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## Economic assessment of the development opportunities of farms participating in agri-environmental programmes

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### Abstract

The study was conducted in 2007 with the inquiry method in 30 farms which specialised in livestock production based on own grasslands and participated in the Rural Development Programme in the years 2004–2006. The mean farm area was 19.69 ha (from 2.2 ha to 182.0 ha) and farms were divided into 4 groups: 1–10; 10–20; 20–50 and >50 ha. The share of permanent grasslands was 53.8% on average. The crop structure was subject to the production of bulk feeds and feed grain (oats), cereal mixtures, triticale and barley. The mean share of cereals was 78.5 %, root crops – 9.4 % and legumes – 2.1 %. The highest livestock (cattle, pigs, horses, poultry) density (mean of 0.5 LU per ha of agricultural land) was in farms from the group of 20–50 ha. Both the farm investments in fixed assets and average direct costs of plant and animal production were low. The revenue from agricultural production was medium to low. The proportion of subsidies from the RDP was high (17%). Gross margin in farms was medium and low. Its value per 1 ha of agricultural land (AL) and per capita increased with the increase of farm surface area (except for a group of 20.1–50.0 ha). The effectiveness of fixed assets was high, its index ranged from 0.39 to 0.58 with a mean of 0.43. Only 23% of surveyed farms had a chance of further development.

**Key words:** *crop structure, efficiency of fixed assets, gross margin, livestock density*

### INTRODUCTION

Subsidies provided for farms participating in the Rural Development Programme (RDP) in the years 2004–2006 increased farmers' interest in a specific way of farming i.e. in protecting valuable grassland habitats and waters in agricultural lands (AL). Farms with a substantial share of grasslands (GL) in the agricultural land structure may breed beef and dairy cattle, without large inputs, to supply Warsaw agglomeration. Acc. to SOSNOWSKI *et al.* [2006] and JANKOWSKA-HUFLEJT, DOMAŃSKI [2008], low-input beef cattle breeding is an alternative for abandoned meadows. This facilitates the development of agricul-

tural landscape and the use of biological function of grasslands [GAJDA *et al.* 1994; JANKOWSKA-HUFLEJT 2006]. Subsidies from Rural Development Programme largely affect agricultural development in the study region of Poland [HARKOT, LIPIŃSKA 2003; MICKIEWICZ *et al.* 2010]. The aim of this study was to assess the farms participating in RDP in the years 2004–2006 in view of further farm development.

### STUDY METHODS

The study was performed in 2007 with the directed inquiry method in 30 selected farms (Masovian Province, district Nowy Dwór Mazowiecki; Fig. 1),



Fig. 1. Localization of the study site: Poland, Masovian Province, district Nowy Dwór Mazowiecki

which participated in the Rural Development Programme in the years 2004–2006. Farms were oriented to animal production based on own grasslands. They were divided into 4 size groups (in ha): 1–10, 10–20 (most frequent), 20–50 and above 50. The largest group consisted of farms with an area of 10.1–20 ha. Agricultural land structure, livestock (mainly ruminants), crop structure and soil class were considered in the questionnaires.

The main criterion in economic evaluation of farms was the gross margin (GM) i.e. the value of annual production per ha or per animal diminished by the direct costs of this production [FAPA 2000]. The production value was the sum of sold plant and animal production and an increase of reserves. Direct costs were calculated for the whole farm and separately for the plant and animal production.

## RESULTS

### SELECTED ELEMENTS OF PRODUCTIVE CHARACTERISTICS

The total area of studied farms was relatively (as for Polish conditions) large with a mean of 19.69 ha. The farms included both typical family farms and those oriented to a specific production, particularly ruminant breeding (Tab. 1). The share of agricultural lands in farm area varied from 58 to 98% (mean 88.20%) in each size group. In farms smaller than 20 ha, grasslands dominated in the agricultural land structure, larger farms were dominated by arable lands. The rest of farm area consisted of forests, built-up areas, lands of ecological use and other. The first and second size group was dominated by grasslands, the third and fourth – by arable grounds. The mean share of grasslands in the agricultural land structure was 53.8% (country mean is 21%) which facilitated ruminant breeding. A high plant diversity – from sedges to legumes to protected plants – predestined for farming in agreement with the rules of environmental protection [JANKOWSKA-HUFLEJT, DOMAŃSKI 2008].

Table 1. Land use and AL structure in studied farms (mean and range)

Group	Farm size ha	No of farms	Surface area ha	AL in the total area, %	Arable lands in the AL structure, %	GL in the AL structure, %	Forests and other ha
I	1–10	11	<u>5.7</u> 2.2–8.9	<u>90.74</u> 70.1–96.6	<u>38.0</u> 0.0–74.9	<u>62.1</u> 25.1–100.0	<u>0.6</u> 0.2–2.7
II	10–20	13	<u>14.4</u> 10.0–19.1	<u>87.3</u> 70.0–98.0	<u>48.3</u> 22.2–96.4	<u>51.8</u> 3.6–77.8	<u>1.8</u> 0.3–3.3
III	20–50	5	<u>21.8</u> 23.2–39.6	<u>87.3</u> 58.0–95.8	<u>52.1</u> 25.8–82.6	<u>47.9</u> 17.4–74.2	<u>4.5</u> 1.0–16.1
IV	>50	1	<u>182.0</u> 182.0–182.0	<u>77.2</u> 77.2–77.2	<u>81.0</u> 81.0–81.0	<u>19.0</u> 19.0–19.0	<u>41.4</u> 41.4–41.4
Total		30	<u>19.7</u> 2.2–182.0	<u>88.2</u> 58.0–98.0	<u>46.2</u> 0.0–96.4	<u>53.8</u> 3.6–100.0	<u>3.1</u> 0.2–41.4

**Crop structure** (Tab. 2) depended on the demand for feed, soil type and farmers' choice (vegetables). It was, however, subject to the production of bulk and grain feed, particularly of oats, cereal mixtures, triticale and barley for livestock and partly for the market. As in the whole country, the share of cereals increased (from 57.1 to 96.5 %) with increasing farm area while that of tuber crops decreased in the same order (from 13.8 to 3.5%), apart from a farm in group IV of rich soils, where wheat, cereal mixtures (70.7%) and sugar beets (15.1 %) were grown. The

share of legumes grown for grain was from 0 % in group III (20.1–50.0 ha), to 14.3 % in group IV (>50 ha) of selected farms.

The main crops were potatoes and oats (in 18 farms), rye and triticale (in 16 farms), wheat (in 13 farms), cereal mixtures (7 farms), barley and lupine (4 farms) – Table 3. Some farmers grew vegetables, mainly tuber crops and onion in one farm. Cattle was bred in 8 farms alone and in 6 – together with pigs. Three farms in each of two groups bred: pigs alone, cattle and poultry. In 2 farms horses were bred alone

**Table 2.** Selected elements of crop structure (%) in studied farms (mean and range)

Group	Farm size, ha	Cereals	Legumes	Tuber crops
I	1.0–10.0	<u>57.1</u> 0.0–100.0	<u>1.9</u> 0.0–20.8	<u>13.8</u> 1.0–100.0
II	10.1–20.0	<u>90.4</u> 69.7–100.0	<u>2.0</u> 0.0–16.8	<u>7.6</u> 1.0–18.1
III	20.1–50.0	<u>96.5</u> 83.4–100.0	<u>0.0</u> 0.0–0.0	<u>3.5</u> 0.0–16.7
IV	>50.0	<u>70.7</u> 70.7–70.7	<u>14.3</u> 14.3–14.3	<u>15.05</u> 15.1–15.1
Mean		<u>78.5</u> 0.0–100.0	<u>2.1</u> 0.0–20.8	<u>9.4</u> 0.0–100.0

**Table 3.** Plants grown and animals bred in farms

Grown plants	No. of farms	Animals bred	No. of farms
Potatoes	18	cattle	8
Oats	18	cattle, pigs	6
Rye	16	pigs	3
Triticale	16	cattle, poultry	3
Wheat	13	horses	2
Cereal mixtures	7	cattle, horses	2
Barley	4	horses, poultry	2
Lupine	4	no animals	4

and in 2 other – horses and poultry. Four farms had no animals and some kept someone else's horses for recreation. Variability of animal production in farms was an effect of the vicinity of Warsaw agglomeration.

**Animal stock** (Tab. 4). The greatest diversity of species and the largest livestock (0.8 LU ha<sup>-1</sup> AL) was found in farms of group III (20–50 ha), slightly smaller (0.5 LU) in groups II and IV (large livestock of pigs in a leased farm). The livestock was very small (below country mean) and diversified among size groups of farms. Farmers kept mainly ruminants and

providing good feed for animals was one of the most important factors in effective management.

**Table 4.** Selected elements of livestock in studied farms (mean and range)

Group	Farm size ha	Total livestock LU ha <sup>-1</sup> AL including:			
		cattle	pigs	horses	total
I	1.0–10.0	<u>0.2</u> 0.0–0.6	<u>0.04</u> 0.0–0.4	<u>0.1</u> 0.0–0.6	<u>0.4</u> 0.0–0.8
II	10.1–20.0	<u>0.2</u> 0.0–0.6	<u>0.2</u> 0.0–0.9	<u>0.1</u> 0.0–0.3	<u>0.5</u> 0.0–0.9
III	20.1–50.0	<u>0.3</u> 0.0–0.6	<u>0.5</u> 0.0–2.4	<u>0.02</u> 0.0–0.1	<u>0.8</u> 0.0–2.4
IV	>50.0	0.0	<u>0.7</u> 0.04–2.4	<u>0.3</u> 0.1–0.6	<u>0.5</u> 0.0–2.4
Mean		<u>0.3</u> 0.0–0.6	<u>0.2</u> 0.0–2.4	<u>0.1</u> 0.0–0.6	<u>0.5</u> 0.0–2.4

### SELECTED ELEMENTS OF ECONOMIC CHARACTERISTICS

**Incomes from agricultural production** amounted 4 849 PLN ha<sup>-1</sup> AL on average and ranged in particular groups of farms from 2 627 PLN·ha<sup>-1</sup> (farms 1.0–10.0 ha) to 7 888 PLN ha<sup>-1</sup> AL (farms >50.0 ha). In particular farms these incomes varied from 1177 to 19 811 PLN ha<sup>-1</sup> AL (Tab. 5). The incomes increased with increasing area of AL. The incomes from plant production predominated over those from animal production and constituted on average 64% of the whole incomes of studied farms. However, the incomes included over 31% of subsidies for plant production including those from RDP (Tab. 5). So, subsidies significantly improved the profitability of plant production and hence – of the whole agricultural production of studied farms.

**Table 5.** Incomes (including subsidies) and costs in studied farms, PLN ha<sup>-1</sup> AL

Group	Farm size ha	Incomes from agricultural production				Direct costs of production		
		plant	subsidies in that amount	animal	total	plant	animal	total
I	1.0–10.0	<u>1979</u> 1177–2920	<u>1218</u> 680–1912	<u>648</u> 0–1724	<u>2627</u> 1177–4590	<u>375</u> 0–800	<u>343</u> 0–946	<u>718</u> 108–1453
II	10.1–20.0	<u>2871</u> 1204–16791	<u>921</u> 540–1732	<u>1097</u> 0–3020	<u>3968</u> 1719–19811	<u>426</u> 80–1710	<u>374</u> 0–1451	<u>780</u> 168–3162
III	20.1–50.0	<u>2091</u> 886–3659	<u>768</u> 581–979	<u>2799</u> 0–10740	<u>4890</u> 1229–14400	<u>371</u> 149–558	<u>2005</u> 0–8636	<u>2376</u> 270–9194
IV	>50.0	<u>5499</u> 5499–5499	<u>959</u> 959–959	<u>2389</u> 2389–2389	<u>7888</u> 7888–7888	<u>975</u> 975–975	<u>918</u> 918–918	<u>1893</u> 1893–1893

**Direct costs of production in size groups** of farms were 1 447 PLN ha<sup>-1</sup> AL on average and varied from 718 PLN (farms 1.0–10.0 ha) to 2 376 PLN ha<sup>-1</sup> AL (farms 20.1–50.0 ha) while the range in particular farms was between 108 and 9 194 PLN ha<sup>-1</sup> AL (Tab. 5). There was a tendency of increasing costs with the farm size (with the exception of one farm in group IV). Mean value of fixed assets – without land – in farms in the year 2007 were 13 913 PLN ha<sup>-1</sup> AL

(from 0 – machines rented in the first group farms – to 40 846 PLN in group II). The highest value of fixed assets was noted in farms of group I (1–10 ha), the lowest – in those of group III (20–50 ha). The value of fixed assets in studied farms showed a decreasing trend with increasing farm size (Tab. 6).

Mean gross margin (GM) was 2 692 PLN ha<sup>-1</sup> AL: from 1 909 PLN in group I (farms 1–10 ha) to 5 945 PLN ha<sup>-1</sup> AL in group IV (farms >50 ha).

**Table 6.** Gross margin in farms of various size and investment (mean and range)

Group	Farm size, ha	No of farms	Area of AL, ha	Value of fixed assets, PLN·ha <sup>-1</sup> AL	Index of soil quality	Employment	Gross margin, in PLN		Effectiveness of fixed assets
							per ha AL	per person	
I	1–10	11	5.1 2.0–7.5	15627 0–29314	24.5 0.0–32.6	27 11–50	1909 492–3444	9509 1040–23246	0.39 0.12–1.01
II	10–20	13	12.7 7.5–18.0	15373 18851–40846	32.2 20.9–55.4	11 6–16	3169 1406–16649	28193 10513–114130	0.47 0.10–1.37
III	20–50	5	27.33 21.8–37.9	6751 1002–12252	30.51 23.9–48.5	7 4–13	2513 821–5205	40210 15546–82636	0.58 0.07–1.1
IV	>50	1	140.6 140.6–140.6	11895 11895–11895	59.28 59.3–59.3	4 4–4	5945 5945–5945	168578 168578–168578	0.50 0.50–0.50
Mean		30	16.6 2.0–140.6	13913 0–40846	30.4 0–59.3	19 4–50	2692 492–16649	28024 1040–168578	0.43 0.07–1.37

Across all farms it ranged from 492 to 16 649 PLN. The value of gross margin per ha increased to 3 169 PLN ha<sup>-1</sup> in farms up to 20 ha, decreased in group III to increase again in the largest farm (>50 ha) to 5 945 PLN ha<sup>-1</sup>. Gross margin per person increased with farm size from 9 509 PLN in group I (farms 1–10 ha) to 168 578 PLN in the farm from group IV (>50 ha).

The effectiveness of fixed assets, i.e. the ratio of gross margin to the value of fixed assets (dimensionless), was high, its index varied from 0.39 to 0.58 with a mean of 0.43 (Tab. 5). Economic analysis demonstrated that ca. 23% of studied farms had an economic size above 40–50 thousand PLN and – according to a study by IRGŻ (Institute of Agricultural and Food Economics – National Research Institute) – a chance for further investments and development. In smaller farms economic barrier is the reason for a lack of necessary investments [MRiRW, MŚ 2004].

## SUMMARY

Various farms entered the agri-environmental programme: from very small (2.16 ha) to large (182.00 ha) situated on various soils – from light and sandy to very good alluvial soils of the Vistula River and of different quality of grassland habitats. Most farms had small cattle stock, particularly dairy cattle, and only some farms were breeding horses and pigs. These farms were less interested in very good fodder quality from permanent grasslands. Meadows in farms of a large percent of permanent grasslands in AL may be divided into intensive and extensive. Most satisfied were farmers having meadows on wetlands where spiking and the beginning of flowering in grasses started later than in meadows on more elevated lands.

Economic status of farms realising agri-environmental programme was medium to very good. The best condition showed medium and large farms, particularly those on very good alluvial soils where profitable plants (wheat and sugar beets) were grown and large cattle herds (less frequently pigs in farms >10 ha AL) were bred. Worse economic condition was noted in farms smaller than 10 ha. Their owners, from necessity, were employed outside agriculture. Further

development of these farms is possible on condition that they increase their area. A chance of development have also farms with a small percent of grasslands in AL oriented to pig and horse breeding and specializing in field and garden crops and farms of a large percent of permanent grasslands in the AL structure.

From performed inquiries with farmers it appears that the main and often sole reason for entering the programme was subsidies which increased the incomes from agricultural production by ca. 30%. Questioned farmers sometimes raised the need of maintaining meadows and pastures in their natural state. If not financially supported, large part of meadows and pastures would not have been used and changed its character from agricultural to barren lands. According to BRODZIŃSKA [2009] the environmental effects of agri-environmental programmes depend on appropriate level of financial subsidy.

Most farmers being financially aided do not want to resign from agricultural activity. Deprived of subsidies they will face the dilemma: to sell farms to other farmers (having larger AL) or to wait for changes in spatial planning and sell farms for non-agricultural purposes (building or services). Many of them are attached to their lands and would like to continue their management. They would agree to assume a function of nature restorers.

Biological and organisational obstacles in meadow and pasture production make impossible obtaining necessary incomes from labour and possessed fixed assets (including land) without subsidies from RDP. For example, market price of hay does not cover the costs of its production. Hence, the necessity of financial aids to farmers interested in extensive plant and animal production. The concept and accomplishment of the programme helped maintaining necessary level of management in large areas (ca. 30%) of permanent grasslands.

## CONCLUSIONS

1. Studied farms showed a low and medium level of investments in fixed assets, low direct costs of

plant and animal production i.e. the low intensity of agricultural production.

2. They had also medium to low incomes from that production; ca. 17% of incomes came from subsidies within the Rural Development Programme.

3. Gross margin (GM) per ha AL increased with increasing farm size (except the group of 20–50 ha) and per person it increased up to a farm area larger than 50 ha AL.

4. Production costs were not always satisfactorily compensated by incomes. Only 23% of studied farms had a chance for further development and investment.

5. The index of the effectiveness of fixed assets was high being 0.43 on average and ranging from 0.39 to 0.58.

6. It is necessary to financially support farmers interested in extensive plant and animal production. The status of nature restorer requires paying for the incomes lost due to extensive production.

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## Ekonomiczna analiza możliwości rozwoju gospodarstw rolnych uczestniczących w programach rolno-środowiskowych

### STRESZCZENIE

**Słowa kluczowe:** efektywność środków trwałych, nadwyżka bezpośrednia, obsada zwierząt, struktura zasiewów

Badania przeprowadzono w 2007 r., metodą wywiadu kierowanego, w 30 gospodarstwach rolnych w woj. mazowieckim, ukierunkowanych na produkcję zwierzęcą opartą na własnych użytkach zielonych i uczestniczących w programach PROW. Gospodarstwa o powierzchni od 2,16 do 182,03 ha (śr. 19,69 ha), podzielono na 4 grupy obszarowe: 1,0–10,0 ha; 10,1–20,0 ha; 20,1–50,0 ha i >50,0 ha. Udział trwałych użytków zielonych w strukturze użytków rolnych wyniósł średnio 53,79%. Struktura zasiewów podporządkowana była produkcji pasz objętościowych i ziarna paszowego (owsa), mieszanek zbożowych, pszenżyta i jęczmienia. Udział zbóż wyniósł średnio 78,54%, okopowych 9,41%, strączkowych 2,05%. Chowano bydło, trzodę chlewną, konie, drób. Największa obsada zwierząt na ha UR była w gospodarstwach z grupy 20–50 ha (0,78 DJP), średnio wynosiła 0,53 DJP na ha UR.

Poziom zainwestowania gospodarstw w środki trwałe oraz poziom kosztów bezpośrednich produkcji roślinnej i zwierzęcej były niskie. Średnie i niskie były też wartości przychodów z produkcji rolniczej. Dużą ich część (ok. 17%) stanowiły subwencje z PROW. Wartość nadwyżki bezpośredniej gospodarstw na ha UR zwiększała się wraz ze zwiększaniem się powierzchni gospodarstwa (z wyjątkiem gospodarstw z grupy 20,1–50,0 ha), natomiast w przeliczeniu na osobę wzrastała. Efektywność środków trwałych była wysoka. Wskaźnik efektywności wahał się od 0,39 do 0,58, średnio 0,43. Nie wszystkie badane gospodarstwa rolne mają szansę dalszego rozwoju i koniecznych inwestycji. W badanej grupie takich gospodarstw było ok. 23%.