

## FARMING CONDITIONS VERSUS THE SIZE AND STRUCTURE OF HERD ON ORGANIC FARMS\*

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**Abstract.** The work presents the area and land use structure, as well as the cropping area and structure. Presented were also the size and structure of herd divided into animal groups. The livestock density was calculated by referring a livestock unit (LU) to arable area. Investigated were 100 organic farms divided into area groups, i.e. of less than 5 ha, from 5.01 to 10.00 ha, from 10.01 to 20.00 ha and more than 20 ha. Conducted statistical analysis revealed a significant relationship between agricultural land area and grassland area, and between arable lands area and cattle herd size.

**Key words:** organic farm, herd size, farming conditions

### Introduction

Organic agriculture offers an alternative form of farming for a considerable number of farmers and gives a chance to earn a substantial income, which leads to a growing number of organic farms. The report of Agricultural and Food Quality Inspection (IJHARS) states that by the end of 2010 almost 21 thousand of these farms operated in Poland, i.e. over 20% more than the previous year [Raporty i analizy 9on-line) 2011]. Increase in the number of organic farms or those in transition to this system of production provides a chance not only for increase in high quality product supply, but also for a considerable diminishing agriculture pressure on the environment, which contributes to soil and water protection and preservation of biodiversity of living organisms. However, it should be pointed out that mounting interest in organic farming in Poland has been observed only currently. Therefore, as has been emphasized by many specialists, the system has not been fully known and we still lack full data on the real organizational and economic situation of organic farms [Wasilewski 1998; Siudek 1998; Gotkiewicz 1998]. Current and future development of organic farming is strictly connected with its competitiveness toward other farming systems [Piskier 2008; Sławiński et al. 2008]. Organic production is more difficult because it requires deeper knowledge and comprehension of mechanisms active in nature' but it also needs greater labour consumption which replaces a lack of fertilizers and chemicals for plant protection.

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## Aim and scope of work

The aim of the paper was determining the farming conditions, i.e. the farm area, the land use and cropping structure in the context of the size and structure of herd kept on organic farms.

Investigations comprised 100 objects located in southern Poland, possessing organic agriculture certificate, which is a statement issued by a certification body that the production remains under constant control and the products meet the requirements of the appropriate legal regulations in force. The investigations were conducted as directed interview with farm owners. Collected information referred to the economic year 2010/2011. The studied farms participate in a three-year project implemented by the Institute of Agricultural Engineering and Computer Science in Krakow, in the framework of development project No. 12-0165-10 entitled: "Innovative effect of technique and technology and IT support of management on production effectiveness on organic farms".

For comparative analysis the studied objects were divided into groups differing with the agricultural land area. These comprised: 31 farms with area of less than 5.00 ha (group I), 32 farms of between 5.01 to 10.0 ha (group II), 23 holdings with area between 10.01 and 20.00 (group III) and 14 farms possessing more than 20 ha of agricultural land (group IV). The paper presents the results of initial investigations.

## Results

Development of organic production is evidenced among others by increasing cropping area. According to the report prepared by Agricultural and Food Quality Inspection (IJHARS), in 2010 the area increased by almost 25% in relation to the previous year and reached c.a. 103 thousand ha. Most frequently organic farms have an area between 5 and 10 ha of agricultural lands. The objects with an acreage of less than 5 ha constituted 23.7%, whereas the largest, with the area exceeding 100 ha only 4.5% of the total number of farms [Raporty i analizy (on-line) 2011].

Among 100 studied farms, these which had less than 10.00 ha of agricultural land made up 63%, while the holdings with the area of more than 20 ha, only 14%. Average agricultural land area of the smallest farms (group I) was 2.88 ha, on medium farms – 7.10 ha (group II and 14.73 ha (group III), whereas in group IV, among the largest farms with acreage of more than 20 ha, the average was 37.85 ha (Tab.1).

Diversification of agricultural land area among farms in the individual area groups was growing with it. Therefore, the smallest differences were registered in group I, where the smallest acreage was 0.90 ha and the largest 4.80 ha (standard deviation on the level of 1.05), whereas the greatest were noted in group IV, where the smallest area was 20.38ha and the biggest 63.58 ha (standard deviation on the level of 15.11).

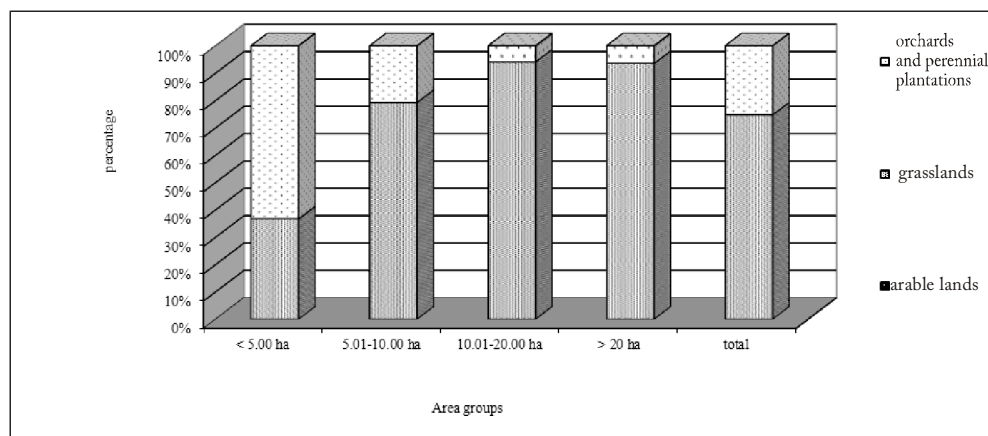
On average for all studied farms, arable lands constituted 50.5%, grasslands 37.0% and orchards and perennial plantations – 12.5% of the agricultural land area (Fig. 1). It should be pointed out that the share of arable lands was decreasing while the share of grasslands was increasing with increasing agricultural land area. On the other hand, orchards and plantations were definitely dominant on the smallest farms, constituting 26.4% of the land use structure.

## Farming conditions versus...

Table 1. Land use in farm area groups

Specification		Area groups				Total
		Group I < 5,00 ha	Group II 5,01-10,00 ha	Group III 10,01-20,00 ha	Group IV > 20 ha	
Number of farms		31	32	23	14	100
Agricultural lands	average	2.88	7.10	14.73	37.85	11.90
	stand. dev.	1.05	1.62	3.24	15.11	12.79
Arable lands	average	1.70	3.67	6.18	13.26	5.02
	stand. dev.	1.18	2.46	6.00	17.30	7.97
Grasslands	average	0.42	2.79	8.25	23.46	6.19
	stand. dev.	0.45	3.00	7.15	19.07	10.92
Orchards and perennial plantations	average	0.76	0.63	0.31	1.13	0.67
	stand. dev.	1.17	1.11	0.69	3.18	1.51

Source: author's own calculations



Source: author's own calculations

Fig. 1. Land use structure in farm area groups

On organic farms where no artificial fertilizers or chemicals for plant protection are used, a crucial role belongs to properly arranged crop rotation, in which cereal and non-cereal crops, winter and spring varieties with faster or slower initial growth, deeper or shallower rooting crops. Such crop rotation inhibits spreading of diseases and pests, since each consecutive plant has a different specific “set of enemies”.

Table 2. Cropping area in farm area groups

Area groups	Crops											
	Cereals		Root crops		Industrial crops		Fodder crops		Vegetables		Herbs	
	ha	%	ha	%	ha	%	ha	%	ha	%	ha	%
Group I < 5.00 ha	0.95	54.1	0.17	10.0	–	–	0.42	23.1	0.08	8.8	0.08	4.0
Group II 5.01-10.00 ha	2.53	65.4	0.33	9.9	0.07	1.3	0.62	15.3	0.13	8.1	–	–
Group III 10.01-20.00 ha	3.75	57.3	0.41	20.9	–	–	1.26	12.5	0.35	4.2	0.64	5.1
Group IV > 20 ha	6.35	51.9	0.14	18.9	–	–	5.92	28.5	0.29	0.7	–	–
Total	2.88	58.1	0.27	13.8	0.02	0.4	1.49	19.1	0.19	6.3	0.17	2.3

Source: author's own calculations

Generally cereals prevailed on the analyzed farms, covering on average 2.88 ha, i.e. 58.1% of the arable land area (Tab.2). Fodder crops were cultivated on an average area of 1.49ha, whereas the acreage under root crops was 0.27 ha, so the crops made up respectively 19.1 and 13.8% of the cropping structure. On the other hand, the share of industrial crops, vegetables and herbs jointly was only 9%.

Organic farms constitute a permanent and self-sufficient system functioning on the basis of mutual cooperation of plants and animals existing in it. Animal husbandry ensures maintaining the fodder-fertilizer balance constituting a link in the closed matter cycling on farms.

Average livestock population on the studied farms was 7.7 livestock units (LU) (Tab.3).

Table 3. Herd size in area groups

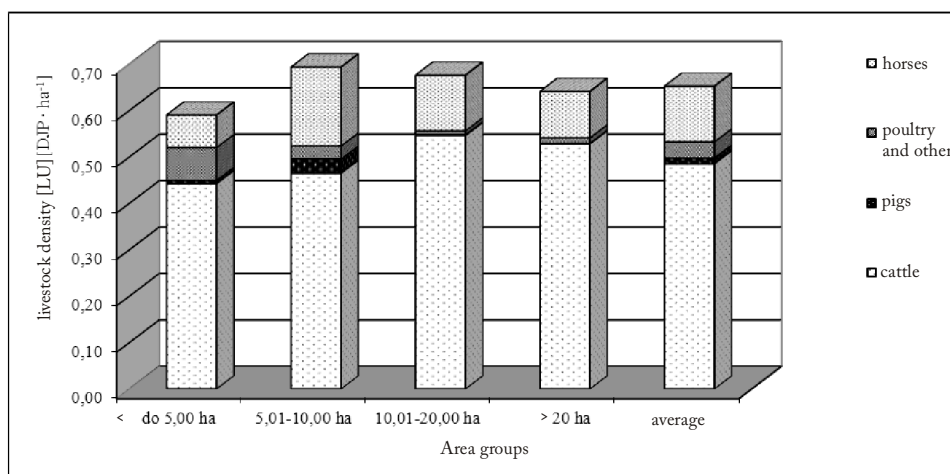
Specification		Area groups								Total	
		Group I < 5,00 ha		Group II 5,01-10,00 ha		Group III 10,01-20,00 ha		Grupa IV > 20 ha			
		LU	%	LU	%	LU	%	LU	%	LU	%
Cattle	average	1.3	77.4	3.4	69.0	7.9	80.9	19.1	82.7	6.1	79.0
	stand. deviation	2.1	–	4.1	–	8.1	–	15.4	–	9.5	–
Pigs	average	0.0	1.1	0.2	3.4	0.0	0.3	0.1	0.2	0.1	1.0
	stand. deviation	0.0	–	0.5	–	0.1	–	0.2	–	0.3	–
Horses	average	0.2	10.6	1.2	24.2	0.1	17.8	3.5	15.3	1.4	17.5
	stand. deviation	0.5	–	3.2	–	0.1	–	8.3	–	4.3	–
Poultry and other	average	0.2	10.9	0.2	3.4	1.8	1.0	0.4	1.8	0.2	2.5
	stand. deviation	0.2	–	0.4	–	4.4	–	1.3	–	0.5	–
Total	average	1.7	100	5.0	100.0	9.8	100.0	23.1	100.0	7.7	100.0
	stand. deviation	2.3	–	4.4	–	7.7	–	13.8	–	9.9	–

Source: author's own calculations

It should be emphasized that the size of the herd was growing with the agricultural land area, so on the farms possessing the smallest area it was 1.7, whereas on the largest 23.1 LU. Cattle dominated in the herd structure in each farm area group and its average share reached 79% (Tab.3). On the other hand a trace share of pigs was surprising, since it reached only 1% on average for all 100 farms. Pigs were kept mainly on farm classified to area group II.

Livestock density results from the possible self-supply in fodder and crop requirements for nutrients. Therefore, a balanced livestock density is one of the elementary principles of organic methods of production and is regulated by the admissible nitrogen content, which cannot exceed  $170 \text{ kg} \cdot \text{ha}^{-1}$  in the total amount of manure applied on farm during the whole year [Dyrektywa 91/676/EWG]. This requirement may be fulfilled at the maximum livestock density of  $2 \text{ LU} \cdot \text{ha}^{-1}$  [Dziennik ustaw (on-line) 2011].

Livestock density on the analyzed farms was comparable between individual area groups and ranged from  $0.59$  to  $0.69 \text{ LU} \cdot \text{ha}^{-1}$  (Fig.2). Cattle constituted on average  $0.52 \text{ LU} \cdot \text{ha}^{-1}$ , i.e. 74.4%. On the other hand, the density of other animal groups, i.e. pigs, horses and poultry was small, on an average level of respectively:  $0.01$ ;  $0.11$  and  $0.02 \text{ LU} \cdot \text{ha}^{-1}$  of agricultural lands.



Source: author's own calculations

Fig. 2. Livestock density in farm area groups

Statistical analysis revealed a significant positive relationship between the land area and number of livestock population expressed in LU. On the basis regression equations it may be stated that increase in the herd size by 1 LU was connected with an increase in agricultural land area by 2.04 ha.

Table 4. Correlation coefficients

Variable	Horses	Cattle	Pigs	Poultry and other
Agricultural lands	0,25	0,67	–	–
Arable lands	–	0,36	–	–
Grasslands	0,25	0,51	–	–
Orchards and plantations	–	–	–	–

Source: author's own calculations

## Conclusions

Average agricultural land area on the studied farms was 11.85ha. Arable lands constituted 50.5% of agricultural land area, 37.0% was covered by grasslands and the remaining part was designed for orchards and perennial plantations. Cereals prevailed in the cropping structure covering 58.1% of arable area. Fodder crops (19.1%), root crops (13.8%) and to a small degree vegetables, herbs and industrial crops (total of 9.0%) were cultivated on the remaining acreage.

The herd size on the analyzed farms was on the level of 7.7 livestock units (LU). Definitely the most numerous livestock populations were registered on farms with the largest acreage. The numbers were several times larger than on smaller area farms. On the other hand, in conversion to area unit, livestock density in the identified area groups was comparable, fluctuating from 0.59 to 0.69 LU·ha<sup>-1</sup>AL, at an average of 0.65 LU·ha<sup>-1</sup>AL. Therefore, the livestock density was smaller than permissible on organic farms. Cattle, mainly cows constituted on average 79% of the cattle population. It should be also pointed out, that pig population made up only 1% of the total animal number, whereas horse population – 17.5%.

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## **WARUNKI GOSPODAROWANIA A WIELKOŚĆ I STRUKTURA STADA W GOSPODARSTWACH EKOLOGICZNYCH**

**Streszczenie.** W pracy przedstawiono powierzchnię i strukturę użytkowania ziemi oraz powierzchnię i strukturę zasiewów. Przedstawiono również wielkość i strukturę stada, przy podziale na grupy zwierząt. Obliczono obsadę inwentarza żywego odnosząc dużą jednostkę produkcyjną (DJP) do powierzchni użytków rolnych. Do badań przyjęto 100 gospodarstw ekologicznych, które podzielono na grupy obszarowe tj. do 5 ha, od 5,01 do 10,00 ha, od 10,01 do 20,00 ha i pow. 20,00 ha. Przeprowadzono analizę statystyczną, która wykazała istotny związek między powierzchnią użytków rolnych i zielonych oraz gruntów ornych a wielkością stada bydła.

**Słowa kluczowe:** gospodarstwo ekologiczne, wielkość stada, warunki gospodarowania

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