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Comparison of the environmental impact of selected farms in the context of using funds of Common Agricultural Policy

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Abstract. In the paper presents analysis on conducted a based on several indicators of agro-environmental and environmental impact, selected farms with different production kinds in the context of the use of CAP. A preliminary assessment shows that income from the farm are very different depending on the conducted kinds of the production. Subsidizing and grants received under CAP are of a big importance for farms with lower profitability (low net returns).

key words: agro-environmental indicators, kinds of production, CAP, profitability

INTRODUCTION

Nowadays, farms should be run in accordance with the principles of sustainable development. For agriculture, this means a need for a proper adjustment of the type and intensity of farming to the requirements for the protection of the environment. The changes of the Common Agricultural Policy (CAP) are moving in the direction of decoupling (direct) payments on the structure and volume of production.

Now, with the introduction of cross compliance, the possibility of using CAP funds has become dependent on the fulfillment of certain "environmental" standards (Łuczka-Bakuła, 2006). The requirements and standards do not directly limit the intensification, but require the inclusion of environmental protection of natural resources in the process of agricultural production (Duer, 2000). Environmental impacts – particularly high-intensive – of agricultural production have measurable effects, namely a change in the indicators of soil fertility and in the composition of the groundwater (Kopiński, 2007; Kopiński, 2009; Kopiński, 2010). Meeting these challenges by farmers is a necessary, yet difficult task given that the processes of concentration, specialization and polarization of agricultural production are more and more visible (Parzonko, 2005; Ziętara, 2005). This applies to many branches of agricultural production – mainly livestock, but also to plant production (including the increase in the number of so called non-livestock farms).

The aim of the study was to compare, on the basis of a number of agri-environmental indicators, the environmental impact of selected farms with different production lines in the context of the use of CAP funds.

MATERIAL AND METHODS

The basis for the analysis are the results of economic and organizational studies conducted in 2006–2008 in 56 farms located in the voivodships: Dolnośląskie, Lubelskie, Podlaskie and Wielkopolskie. The studied farms are too small in number to be considered as representative of the region, but the three years of study enable us to make comparisons between different groups. Documentation (survey) developed by the authors constituted the source materials used for the analysis. The main criterion for the division of farms into 4 groups was the direction of production. These holdings represented such lines as: mixed-type (A), milk production (B), production of pigs (C) and crop production (non-livestock) (D). The criterion of specialization of individual farm was the share of particular branches in the final gross production.

To assess productive-economic effects of the surveyed farms, analytical indicators proposed by Harasim (2001) were selected. They characterize organizational and economic conditions. In order to ensure the comparability of the results, a uniform method of analysis and the same evaluation criteria were used for all the farms.

Agri-environmental indicators were: the balances of nitrogen, phosphorus and potassium calculated in accord-

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ance with the methodology of the OECD (Kopiński, 2007), the balance of soil organic matter (Maćkowiak, 1997) and the index of the soil vegetation cover in winter (Kuś, Krasowicz, 2001).

RESULTS

Table 1 shows the characteristics of the organizational and production conditions of the studied groups of farms differing in number. In addition to the diversified structure of agricultural production, which is the basis of their division according to the type of farming, they are also characterized by different environmentally-organizational conditions and a different level of intensity of production.

In the whole group of farms, the majority, namely 23 specialized in crop production (group D). Holdings in this group were also the largest in terms of area and economic size („big class") and had the best soil quality of arable land. Another characteristic of the „non-livestock production" was also its low labor requirements. In the remaining groups of holdings with „medium high" class of economic size, the level of employment rate ranged from 5.5 people working full-time (AWU) per 100 ha of arable land in mixed-type farms to 7–8 AWU/100 ha AL in farms specializing in breeding pigs and dairy cattle.

In the three groups of holdings, except for the holdings with only crop production, the entire organization was directly subordinated to the needs of livestock production, including their directional specialization. In group C, the share of cereals, which are the main source of feed for fattening pigs, amounted to nearly 95% of the sown area, being disadvantageous from the standpoint of proper management of crop rotations. A high share of forage crops, amounting to more than 40%, constituted the main forage base for cattle is characteristic of the group of dairy farms (group B). Maintaining this type of production was largely determined by the possession of permanent grasslands. In the structure of sown area in the group of non-livestock holdings, sugar beet and rape crops with high technological requirements had a significant share.

The level of mineral fertilization and the density of livestock in the study groups were a reflection of the intensity of farming. Consumption of mineral fertilizers per ha ranged from 153 kg of NPK in group 'A' to 255 kg of NPK in the group „D". Its consequence, also taking into account soil quality, was plant production per ha, expressed in cereal units. Farms with mixed-type farming possessing their own manure were the leaders in terms of average efficiency of fertilization.

Targeting production was expressed in the density and structure of livestock. Livestock density on the studied farms was similar to the national average and was on average 0.47 LU ha^{-1} AL. The highest concentration of livestock were found on the farms specializing in raising one species (1.2–1.4 LU ha^{-1}, AL). In the group 'D', livestock density was very low (Table 1).

Production results, which are derived from the obtained yields and animal productivity and the level of intensity of agricultural production also affected the economic results of the surveyed holdings (Table 2). Expression of the economic effects and a specified level of input costs for agricultural production was the income from the farming.

The highest economic efficiency, direct surplus, and the income from the agricultural farm per area unit were reached by the farms implementing the

Table 1. Characteristic of organisation and production conditions the analysed groups of farms in 2006–2008 years.

Specification	Type of production[#]				Average
	A	B	C	D	
Number of farms	8	16	9	23	-
Agricultural lands (AL) [ha $farm^{-1}$]	40.4	27.5	36.8	77.8	50.6
Grasslands [%]	19	25	10	1	8
Value index of AL	0.87	0.83	0.81	0.91	0.86
Employment [AWU/100 ha AL]	5.5	8.0	7.0	2.9	4.5
Cropland structure [%]					
cereals	74.9	46.8	94.6	71.2	71.4
legume crops	2.3	1.3	3.4	1.5	1.8
potato	2.0	3.7	0.2	0.6	1.1
industrial crop (sugar beet, rape)	13.8	3.3	0.5	23.8	17.2
fodder crops on ArL	6.1	43.6	1.1	-	6.4
other	0.9	1.3	0.2	2.9	2.1
Mineral fertilizers (kg NPK ha^{-1} of AL) of which:	153	191	159	255	220
N [kg N ha^{-1} AL]	68	109	91	130	114
P [kg P_2O_5 ha^{-1} AL]	28	33	30	49	41
K [kg K_2O ha^{-1} AL]	57	49	38	76	65
Yields [cereal units ha^{-1} AL]	45.4	41.9	42.4	61.1	53.8
Average efficiency of gross fertilizers [cereal units·kg^{-1} NPK]	0.30	0.22	0.27	0.24	0.24
Livestock density [LU·ha^{-1} AL] of which:	0.72	1.22	1.42	0.02	0.47
cattle [LU·ha^{-1} AL]	0.43	1.21	0.09	0.01	0.26
pigs [LU·ha^{-1} AL]	0.13	0.01	1.32	0.01	0.19
Economic value of farms [ESU]	22.5	28.7	28.8	41.7	32.8

[#] A – mixed-type farms, B – milk production, C – pig production, D – crop production (non-livestock)

Source: author's own study

Table 2. Selected of economic indices the analysed groups of farms in 2006–2008 years.

Specification	Type of production#				Average
	A	B	C	D	
Income from farming (Y) [thous. PLN ha^{-1} of AL] of which:	4.3	8.8	11.7	4.3	5.9
share of direct payments and LFA [%]	16	7	5	14	10
share of agri-envirnomental payments [%]	3	1	1	2	2
share of other payments (eg. for investition, refund of excise duty, etc.) [%]	2	10	3	4	5
Agricultural production inputs [thous. PLN ha^{-1} of AL] of which	2.5	4.1	8.5	2.1	3.2
share of value cost direct [%]	49	59	84	56	65
Gross margin [thous. PLN ha^{-1} of AL]	2.9	5.4	4.1	2.8	3.4
Gross agricultural income [thous. PLN ha^{-1} of AL]	1.8	4.6	3.2	2.2	2.7
Share of subsydies and payments in income [%]	45	14	23	32	27
Economic efficience	1.76	2.13	1.37	2.09	1.82
Gross agricultural income per full-time paid employees person (FWU) [thous. PLN]	36.0	61.9	46.8	83.4	63.0

see Table 1
Source: author's own study

Table 3. Selected agri-envirnomental indicators in the analysed groups of farms in 2006–2008.

Specification	Type of production				Average
	A	B	C	D	
Balance of gross nitrogen [kg ha^{-1} AL]	37	103	167	78	94
Nitrogen efficiency of use [%]	76	56	38	60	58
Phosphorus balances (P) [kg ha^{-1} AL]	3	9	34	5	11
Potassium balances (K) [kg ha^{-1} AL]	20	41	88	30	42
Soil organic matter balance (t DM ha^{-1} AL)	0.45	1.33	2.21	-0.07	0.81
Soil cover by plants index (%)	40	41	59	52	48

see Table 1
Source: author's own study

labour-intensive model of intensification of agricultural production (milk production). The least cost-effective, due to high labour- and capital-intensive nature of production, were farms breeding pigs. They obtained the income from 1 ha of AL by 1.4 thousand zł lower than the farms with cattle breeding. Satisfactory economic effects at a much lower level of effort and capital was obtained by the holdings with crop production exclusively (group D). In this group, the level of agricultural income compared to own work input (FWU), excluding depreciation rate was twice as high as in "mixed-type" holdings.

Research shows that the amount of profits and incomes of all the surveyed groups of farms were highly influenced by the funds obtained through the functioning of CAP mechanisms. On average, the total value of grants and subsidies accounted for about 27% of the income from the farm. The share of direct payments and LFA in the total farm income was the highest in the groups of mixed-type and "non-livestock" farms (14–16%), which obtain relatively lower revenues for 1 ha. A significant possibility of increasing the income of farms engaged in cattle breeding was using other financial sources such as the VAT refund, or subsidizing investments in progress. According to Mądra (2009) income growth promotes the expenses for investment, being an important determinant of implemented investments. For „dairy" farms, a form of income stabilization is a current system of „quoting" of milk production.

Table 3 presents selected agro-environmental indicators informing about potential environmental impact of the agricultural production of surveyed holdings. Balance of minerals in given groups of farms is consistent with the level of intensity of agricultural production. The closest value to optimal (low NPK balances, positive balance of organic matter, more than 40% of the area under plant cover in the winter) (Kuś, Krasowicz 2001), was the level of the evaluated agri-environmental indicators in the group of „mixed-type" farms. These farms had the highest, namely 76%, nitrogen utilization efficiency ratio among all the studied groups of farms. Holdings in this group benefited from the support of the CAP, including means from agri-environment schemes, to the greatest extent.

A very high surplus of nitrogen balance was found in the groups of specialized farms. It concerns especially pig farms, which are based on a large flow of feed from the outside (group C). They were found to have a very low efficiency of nitrogen utilization, and consequently, to generate potential environmental hazards. This negative assessment of the fertilizer management of this group of holdings is true of all three macronutrients tested. High doses of mineral and natural fertilizers are not in many farms rationally utilized and absorbed in the nutrient cycle: an animal → field → plant.

Farms with specialist livestock production have a very high positive balance of soil organic matter. It is generally advantageous, but the problem may be an appropriate management of animal faeces in the form of manure.

A negative reproduction of organic matter, which takes place on non-livestock farms (group D) can lead to soil degradation on these farms. This danger may be increased in case of further simplification of the structure of sowings. In all groups of holdings, soil vegetation coverage rate exceeded 40% and was too low, pointing to the possibility of leaching of nitrates and weaker protection against soil erosion during the winter.

CONCLUSIONS

1. Income from holdings varies widely depending on the direction of the production. For holdings with lower profitability, subsidies and grants received under CAP are important.
2. Mixed-type farms are characterized by a nearly optimal level of the evaluated agri-environmental indicators. Also, they benefit from the support of the CAP, including means under the RDP to the greatest extent.
3. The high balance and low gross efficiency of nitrogen use in specialized farms with livestock production, especially those breeding pigs, indicate their potential adverse environmental impact.
4. A negative reproduction of organic matter, which takes place on non-livestock farms, can lead to soil degradation in these farms in case of a further simplification of crop structure.
5. The implementation of the principles of sustainable agriculture at the farm level requires consideration in the management, in addition to economic goals, risk mitigation measures for the natural environment taking into account all the dependences and relationships that occur on the farm.

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