of financial means under government programmes. Despite the external support, the difference in profitability of factors of production between these farms is levelled to a small degree.
- Differences in profitability of factors of production between multidirectional farms and average farms deepens, while the stream of payments that goes to these farms is comparable.
- Omission or incomplete consideration of externalities in the account of the agricultural producer will contribute to growing differences in profitability of farms providing services for the communities and the environment and those exercising pressure on the environment. Setting methodological grounds in this field, is the basic challenge.
- Given the significance of multidirectional farms in the concept of sustainable development, it seems justified to assess the measures targeted at support to agri-environmental activities under the Rural Development Programmes both in terms of economic and environmental effects.
- Profitability of factors of production in specialised farms in animal production is rather high, which is mainly the effect of the value of agricultural production. The subsidies for these farms play a rather minor role, but in absolute terms they constitute a major source of revenues.
- The stream of support that goes to an average specialised, organic and bidirectional farm is comparable. The obtained results justify the statement that the adopted conditions of subsidisation of farms (including environmental requirements) do not differentiate the access into profile and level of specialisation of agricultural production.
- Poland's accession to the European Community created possibilities for participation in a broad range of agriculture support programmes. The idea behind the construction of rural development programmes is the drive at sustainability of farms and agriculture. The presented data rather point to differ-

ences between theory and practice. Despite implementation of programmes for sustainable development, the economic advantage of highly specialised farms over other farms strengthens. The presented results allow for a conclusion that the currently implemented rural development support instruments are insufficient as regards support to environmental agricultural activity.

References

Altieri, M.A. (1995). *Agroecology: principles and strategies for designing sustainable farming systems*. Berkeley: University of California.

Bieńkowski, J. (2010). Regionalne zróżnicowanie emisji amoniaku w polskim rolnictwie w latach 2005-2007. *Fragm. Agron. 27*(1).

Bocian, M., Malanowska, B. (2014). *Wyniki Standardowe 2012 uzyskane przez indywidualne gospodarstwa rolne uczestniczące w Polskim FADN. Część I. Wyniki Standardowe*. Warszawa: IERiGŻ-PIB.

Bołtromiuk, A. (1999). Popyt na produkty rolnictwa ekologicznego w Polsce na tle krajów Unii Europejskiej. *Zagadnienia Ekonomiki Rolnej*, No. 2-3(271-272).

Centrum Doradztwa Rolniczego w Brwinowie, Oddział w Radomiu (2006). *Ochrona środowiska w gospodarstwie rolnym*. Poradnik dla rolnika. Radom: CDR.

Compassion in World Farming (2009). *Globalne ostrzeżenie: zmiany klimatyczne a dobrostan zwierząt hodowlanych*. Raport stowarzyszenia Compassion in World Farming. Wilkowice: Klub Gaja.

Czarnota, P. (2013). Struktura działalności pozarolniczej w towarowych gospodarstwach rolnych w Polsce. *Roczniki Naukowe SERIA*, vol. XV, issue 3.

Czubak, W., Góral, J., Kulawik, J., Osuch, D., Płonka, R., Soliwoda, M., Wąs, A. (2016). *Subsydia a ekonomika, finanse i dochody gospodarstw rolniczych (2)*. Monografie Programu Wieloletniego 2015-2019, No. 37. Warszawa: IERiGŻ-PIB.

European Commission (2005). Perspective Analysis of Agricultural Systems. Technical Report EUR 21311. Brussels, Luxembourg: European Commission, Directorate General Joint Research Centre.

Faber, A., Pudełko, R., Filipiak, K., Borzęcka-Walker, M., Borek, R., Jadczyszyn, J., Kozyra, J., Mizak, K., Świtaj, Ł. (2010). Ocena stopnia zrównoważenia rolnictwa w Polsce w różnych skalach przestrzennych. In: A. Harasim (ed.), *Ocena zrównoważenia gospodarowania zasobami środowiska rolniczego w wybranych gospodarstwach, gminach, powiatach i województwach*. Studia i Raporty IUNG-PIB, No. 20. Puławy: IUNG-PIB.

Goraj, L., Mańko, S. (2009). *Rachunkowość i analiza ekonomiczna w indywidualnym gospodarstwie rolnym*. Warszawa: Difin.

Góral, J. (2016). *Oddziaływanie dotacji na efektywność techniczną gospodarstw wielkotowarowych*. Studia i Monografie, No. 166. Warszawa: IERiGŻ-PIB.

Harasim, A. (2006). *Przewodnik ekonomiczno-rolniczy w zarysie*. Puławy: IUNG-PIB.

Harasim, A. (2013). Ocena stopnia zrównoważenia gospodarstw rolnych (na przykładzie RZD IUNG). In: A. Harasim (ed.), *Wybrane aspekty zrównoważonego rozwoju i specjalizacji gospodarstw rolnych*. Studia i Raporty IUNG-PIB, No. 32(6). Puławy: IUNG-PIB.

Harasim, A., Kopiński, J., Madej, A., Matyka, M. (2014). Ocena stopnia zrównoważenia indywidualnych gospodarstw rolnych o różnych kierunkach produkcji. In: A. Harasim (ed.), *Wybrane problemy rolnictwa polskiego z uwzględnieniem stanu jego zrównoważenia*. Studia i Raporty IUNG-PIB, No. 40(14). Puławy: IUNG-PIB.

Harasim, A., Krasowicz, S., Madej, A. (2014). Ocena stopnia zrównoważenia uspołecznionych gospodarstw towarowych o różnych kierunkach produkcji. In: A. Harasim (red.), *Wybrane problemy rolnictwa polskiego z uwzględnieniem stanu jego zrównoważenia*. Studia i Raporty IUNG-PIB, No. 40(14). Puławy: IUNG-PIB.

Herbut, E., Walczak, J., Krawczyk, W., Szewczyk, A., Pająk, T. (2010). Badania emisji odorantów z utrzymania zwierząt gospodarskich. In: M. Szynkowska, J. Zawoździak (ed.), *Współczesna problematyka odorów*. Warszawa: WNT.

Jugowar, J.L., Rzeźnik, W., Mielcarek, P. (2015). *Emisje z sektora rolniczego – problem, którego nie unikniemy*. Ogólnopolska konferencja upowszechnieniowo-wdrożeniowa Instytut Technologiczno-Przyrodniczy dla nauki, praktyki i doradztwa. Warszawa: ITEP.

Kopiński, J. (2006). Porównanie grup gospodarstw rolnych o różnych kierunkach produkcji w aspekcie zrównoważonego rozwoju. *Zeszyty Naukowe Akademii Rolniczej Wrocław. Rolnictwo, No. 540*(87).

Kopiński, J. (2007). Bilans azotu brutto na powierzchni pola jako agrośrodowiskowy wskaźnik zmian intensywności produkcji rolnej w Polsce. In: A. Harasim, I. Marcinkowska (ed.), *Monitoring skutków środowiskowych planu rozwoju obszarów wiejskich*. Studia i Raporty IUNG-PIB, No. 4. Puławy: IUNG-PIB.

Kopiński, J. (2010). Bilans azotu w Polsce na tle zmian intensywności produkcji rolniczej. In: A. Harasim (ed.), *Ocena zrównoważenia gospodarowania zasobami środowiska rolniczego w wybranych gospodarstwach, gminach, powiatach i województwach*. Studia i Raporty IUNG-PIB, No. 20. Puławy: IUNG-PIB.

Kopiński, J. (2013). Ocena produkcyjno-ekonomiczna wybranych gospodarstw rolnych w województwie podlaskim. In: A. Harasim (ed.), *Wybrane aspekty zrównoważonego rozwoju i specjalizacji gospodarstw rolnych*. Studia i Raporty IUNG-PIB, No. 32(6). Puławy: IUNG-PIB.

Kośmicki, E. (1993). Tendencje rozwojowe rolnictwa na świecie i w Polsce. In: U. Sołtysiak (ed.), *Rolnictwo ekologiczne od teorii do praktyki*. Warszawa: Stowarzyszenie EKOLAND.

Krasowicz, S. (2005). Cechy rolnictwa zrównoważonego. In: J.St. Zegar (ed.), *Koncepcja badań nad rolnictwem społecznie zrównoważonym*. Monografie Programu Wieloletniego 2005-2009, No. 11. Warszawa: IERiGŻ-PIB.

Kuś, J. (2006). Możliwości zrównoważonego rozwoju specjalistycznych gospodarstw rolnych. *Problemy Inżynierii Rolniczej*, No. 2/2006.

Kuś, J. (2012). Produkcyjne i środowiskowe następstwa specjalizacji gospodarstw rolniczych. In: A. Harasim (ed.), *Problemy zrównoważonego gospodarowania w produkcji rolniczej*. Studia i Raporty IUNG-PIB, No. 29(3). Puławy: IUNG-PIB.

Kuś, J. (2014). Stan rolnictwa ekologicznego na świecie w Unii Europejskiej i Polsce. In: A. Harasim (ed.), *Wybrane problemy rolnictwa polskiego z uwzględnieniem stanu jego zrównoważenia*. Studia i Raporty IUNG-PIB, No. 40(14). Puławy: IUNG-PIB.

Kuś, J., Krasowicz, S., Kopiński, J. (2008). Ocena możliwości zrównoważonego rozwoju gospodarstw bezinwentarzowych. In: J.St. Zegar (ed.), *Z badań nad rolnictwem społecznie zrównoważonym [5]*. Monografie Programu Wieloletniego 2005-2009, No. 87. Warszawa: IERiGŻ-PIB.

Kwasek, M., Obiedzińska, A. (2013). Spożycie żywności a środowisko. In: J.St. Zegar (ed.), *Z badań nad rolnictwem społecznie zrównoważonym [20]. Wybrane zagadnienia zrównoważonego rozwoju rolnictwa*. Monografie Programu Wieloletniego 2011-2014, No. 93. Warszawa: IERiGŻ-PIB.

Kwiatkowski, C.A., Harasim, E., Maziarz, P. (2013). Gospodarstwa ekologiczne w strategii zrównoważonego rozwoju. In: A. Harasim (ed.), *Wybrane aspekty zrównoważone-*

go rozwoju i specjalizacji gospodarstw rolnych. Studia i Raporty IUNG-PIB, No. 32(6). Puławy: IUNG-PIB.

Lampkin, N.H. (1994). Organic Farming: Sustainable Agriculture in Practice. In: N.H. Lampkin, S. Padel (ed.), *The Economics of Organic Farming. An International Perspective*. Wallingford: CAB International.

Loon van, G.W., Patil, S.G., Hugar, L.B. (2005). *Agricultural Sustainability. Strategies for Assessment*. New Delhi/Thousand Oaks/London: SAGE Publications.

Niezgoda, D. (2005). Funkcje gospodarstwa rolniczego i jego złożoność. In: J.St. Zegar (ed.), *Koncepcja badań nad rolnictwem społecznie zrównoważonym*. Monografie Programu Wieloletniego 2005-2009, No. 11. Warszawa: IERiGŻ-PIB.

Majewski, E. (2002). *Ekonomiczno-organizacyjne uwarunkowania rozwoju Systemu Integrowanej Produkcji Rolniczej (SIPR) w Polsce*. Warszawa: Wydawnictwo SGGW.

Perepeczko, B. (2011a). Edukacja ekologiczna: dokumenty, badania, refleksje. In: A. Bołtromiuk (ed.), *Natura 2000 jako czynnik zrównoważonego rozwoju obszarów wiejskich regionu Zielonych Płuc Polski*. Warszawa: IRWiR PAN.

Perepeczko, B. (2011b). Świadomość ekologiczna mieszkańców i ich postawy proekologiczne. In: A. Bołtromiuk, M. Kłodziński (ed.), *Uwarunkowania zrównoważonego rozwoju gmin objętych siecią Natura 2000*. Warszawa: IRWiR PAN.

Romaniuk, W., Domasiewicz, T., Karbowy, A., Wardal, W.J. (2009). Ograniczenie wpływu produkcji zwierzęcej na środowisko. *Inżynieria Rolnicza*, No. 1(110).

Sapek, A. (2013). Emisja amoniaku z rolnictwa w Polsce. *Zagadnienia Ekonomiki Rolnej*, No. 2(335).

Sołtysiak, U. (1995). O kryteriach w rolnictwie ekologicznym. In: U. Sołtysiak (ed.), *Rolnictwo ekologiczne od producenta do konsumenta*. Warszawa: Stowarzyszenie EKOLAND.

Tyburski, J. (ed). (2013). *Żywność Ekologiczna*. Olsztyn: Uniwersytet Warmińsko-Mazurski.

Tyburski, J., Żakowska-Biemans, S. (2007). *Wprowadzenie do rolnictwa ekologicznego*. Warszawa: SGGW.

Wrzaszcz, W. (2012). *Poziom zrównoważenia indywidualnych gospodarstw rolnych w Polsce (na podstawie danych FADN)*. Studia i Monografie, No. 155. Warszawa: IERiGŻ-PIB.

Wrzaszcz, W. (2016). Ekonomika gospodarstwa rolnego a środowisko przyrodnicze. In: A. Kowalski, M. Wigier, B. Wieliczko (ed.), *Ekonomia versus środowisko – konkurencyjność czy komplementarność*. Monografie Programu Wieloletniego 2015-2019, No. 23. Warszawa: IERiGŻ-PIB.

Wrzaszcz, W., Zegar, J.St. (2014). Sprawność ekonomiczna wybranych form rolnictwa zrównoważonego środowiskowo. In: J.St. Zegar (ed.), *Z badań nad rolnictwem społecznie zrównoważonym [23]*. Monografie Programu Wieloletniego 2011-2014, No. 158. Warszawa: IERiGŻ-PIB.

Wrzaszcz, W., Zegar, J.St. (2016). Wspólna Polityka Rolna a zrównoważenie ekonomiczne gospodarstw rolnych. In: J.St. Zegar (ed.), *Z badań nad rolnictwem społecznie zrównoważonym [35]*. Monografie Programu Wieloletniego 2015-2019, No. 24. Warszawa: IERiGŻ-PIB.

Zegar, J.St. (1986). Czynniki różnicujące sprawność gospodarstw indywidualnych w świetle danych rachunkowości rolnej. In: J.St. Zegar (ed.), *60-lecie systemu rachunkowości rolnej w Polsce*. Warszawa: IERiGŻ.

Zegar, J.St. (2008). *Dochody w rolnictwie w okresie transformacji i integracji europejskiej*. Warszawa: IERiGŻ-PIB.

Zegar, J.St. (ed.). (2009). *Sytuacja ekonomiczna polskiego rolnictwa po akcesji do Unii Europejskiej*. Warszawa: IERiGŻ-PIB.

Zegar, J.St. (2012). *Współczesne wyzwania rolnictwa*. Warszawa: Wydawnictwo Naukowe PWN.

Zegar, J.St. (ed.). (2013). *Zrównoważenie polskiego rolnictwa. Powszechny Spis Rolny 2010*. Warszawa: GUS.

Ziętara, W. (1998). *Ekonomika i organizacja przedsiębiorstwa rolniczego*. Warszawa: FAPA.

Ziętara, W. (2014). *Koncentracja i specjalizacja gospodarstw rolniczych w procesie integracji z Unią Europejską*. Zeszyty Naukowe SGGW w Warszawie. Problemy Rolnictwa Światowego, vol. 14(29), issue 1.

Zimny, L. (2003). *Encyklopedia ekologiczno-rolnicza*. Wrocław: Akademia Rolnicza we Wrocławiu.

Zimny, L. (2014). *Leksykon przyrodniczy polsko-angielski*. Wrocław: Wydawnictwo Uniwersytetu Przyrodniczego we Wrocławiu.

www.agronews.com.pl/pl/0,58,21378,zbliza_sie_worldfood_warsaw_sektor_eco_ma_byc_hitem.html (access data: 18.01.2017).

www.minrol.gov.pl/Jakosc-zywnosci/Rolnictwo-ekologiczne (access date: 12.01.2017).

www.minrol.gov.pl/Wsparcie-rolnictwa (access date: 10.01.2017).

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WYNIKI PRODUKCYJNO-EKONOMICZNE GOSPODARSTW ROLNYCH ODDZIAŁUJĄCYCH W RÓŻNYM ZAKRESIE NA ŚRODOWISKO PRZYRODNICZE

Abstrakt

Podstawowym celem działalności rolnej, tak jak ma to miejsce także w przypadku innych działalności gospodarczych, jest uzyskanie korzyści ekonomicznych. Wynik gospodarowania jest efektem potencjału produkcyjnego gospodarstwa, organizacji produkcji rolnej, a także różnego rodzaju wsparcia finansowego skierowanego do producentów rolnych. Organizacja gospodarstwa warunkuje także zakres i skalę jego oddziaływania na środowisko przyrodnicze. Celem artykułu jest ustalenie zróżnicowania zmian potencjału produkcyjnego oraz wyników produkcyjno-ekonomicznych gospodarstw rolnych oddziałujących w różnym zakresie na środowisko przyrodnicze. Okres badań obejmuje lata 2004-2013.

Słowa kluczowe: wyniki produkcyjno-ekonomiczne, środowisko przyrodnicze, typ rolniczy gospodarstwa, system gospodarowania, Wspólna Polityka Rolna, subsydia, FADN.

Accepted for print: 04.09.2017.

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