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PRODUCTIVITY AND PROFITABILITY OF PRODUCTION IN AGRICULTURAL FARMS IN PRZYSUCHA DISTRICT FARMING ON LIGHT SOILS[1]

Key words: evaluation, production result, agricultural farm, Przysucha district

ABSTRACT. The purpose of the research was a comparative evaluation of production and economic results of agricultural farms according to area, production direction and intensity of production. The agricultural farms were situated in the Przysucha district (Masovian Voivodship). Results were compared between farms classified as different production directions. Research was carried out in 100 agricultural farms located on light soils – rye complexes. The evaluation was carried out using selected production and economic indices. Information and source data from farms were acquired using direct interviews in the form of a questionnaire. Research objects were intentionally selected from farms from the Przysucha district. Farms were divided into groups with the help of particular evaluation criteria, such as: production specialization, farm area size and intensity of production. On the basis of the research conducted, it was stated that achieving better results depended primarily on the chosen production direction. Orchards and vegetable farms, classified as small farms, due to their type of production, were more intense and achieved a higher value of global commodity production per 1 ha of UAA and production commodity. Relations discovered by the research concern farm specialization and how a farm functions in specified organizational as well as economic conditions.

INTRODUCTION

One of the basic determinants of farming, from a farmer's perspective, is to achieve a production and economic goal. This goal is to produce a sufficient number of agricultural products and ensure satisfactory income [Duer et al. 2002, Fereniec 1999]. Such evaluation shows which farms operate at a satisfactory level and provide parity salary for the farmer's family in comparison with the average income of persons working in other sectors of the national economy.

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The purpose of agricultural activity, as is the case with other economic activities, is to obtain economic benefits. The result of management is the result of the farm's production potential, organization of agricultural production, as well as various types of financial support addressed to agricultural producers. [Musiał et al. 2010, Wrzaszcz 2017]

Wojciech Józwiak [1998] defines the efficiency of management in agriculture as one of the methods of evaluating the functioning of farms, i.e. the relation of effects to the means used. This approach enables the measurement of efficiency using partial synthetic indicators of productivity of resource use.

The economic result of the decisions made by the farmer is the income obtained from the farm, which is a measurable effect of agricultural activity. It is also used to evaluate the value of agricultural production factors, including labour productivity at the farm, in the context of both expanded reproduction capacity and the ability to maintain the family running the farm [Zegar 2008, Goraj 2009].

MATERIAL AND METHODS

The purpose of the research was a comparative evaluation of production and economic results of agricultural farms according to area, production direction and production intensity. The agricultural farms were situated in the Przysucha district. The study assumed the intentional selection of agricultural farms. The study covered 100 family entities located on light soils - rye complexes engaged in commodity production. The selection of farms was made by the employees of the Poviat Agricultural Advisory Team in Przysucha (expert method). The advisers had the task of selecting the agricultural farms best reflecting the most common agricultural types of farms adapted to local conditions.

RESEARCH RESULTS

The farms were classified according to the type of farms and level of selected features as a criterion for division. The specialisation of farm production was determined according to technical and organizational measures adopted by Edward Majewski [2002]. On this basis, 4 types of farms were distinguished, i.e. orchard (24 farms), vegetable (24), mixed (19) and cattle (33). In addition, farms were divided into 3 area groups according to the area of used agricultural land: up to 7 ha (37), 7-15 ha (41) and above 15 ha (22). In the last criterion, as a measure of production intensity, the amount of direct costs related to 1 ha of used agricultural land was assumed and 3 groups of farm were classified as extensive (direct costs below 600 PLN/ha of UAA – 31), average intensity (600-1,200 PLN/ha of UAA – 33) and intensive (above 1,200 PLN/ha of UAA – 36). An important factor affecting the size of agricultural production is quality of soil [Ziętara 2009, Dudzińska 2011]. Due to the fact that the agricultural farms selected for this study manufactured on light soils, with a low bonitation index, soil quality was not taken into consideration.

Land is the basic factor of production in the agricultural farm and can be described by farm size, land use structure and quality [Kołodziejczak 2014, Musiał et al. 2010]. The analysis of production factor resources (land, labor and capital) shows that orchard

farms, compared to other types, were characterized by a smaller area of UAA, dominated by orchards and permanent plantations, better soil quality, more full-time employees and agricultural tractors converted per unit of area. Vegetable farms were distinguished by a large share of arable land in the structure of UAA, and their owners were, on average, younger by about 10 years from farmers managing other groups of specialized farms. Cattle farms were characterized by the largest area of UAA, a large share of permanent grassland, very small orchards and permanent plantations in the structure of agricultural land, the worst soil quality and the lowest number of agricultural tractors per unit of UAA. Mixed production farms were only distinguished by the highest number of combine harvesters per 1 ha of arable land (Table 1).

A study by Maria Orłowska [2010], conducted in various types of agricultural farms in the field of FADN observation, showed that farms specializing in permanent and horticultural crops were small in area. In contrast, farms focused on breeding dairy cows whereby animals fed in the grazing system were significantly larger in area. It should be

Table 1. The resources of basic production factors in farms with different production directions

No.	Specification	Farms in total	Production direction			
			orchard	vegetable	mixed	cattle
I.	Land					
1.	Area of agricultural land [ha]	10.7	6.9	10.8	10.7	13.5
2.	Area of arable land [ha]	6.7	2.1	8.5	6.9	8.5
3.	Area of permanent grassland [ha]	2.3	0.2	0.8	2.7	4.7
4.	Area of orchards and permanent plantations [ha]	1.7	4.6	1.5	1.1	0.3
5.	The structure of UAA [%]:					
	–arable land	62.6	30.4	78.7	64.5	63.0
	–permanent grassland	21.5	2.9	7.4	25.2	34.8
	–orchards and permanent plantations	15.9	66.7	13.9	10.3	2.2
6.	Soil quality [bonitation indicator UAA]	0.6	0.7	0.6	0.6	0.5
II.	Labour resources					
1.	Full-time employees:					
	–in the agricultural farm	2.1	2.0	1.9	2.3	2.1
	–per 100 ha UAA	19.6	29.4	17.6	21.5	15.6
2.	Farmer's age [years]	43.3	45.4	34.8	45.6	46.6
III.	Selected fixed assets					
1.	Farm tractors [pcs.]:					
	–in the agricultural farm	1.2	1.3	1.2	1.2	1.2
	–per 100 ha UAA	11.0	18.8	14.0	11.4	9.0
2.	Combine harvesters [pcs./100 ha of arable land]	0.7	0.0	0.5	2.2	1.4

Source: own study on the basis of farms surveyed

noted that, in typology, according to European Union standards [Augustyńska-Grzymek et al. 2000], orchards (from own research) fall into the category of farms specializing in permanent crops. Vegetables fall into categories depending on the type of horticultural crop, while cattle belong to breeding animals fed in the grazing system. In addition, it should be noted that, in the group of cattle farms observed in own research, a large share of permanent grassland was accompanied by the lowest quality of arable land. Such a relation between permanent grassland and soil quality was also reported by other authors both at national and voivodship levels [Kuś, Krasowicz 2001, Harasim, Matyka 2009], as well as farms [Harasim, Madej 2008, Madej 2013].

Table 2 presents selected production and economic indices characterizing the examined group of farms. Analyzing plant yield in 4 types of agricultural farms, it is observed that farm size slightly differed. Higher cereal yield was characteristic of vegetable farms, size being a result of plant changes and more intensive forecrop fertilization of vegetables.

The assessment of production activity showed that the specialization of farms located on light soils did not affect the yield size of cereals or potatoes. Plantations typical for the direction of specialization (orchards, permanent plantations, vegetable crops) were located on better quality soils, and for the cultivation of cereals and potatoes remained the weakest soils in the farms. In such conditions, the yield of these plants in particular types of farms was at a similar level. The direction of production clearly influenced the indicators of value of commodity and global production per unit of area and productiv-

Table 2. Indicators characterizing production in particular types of agricultural farms

Specification	Farms in total	Production direction			
		orchard	vegetable	mixed	cattle
Yield of selected plants [t/ha]:					
– cereal	3.3	3.2	3.3	3.1	3.2
– potato	17.1	17.8	16.8	17.5	16.9
Milk production*:					
– from 1 cow [l/year]	4,178	0	0	3,203	4,469
– per 1 ha UAA [l]	1,955	0	0	1,102	2,344
Production level [cereal units/ha UAA]:					
– plant	39.6	38.9	38.3	40.1	40.1
– animal	17.9	0	0	26.8	39.0
– agricutural	57.5	38.9	38.3	66.9	79.1
Commodity production [PLN/ha UAA]	7,179	9,421	12,309	4,051	3,621
Global production of farm [PLN/ha UAA]	7,991	9,692	12,423	5,212	5,132
Productivity of production [%]**	89.8	97.2	99.1	77.7	70.6

* concerns farms with production

** productivity of production = commodity production (PLN) / global production (PLN) x 100

Source: own study on the basis of farms surveyed

ity of agricultural production. In the range of analyzed indicators, the examined types of farms can be ranked according to the decreasing value in the following order: vegetable> orchard> mixed> cattle. The value of production in vegetable farms was more than twice as high as that achieved in mixed and cattle farms.

Selected production indices depending on the area of the agricultural farm are presented in Table 3. Cereal yield was the largest in the area group of farms, 7-15 ha (3.8 t/ha), in which there was a large number of vegetable farms and mixed farms. Therefore, higher yield was a result of higher fertilization and better plant shifting. On the other hand, potato yield was the highest (18.7 t/ha) in the group of farms with an area of over 15 ha of UAA. However, it should be emphasized that the potato was not cultivated in all farms, and its share in the structure of sowings was rather as a vegetable plant, not a fodder plant. It was often grown for the farm's own needs, in small areas, but also as a commercial product. Farms above 15 ha were, to a large extent, linked to livestock production, especially dairy cattle. For this reason, they also had more manure resources, which has a positive effect on potato yield.

The size of the agricultural area of the farm had a beneficial influence on the volume of milk production and the value of agricultural production expressed in cereal units. It unfavorably affected the value of commodity and global production related to the unit of area and the marketability of production. Along with an increase in the area of the

Table 3. Production indicators depending on the area of the agricultural farm

Specification	Farms in total	The size of the farm [UAA area in ha]		
		< 7	7-15	> 15
Yield of selected plants [t/ha]:				
–cereals	3.3	3.2	3.8	3.3
–potato	17.1	16.9	15.6	18.7
Milk production:*				
–from 1 cow [l/year]	4,048	3,415	3,738	4,704
–per 1 ha UAA [l]	1,936	1,837	1,511	2,415
Production level [cereal units/ha UAA]:				
–plant	39.6	42.2	35.2	43.4
–animal	17.9	13.4	13.8	33.2
–agricultural	57.5	55.6	49.0	76.6
Gross agricultural income [thous. PLN]:				
–per farm	56.3	36.3	58.2	86.5
–per 1 ha of UAA	5.2	7.8	5.9	3.8
–per 1 full-time employee	27.3	18.3	27.3	42.2
Commodity production [PLN/ha UR]	7,179	8,688	7,467	4,188
Global farm production [PLN/ha UAA]	7,991	9,289	8,349	5,596
Marketability of production [%]**	89.8	93.5	89.4	74.8

* and ** see table 2

Source: own study on the basis of farms surveyed

analyzed farms, the gross agricultural income, calculated per 1 full-time employee, also increased, yet decreased in 1 ha of UAA.

The calculation of the correlation between the area of agricultural land of farms (expressed in ha) and production and economic indicators point to the occurrence of specific dependencies. The area of arable land had a significant positive impact on economic indicators (income) in vegetable, mixed and cattle farms (Table 4). In conditions of increasing area of agricultural farm land, values of indicators increased. Economic income was strongly correlated with personal income.

The impact of arable land area on economic indicators in orchards was not significant (tab. 4). Particularly in the case of vegetable and mixed farms, it can be noticed that the larger the UAA area allocated to the production of vegetables, the greater the income

Table 4. Relation of selected indicators on the area of farmland in farms

Dependent variables (indicators)	Correlation coefficients (r) for farms			
	orchard (n = 24)	vegetable (n = 24)	mixed (n = 19)	cattle (n = 33)
Y_1 – commodity production	0.09	-0.23	-0.26	0.09
Y_2 – direct costs	0.30	-016	0.02	0.14
Y_3 – gross agricultural income	0.29	0.78*	0.72*	0.59*
Y_4 – personal income	0.33	0.83*	0.72*	0.63*
Y_5 – parity of income	0.25	0.72*	0.68*	0.57*

* correlation significant at a = 0.05
Source: own study on the basis of farms surveyed

Table 5. Regression equations describing important relationships between the studied indicators and the area of agricultural land in particular types of farms

Indicators (dependent variables)	Regression equation	R^2	Correlation coefficient (r)*
Vegetable farm			
Gross agricultural income	Y3 = 28,584 + 2,563x	0.61	0.78
Personal income	Y4 = 36,736 + 3,039x	0.69	0.83
Parity of income	Y5 = 57,451 + 4,413x	0.52	0.72
Mixed farms			
Gross agricultural income	Y3 = -4,409 + 3,242x	0.52	0.72
Personal income	Y4 = 8,360 + 3,599x	0.52	0.72
Parity of income	Y5 = -9,744 + 5,594x	0.46	0.68
Cattle farms			
Gross agricultural income	Y3 = -9,826 + 3,293x	0.35	0.59
Personal income	Y4 = 7,493 + 3,994x	0.40	0.63
Parity of income	Y5 = -18,477 + 5,924x	0.32	0.57

* correlation significant at a = 0.05
Source: own study on the basis of farms surveyed

achieved. In cattle farms, a larger area of arable land allowed for maintaining a larger herd of cattle, which contributed to higher income. The impact of arable land area on the profitability of holdings for material interdependencies is also presented in the form of linear regression equations (Table 5).

In the economic assessment, both agricultural and personal income clearly depended on the size of the farm. An increase in area increased income per household, was related to more full-time employees and more working hours, while the costs related to 1 ha of UAA decreased. Parity of income was achieved by farms with an area of over 15 ha of UAA. The study by Teresa Miś [2010] also shows that the largest income from both the farm and full-time employee, as well as other favorable economic indicators are achieved by the largest farms.

The production direction of the surveyed farms exerted a significant influence on the income achieved. Vegetable farms had an advantage over others in terms of economic indicators achieved, i.e. agricultural and personal income as well as income parity. The lowest income was achieved by mixed farms. FADN accounting holdings showed similar dependencies of income related to production direction [Orłowska 2010]. The most

Table 6. Production indicators depending on intensity of production (level of direct costs)

Specification	Farms in total	Intensity of production (direct costs in PLN/ha of UAA)		
		extensive (< PLN 600)	average intensity (PLN 600-1,200)	intensive (> PLN 1,200)
Yield of selected plants [t/ha]:				
- cereals	3.3	3.1	3.3	3.2
- potato	17.1	16.8	17.9	16.3
Milk production:				
- from 1 cow [l/year]	4,048	3,146	4,114	4,197
- per 1 ha of UAA [l]	1,936	1,020	1,573	2,755
Production level [cereal unit/ha of UAA]:				
- plant	39.6	35.1	39.3	43.7
- animal	17.9	27.7	28.4	0.3
- agricultural	57.5	62.8	67.7	44.0
Gross agricultural income [thous. PLN]:				
- per farm	40.1	28.1	40.0	54.3
- per 1 ha of UAA	3.7	2.4	2.9	6.4
- per 1 full-time employee	19.5	12.7	18.3	26.7
Commodity production [PLN/ha of UAA]	7,179	3,489	4,656	12,721
Global farm production [PLN/ha of UAA]	7,991	4,682	5,542	13,546
Marketability of production [%]	89.8	74.5	84.0	93.9

Source: own study based on the surveyed farms

profitable were farms specialized in horticultural crops, dairy cows and grazing animals, while mixed farms had the lowest income. Among the farms surveyed by Teresa Pokrzywa [2003], cereal farms were the most profitable, followed by vegetable, orchard and pig farms, while the most unprofitable turned out to be one-way cattle production. In terms of the size of agricultural income per 1 ha of UAA, the predominance of vegetable and orchards over cereal and cattle was very high (income ratio 4-5: 1). However, the research of Alina Syp and Franciszek Wocha [2010] showed that the highest profitability rates of production factors were held by farms specializing in milk production, and the lowest – by farms with field crops (vegetable crops).

Production indices were also analyzed in terms of the amount of direct costs incurred (Table 6). In the majority of selected analysed elements, such as: milk production, level of crop production, commodity and global production as well as marketability of production, the highest values were achieved in the group of intensive production farms, i.e. bearing the largest direct costs on agricultural production. The amount of direct costs did not have a clear impact on the yield of cereals or potatoes.

Analyzing the agricultural income obtained by farmers depending on the intensity of production, it can be concluded that, along with intensity of production, the income obtained also increased. The largest income per farm, 1 ha of UAA and full-time employee, was achieved by the most intensive farms.

Table 7. Dependence of selected indicators on intensity of production (direct costs in PLN /ha of UAA) in particular types of agricultural farms

Dependent variables (indicators)	Correlation coefficients (r) for farms			
	orchard (n = 24)	vegetable (n = 24)	mixed (n = 19)	cattle (n = 33)
Y1 – commodity production	0.60*	0.82*	0.42	0.47
Y2 – gross agricultural income	0.47	0.16	0.11	0.36
Y3 – personal income	0.39	0.11	-0.11	0.34
Y4 – parity of income	0.42	0.19	0.16	0.38

* correlation significant at a = 0.05
Source: own study on the basis of farms surveyed

Table 8. Regression equations describing important relationships between the examined indicators and intensity of production in particular types of agricultural farms

Indicators (dependent variables)	Regression equation	R^2	Correlation coefficient (r)*
Orchards			
Commodity production	Y1 = 4,725 + 2,911x	0.36	0.60
Vegetable farms			
Commodity production	Y1 = 3,782 + 3,425x	0.67	0.82

* correlation significant at a = 0.05
Source: own study on the basis of farms surveyed

Data contained in Tables 7 and 8 indicate that intensity of production, measured by the level of direct costs, correlated significantly positively with the value of commodity production in orchards (r = 0.60) and vegetable farms (r = 0.82). In the case of mixed and cattle farms, none of the indicators were significantly correlated with intensity of production.

SUMMARY

Summing up the results of research carried out in the production of agricultural farms farming on light soils in the district of Przysucha, it can be concluded that:

1. Average cereal yield was most advantageous in medium-sized farms with an area of 7-15 ha of UAA, while, in the case of the potato, on larger farms (> 15 ha of UAA) and with medium-intensive input. Milk production per cow and per 1 ha of used agricultural area was the greatest in larger farms (> 15 ha of UAA) and with more intensive input. The highest level of agricultural production expressed in cereal units was achieved in larger farms (> 15 ha of UAA), with medium intensive input, and the value of this indicator depended significantly on the level of animal production.
2. The increase in the area of analyzed farms positively influenced gross agricultural income calculated per 1 full-time employee and per household, yet decreased on 1 ha of UAA.
3. Achieving better production results depended primarily on the chosen production direction. Orchards and vegetable farms, classified as small farms, due to their type of production, were more intense and achieved a higher value of commodity and global production per 1 ha of UAA, as well as a larger marketability of production. Higher intensity of production contributed to achieving greater commodity and global production.
4. The area of agricultural land significantly positively affected the income of vegetable, mixed and cattle farms. Intensity of production measured by direct costs (PLN / ha of UAA) significantly shaped commodity production in orchards and vegetable farms.

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WYDAJNOŚĆ I DOCHODOWOŚĆ PRODUKCJI W GOSPODARSTWACH ROLNICZYCH W POWIECIE PRZYSUCHA GOSPODARUJĄCYCH NA GLEBACH LEKKICH

Słowa kluczowe: ocena, wynik produkcyjny, gospodarstwo rolne, powiat Przysucha

ABSTRAKT

Celem opracowania była ocena porównawcza wyników produkcyjno-ekonomicznych gospodarstw rolnych ze względu na ich powierzchnię, kierunek produkcyjny i intensywność produkcji. Gospodarstwa położone były w powiecie Przysucha (województwo mazowieckie). Porównano wyniki między gospodarstwami zaliczonymi do różnych kierunków produkcji. Badania przeprowadzono w 100 gospodarstwach rolnych położonych na glebach lekkich – kompleksów żytnich. Oceny dokonano za pomocą wybranych wskaźników produkcyjnych i ekonomicznych. Metodą pozyskiwania informacji i danych źródłowych z gospodarstw był wywiad bezpośredni z wykorzystaniem kwestionariusza. Zastosowano celowy dobór obiektów do badań spośród gospodarstw powiatu Przysucha. Podział badanych gospodarstw na grupy przeprowadzono w obrębie poszczególnych kryteriów oceny, którymi były kierunek produkcji, wielkość powierzchni gospodarstw i intensywność produkcji. Na podstawie przeprowadzonych badań stwierdzono, że osiąganie lepszych wyników zależało przede wszystkim od wybranego kierunku produkcji. Gospodarstwa sadownicze i warzywne zaliczone do gospodarstw małych, z racji typu swojej produkcji były intensywniejsze i osiągały większą wartość produkcji towarowej globalnej na 1 ha UR oraz towarowość produkcji. Zależności wykazane w badaniach miały związek ze specjalizacją gospodarstw i ich funkcjonowaniem w określonych warunkach organizacyjno-ekonomicznych.

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