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PRODUCTIVITY OF SOME FACTORS OF PRODUCTION IN ORGANIC FARMS

Summary

The aim of this work was to characterize the productivity of conducting organic production in farms oriented to milk production. The aim of this work was achieved by determining the productivity of some factors of production, i.e. land, labor and machinery. The scope of this work covered farms associated in a producer group from the Podkarpackie province. The analysis of the obtained results showed that the mean area of the studied farms was 37.37 ha UAA, and the average livestock density was 0.81 LU·ha^{-1} AL. The granted subsidies (which differentiated the obtained index of land productivity at a level of 2.58 thous. PLN·ha^{-1} AL) were a very important element from the point of view of production profitability.
***Key words**: organic agricultural production, efficiency of production, machinery, land resources, labor consumption*

PRODUKTYWNOŚĆ WYBRANYCH CZYNNIKÓW PRODUKCJI W GOSPODARSTWACH EKOLOGICZNYCH

Streszczenie

Celem pracy było scharakteryzowanie efektywności prowadzenia ekologicznej produkcji w gospodarstwach ukierunkowanych na produkcję mleka. Aby zrealizować cel pracy określono produktywność wybranych czynników produkcji, tj. ziemi, pracy, oraz parku maszynowego. Zakresem pracy objęto gospodarstwa zrzeszone w grupie producenckiej z woj. podkarpackiego. W efekcie przeprowadzonej analizy uzyskanych wyników stwierdzono, że średnia powierzchnia badanych gospodarstw wyniosła 37,37 ha UR, a średnia obsada inwentarza żywego 0,81 DJP·ha^{-1} UR. Istotnym elementem z punktu widzenia opłacalności produkcji były pozyskane dopłaty, które różnicowały uzyskany wskaźnik produktywności ziemi na poziomie 2,58 tys.zł·ha^{-1} UR.
***Słowa kluczowe**: ekologiczna produkcja rolnicza, efektywność produkcji, park maszynowy, zasoby ziemi, pracochłonność*

1. Introduction

Organic farming, which is a modern system of agricultural production that instead of agrochemical products uses natural, organic products and, to a larger extent, human labor, is regarded as one kind of intensive farming. Farms which have decided to conduct organic farming aim at obtaining high quality food without harming the environment, without using artificial manure and chemical pesticides, but using modern means of production. Organic farming is an alternative form of farming for most farmers and provides a chance to gain high revenue. Such type of production is not an easy one and requires extensive knowledge on the mechanisms occurring in nature, and chemical agents and artificial manure are replaced by maximum labor consumption. In recent years there has been a visible increase in the number of organic farms, because it gives a chance to increase the supply of agricultural products and reduces the pressure of agriculture on the environment [1]. Hitherto, there has been a varied rate of increase in the amount of certified organic plant and livestock production in the development of organic farming. At first, the market of plant products grew faster than the market of animal products. In the following period, there was acceleration in the development of organic livestock production, including organic milk production [2].

The amount and importance of organic milk production are spatially varied. This applies to the global and European economy, and to the economy of individual countries. In this respect, Europe and Northern America are in the leading position [3]. Organic milk production in Europe reached 2.5 million tons in 2006, which constitutes about 1.8% of total milk production. The major producers of organic milk in Europe are: Germany, Austria, Great Britain, France, and Denmark. In 2004, these countries had the highest number of cows kept in ecological conditions (Tab. 1).

For comparison, data from recent years from EU countries indicate that trends to orient production of organic farms to milk production are the same – not so dynamic (Fig.). The number of dairy cows on organic farms in EU countries reached 720 thousand in 2011, which is 3% of total livestock population. There are 18.3 thousand dairy cows on organic farms in Poland (for comparison, there were 7.8 thousand heads in 2004, and 10.6 thousand heads in 2008) [5, 6].

The area structure is one of the most important determinants of the economic situation of organic farms in Poland as well. It is often accompanied by obsolete technologies which are used mainly on small farms where relationships between labor resources and capital or between labor and land are improper. In consequence, this leads to low quality of products obtained, high costs and low revenue [7]. According to Pawlak [8] and other specialists in agricultural engineering [2, 3, 7], effectiveness of farming depends on the organizational and economic situation in the supply and sales market for agricultural products. Market instability and price fluctuations offered to producers cause unfavorable changes in the structure and scale of farm production. In this case, purchase of specialist machines is questioned, despite the fact that these machines increase the amount of production and improve its quality [8]. Taking the above-mentioned into account, the assumed aim of this work was to determine the productivity of selected factors of production on organic farms oriented to milk production.

Table 1. Number of dairy cows and the share in total livestock population, as well as the area of organic cultivation and its share in total cultivated area in selected EU countries in 2004 (before Poland's accession to the European Union) [4]
Tab. 1. Pogłowie krów mlecznych i udział w pogłowiu ogółem oraz powierzchnia upraw ekologicznych i jej udział w powierzchni ogółem w wybranych krajach UE w 2004 roku (przed przystąpieniem Polski do Unii Europejskiej) [4]

Country	Number of cows (heads)	Share in total livestock population (%)	Area of organic cultivation (ha)	Share in total cultivated area (%)
Austria	86,896	16.1	360,972	14.16
Belgium	7,993	1.5	22,966	1.65
Czech Republic	2,865	0.7	254,982	5.97
Denmark	53,115	9.5	145,636	5.62
Finland	5,052	1.6	147,587	6.52
France	66,123	1.8	560,838	2.03
Germany	101,000	2.4	807,406	4.74
Great Britain	83,252	4.0	619,255	3.90
Greece	480	0.3	288,255	3.15
Italy	38,284	2.1	1,067,102	8.40
Latvia	3,048	1.6	118,612	4.78
Lithuania	3,447	0.8	69,430	2.49
Luxembourg	243	0.6	3,243	2.51
Slovakia	1,550	0.8	92,191	4.91
Slovenia	1,004	0.7	23,499	4.84
Sweden	22,321	5.6	200,010	6.27
The Netherlands	305	<1	48,765	2.49

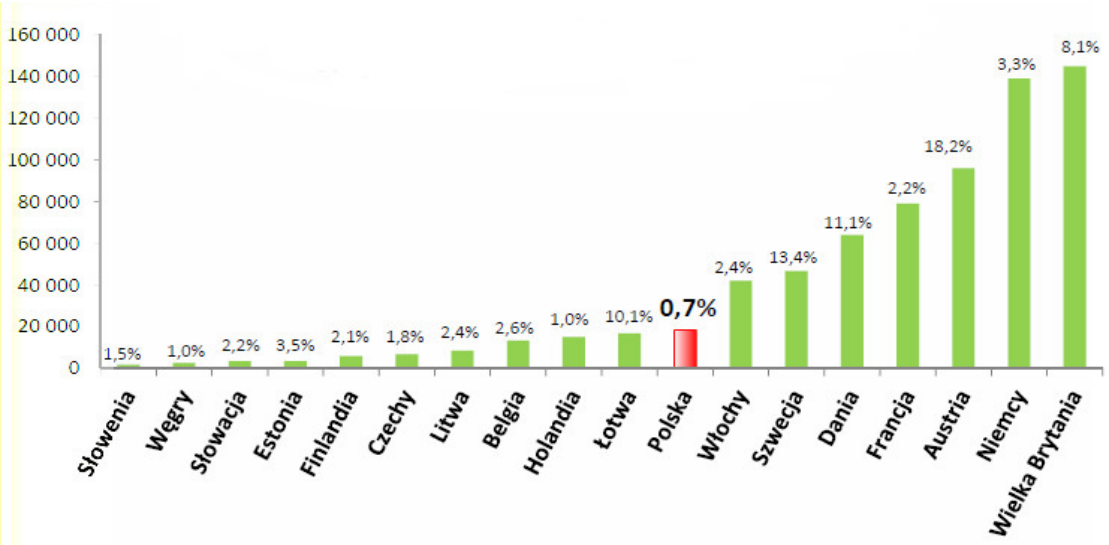

Fig. Number of dairy cows on organic farms and the share in total livestock population in EU countries in 2011 [5, 6]
Rys. Liczebność krów mlecznych w gospodarstwach ekologicznych oraz udział w pogłowiu ogółem w krajach Unii Europejskiej w 2011 roku [5, 6]

2. Material and methods

The study was performed in the form of a guided interview during which a previously drawn up questionnaire was used, which allowed collecting necessary source data from the production year 2013/2014. The scope of the study covered two producer groups incorporating 42 farmers whose production was oriented to milk production.

Furthermore, calculations were made for selected indicators which characterize land productivity, index of technical means of labor, power intensity index, and the amount of labor input. For it to be possible, however, initial indexes were calculated first, i.e. final gross production, index of power installed in technical means of work, amounts of labor in plant and livestock production. Moreover, selected data were compared (agricultural land area, livestock density, number of machines), which allowed to represent the farming conditions on the analyzed farms.

Calculated indexes:

Final gross production - sum of the obtained plant and livestock production value; it covered the following: value of the main product, value of the by-product (only when it was the object of market exchange), domestic use value, subsidies to a product or to its cultivation area. Value of production in the case of particular activities of plant production was calculated for 1 ha AL [9].

Final net production – calculated as the final gross production minus the value of the obtained subsidy [9].

Gross machine stock replacement value (thous. PLN·ha^{-1}AL) – the replacement value was the current value of new or similar (fully functional) machines without taking into account the degree of their physical and economic wear [10].

The farm **power intensity** index was assumed as total power of tractors, mobile equipment possessed by the farm, and of other appliances which have their own power source, per unit of AL.

The **indicator of productivity of fixed assets**, an abstract indicator that determines the value of production per 1 unit of value of fixed assets (machinery) [11].

Index of productivity of farm power intensity – the relationship between the value of the total power installed in technical means of work and the value of the final gross production.

Labor input productivity index was determined as the ratio of the value of final gross production to the total amount of labor input (in plant and livestock production) thous. PLN·man-hour^{-1}.

3. Results

The factor that is the main determinant of the productive potential of farms is the amount of land resources owned. It plays a special role in the case of organic farms oriented to livestock production, where there are restrictions as to the level of livestock density in relation to the land resources owned. In the case of the studied organic farms, the average area of agricultural land owned was 37.37 ha, which was large compared with the current average area of agricultural land per farm in Poland – 11.54 ha [12]. The studied farms were oriented to livestock production, including milk production, which is not a common specialization on organic farms in Poland. The mentioned European regulations on livestock density (livestock units – LU) in relation to the area of agricultural land (AL) owned state that it cannot exceed 1 LU per 1 ha AL. On the analyzed farms, this index did not meet the acceptable standards, because it amounted to 0.81 LU · ha^{-1} AL, and therefore those farms had the possibility to increase the production potential – to increase production by increasing the density (Tab. 2).

According to the Common Agricultural Policy regarding popularization of development of organic farming, it is gradually subsidized, the result of which is that the obtained subsidies for the carried out production constitute an important share in the attained efficiency of production. In the case of the studied farms, apart from the obtained subsidies to plant production at a level of 1.5 thous. PLN·ha^{-1} AL, the farmers (as a result of having animals which are subject to protection under the measure "Protection of local breeds of farm animals" within the Rural Development Programme) obtained subsidies amounting to 1.08 thous. PLN·LU^{-1}. Value of the final gross production is an indicator which characterizes utilization of the production potential of possessed resources. Apart from the value of obtained production (yields), it takes into account obtained subsidy. In the case of the analyzed organic farms, Final net livestock production (with and without taking into account the obtained subsidy) was nearly twice higher than Final net plant production, and the difference was 1.91 thous. PLN·ha^{-1} AL (Tab. 1).

Production generates the need to incur inputs, including labor inputs. Production labor consumption on the studied farms was at a level of 60.06 man-hour·ha^{-1} AL. Those were mostly (89.97%) inputs associated with livestock production, which is characterized by lack of seasonality, as in the case of plant production (Tab. 2). The low level of obtained labor input in plant production was a result of the owned structure of land use with grasslands dominating, where seasonal cattle grazing took place.

Carrying out livestock production oriented to milk production had a direct effect on the value of the quantitative index of equipping farms with machinery. It can be generally stated that the farms had the necessary machines and tools which are used in keeping a cattle herd and in plant production for the need of providing own feed for the herd owned. Detailed analysis indicates that harvest of green fodder is almost fully mechanized. This is confirmed by the fact that almost all the farms had mowing machines, hay tedders, pick-up balers, and self-loading trailers. Directly in livestock production on each farm, milking was mechanized, and the owned milk chilling containers and milk coolers made it possible to ensure the expected quality of the obtained milk. The gross machine stock replacement value value averaged at 8.01 thous. PLN·ha^{-1} AL (Tab. 3).

The analysis of productivity of the owned resources and inputs was conducted with taking into account the subsidies as well as cases without subsidies obtained; this was aimed at representing the differences arising from this fact. As a result, it turned out that land productivity in the analyzed cases differed by 2.58 thous. PLN·ha^{-1} AL.

Table 2. Production potential of studied farms
Tab. 2. Potencjał produkcyjny badanych gospodarstw

Plant production		Livestock production	
Structure of land use (ha)		Livestock density on the studied farms (LU·ha^{-1} AL)	
Arable land	3.59	Cattle	0.80
Grasslands	33.78	Poultry	0.01
Agricultural land	37.37	Total	0.81
Subsidies for production			
Subsidies for plant production (basic payment and payment for plants cultivated in the organic system) (thous. PLN·ha^{-1} AL)	1.50	Subsidies for livestock production (under the measure: protection of local breeds of farm animals) (thous. PLN·LU^{-1})	1.08
Final net production (thous. PLN·ha^{-1} AR)			
Final net plant production	1.69	Final net livestock production	3.60
Final gross production (thous. PLN·ha^{-1} AR)			
Final gross plant production	3.19	Final gross livestock production	4.68
Production labor consumption (man-hour·ha^{-1} AL)			
Labor consumption of plant production	6.02	Labor consumption of livestock production	54.04

Source: own study / Źródło: opracowanie własne

Table 3. Characteristics of farm machinery
Tab. 3. Charakterystyka wyposażenia parku maszynowego

Number of machines (piece·farm^{-1})			
Delivery vehicles	0.48	Grain drills	0.2
Farm tractors	1.64	Rotary mowing machines	1.0
Trailers	1.10	Pick-up balers	0.6
Plows	1.00	Hay tedders	1.0
Cultivators, harrows	0.40	Self-loading trailers	0.1
Manure spreaders	0.40	Grain mill	0.2
Fertilizer distributors	0.10	Milking machines	1.0
Manure loaders	0.30	Milk chilling containers and coolers	1.0
Gross machine stock replacement value (thous. PLN·ha^{-1} AL)	8.01		
Power intensity index (kW·ha^{-1}AL)	3.67		

Source: own study / Źródło: opracowanie własne

Table 4. Productivity of selected production factors
Tab. 4. Produktywność wybranych czynników produkcji

Productivity with taking into account the obtained subsidies for organic production	On average	Productivity without taking into account the obtained subsidies for organic production	
Land productivity index (thous. PLN·ha AL^{-1})	7.87	Land productivity index (thous. PLN·ha AL^{-1})	5.29
Indicator of productivity of selected fixed assets (machinery)	0.98	Indicator of productivity of selected fixed assets (machinery)	0.66
Index of productivity of power intensity (thous. PLN·kW^{-1}	2.14	Index of productivity of power intensity (thous. PLN·kW^{-1}	1.44
Labor input productivity index (thous. PLN·man-hour^{-1})	0.13	Labor input productivity index (thous. PLN·man-hour^{-1})	0.08

Source: own study / Źródło: opracowanie własne

Machinery is a resource which on nearly each farm has one of the highest values among fixed assets. That is why the relationship between the value of the obtained final gross production and its gross replacement value appears to be so important, because this relationship is supposed to provide information about the level of productivity of the machinery. The value of this indicator on the studied farms was at a level of 0.98.

From the point of view of, among other things, organization of production, it is important to determine the effectiveness of the amount of labor input. When analyzing the obtained results, taking into account the aspect of having or not having the subsidy for production, productivity of labor input on the studied farms differed by 0.05 thous. PLN·man-hour^{-1}. In real conditions on the studied farms, one man-hour was compensated with 0.13 thous. PLN of the final gross production value (Tab. 4).

4. Conclusions

Milk production on organic farms in EU countries is regarded as niche production. This is confirmed by statistical as well as production and economic data from other authors [13], but availability and range of this information are still insufficient. Information in mass media points to a great interest among consumers and to increasing turnover in the market of organic products. The hitherto conducted studies on the market of organic products [14] point to the growing interest in this group of products. Results of the conducted analysis also confirm the significance of the level of the subsidy obtained in the revenue generated from agricultural activities. Additionally, the examined organic farms used subsidies from the programme of preservation of genetic resources of local animal breeds.

To sum up the result analysis, the following conclusions can be drawn:

1. Land productivity on the studied farms was substantially determined by the obtained subsidy.
2. Productivity of the indicators that characterize the machinery was at a level comparable to that of conventional farms [15].
3. Productivity of the labor input in the variant taking into account the subsidy for production was at a satisfactory level.

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