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PRODUCTIVITY OF TECHNICAL OPERATING RESOURCES ON FARMS ASSOCIATED IN PRODUCER GROUPS

Anna Szeląg-Sikora, Jakub Sikora, Urszula Malaga-Toboła, Sylwester Tabor
University of Agriculture in Krakow

Abstract

The objective of the study was comparative analysis of production and technical circumstances of the functioning of two producer groups aimed at pig production. A significant difference between the compared producer groups was observed, in the group from (G1) mean livestock size was 48.93 LU·ha^{-1} AL. Whereas in the second group (G2), the livestock was at the level of only 19.45 LU·ha^{-1} AL. Within the compared groups (G1; G2) a significant discrepancy between the number of some machines is noticeable, such as: manure spreader, seeder, rotary mower, collecting balers. Farms of the G2 group had more extensively equipped machine stocks and the difference primarily stems from the size of the cultivated area AL, since in the producer group of (G2) the mean AL value was 30.80 ha and only 17.30 ha in the second studied group (G1). The conducted detailed analysis allowed to demonstrate that the group from Pałecznica (G1) should be assessed as the better one in terms of the productivity of fixed resources. In this group, the fixed resource productivity index indicates, that 1.07 thousand PLN·ha^{-1} AL of the production value corresponds to 1 unit of fixed resource value, i.e. 1 thousand PLN·ha^{-1} AL, whereas in the compared G2 group, the value was over half lower.

Keywords: machine stock, gross final production, gross replacement value

INTRODUCTION

Unfavourable structure of the agricultural production indicates the validity and necessity for development of all forms of cooperation between producers, both in the form of horizontal integration (e.g., agricultural producer groups, machinery sharing cooperatives) as well as vertical integration (relationships between producers and recipients, processors of agricultural raw materials). In order to change the situation, an acceleration of the integration processes should be pursued. The constitute the indispensable condition of agriculture modernization and improvement of its efficiency under the conditions of fragmented agricultural structure in Poland, multi-directional farm production, high prices of production resources (Bachev 2004, Cupiał 2006, Sikora 2009). The availability of modern and efficient agricultural equipment is one of the fundamental factors of efficient agricultural production. The level of this equipment and modernity of the used mechanization resources also constitutes one of traits of economic development of individual farms (Muzalewski 2000), which influences the constant need for modernization of agricultural machinery, particularly on commercial farms. At the same time it should be noted, that the purchase of machines and agricultural tractors is linked to the capital invested in them for many years of their usage, and the consequence of a misguided investment may be deterioration of the financial result of a farm. The above conditions determine the need for a rational planning of machine investments, taking into consideration the appropriate intensity and forms of machine usage. This is particularly significant in the conditions of fragmented Polish agriculture, characterized by low investment capabilities and on the other hand the lack of possibility for intensive usage of machines on limited area of individual farms (Figurski and Lorencowicz 2008). Under such circumstances, the proper management of machine and tractor stock gains a significant importance (Muzalewski 2010). One of the indices characterizing the level of farm equipment with machine stock is the sum of power installed in the energy resources. Mechanical tractive force is the most important in a machine stock structure, because it significantly decides on the usage of accompanying machines. Thus, it indirectly influences the timeliness and quality of production processes and the level of expenditures, and eventually, the obtained production efficiency (Szeptycki 2005).

The objective of this study was comparative analysis of production and technical circumstances of two producer groups aimed at pig production. Both groups operate in neighbouring localizations, and thus have similar conditions for space management. Due to the lack of information in the available literature on the cost-efficiency of producer groups directed at animal production, an analysis of the calculated indices for the entire sample {G1;G2} was also

performed. The detailed objective was determination of productivity of technical operation resources.

Characteristics of farms associated in producer groups included in the study

The study conducted on the first producer group (G1) demonstrates, that all farms were located in the district of Proszowice, with the group's office in Pałecznica. In the case of the second producer group (G2) included in the study, all ten farms were located in the Miechów district. Among these, six farmers operated inthe municipality of Książ Wielki, in which the office of the group was located (Tochołów – 4, Głogowiany-Wrzosy – 2), three in the Miechów municipality (Brzuchania – 3) and the neighbouring Słaboszów (village of Święcice) (Figure 1). The location of farms is not accidental. The Agricultural Producer Groups Act determines the conditions for locations of group members. The main criterion for the selection of producer groups was the same production objective, however due to the performed comparative analysis, the neighbourhood of their locations was also significant, which is linked to identical farming conditions.

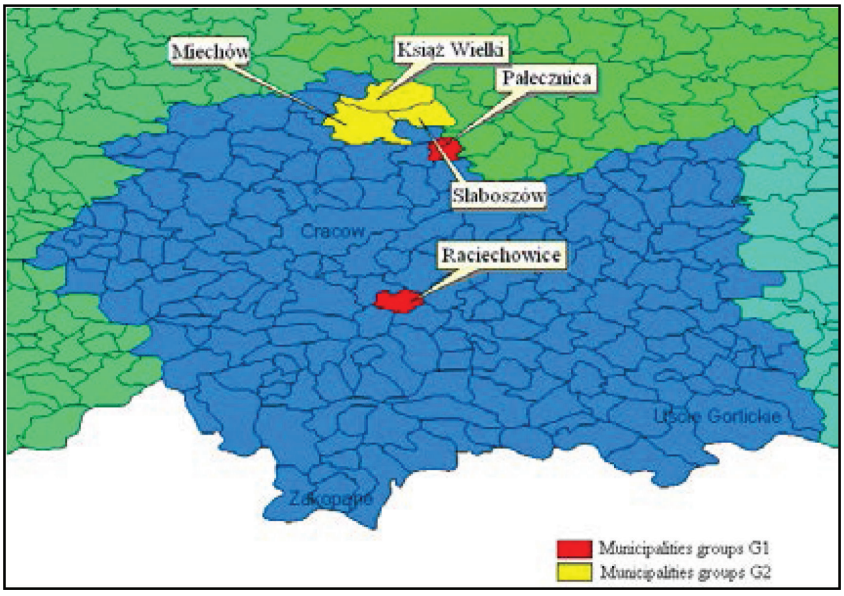

Figure 1. Location of the studied farms

Based on Figure 1 it can be noted o that all the farms included in the study have arable lands in their structure. The study demonstrated, that the average ar-

able land area was 98.5% of the agricultural land surface area, whereas pastures only 1.44%. Only in the group from Książ Wielki land area used as pastures was reported. This was related to the additional milk production in one of the group members. In the group from Pałecznica the cultivation structure was dominated by arable lands, and the run plant production was related solely to the provision of the animals in the breeding facility with feed. All the harvested crops were used for own needs. Cereal cultivation occupied 77.6%, root vegetables 19.9% and fodder plants only 1% of the total arable land area. On the other hand, in the second group (Książ Wielki) the same plant groups were included in the arable lands in the following composition: cereals (87.5%), root vegetables (5.5%) and fodder plants (2%). The collected source data allow to determine, that the most commonly cultivated cereals were: winter wheat, spring barley and triticale. Half of the all studied farms cultivated root vegetables and their mean cultivation area was only 0.35 ha.

The obtained results indicate considerable difference in the average agricultural land surface area for the compared groups. Mean AL area of a farm from G1 is 17.63 ha and is over 13 ha smaller than in the compared G2 group (table.1).

Table 1. Characteristics of the studied producer groups (G1; G2)

Specification		Mean	Producer group:	
			G1	G2
Plant production area (ha)				
Arable land		22.57	17.63	29.98
including:	Cereals	18.70	13.68	26,23
	root vegetables	2.76	3.50	1,65
	fodder plants	0.33	0.18	0,60
Pastures		0.33	–	0.82
Agricultural lands		22.90	17.63	30.80
Livestock on the studied farms (LU·ha^{-1} AL)				
Total		37.14	48.93	19.45
Pigs		36.81	48.93	18.64
Cattle		0.33	–	0.82
Gross final production (PLN thousand·ha^{-1} AL)				
Total		23.80	37.56	11.70
including: direct payments		0.94	0.94	0.93
gross plant final production		5.40	6.33	4.59
gross animal final production		18.30	31.23	7.11

The main criterion, which was the basis for the formation of both analyzed producer groups was production of fattening pigs for slaughter, on each of the associated farms. Data presented in table 1 indicate, that the average livestock size for the studied facilities was 37.14 LU·ha^{-1} AL, including cattle, which constituted additional production. A considerable difference between the compared producer groups is visible. It can be observed, that the group from Pałecznica (G1) is focused in 100% on the production of pigs, and the mean livestock size was as high as 48.93 LU·ha^{-1} AL. On the other hand, in the second group the livestock size was 19.45 LU·ha^{-1} AL, out of which pigs constituted 96% of the livestock, the remaining 4% was cattle production, which constituted additional production on one farm (0.82 LU·ha^{-1} AL). Moreover, one farm of the G2 group produced and sold piglets for fattening.

The basic, output index, which enables determination of the productivity of individual agricultural production factors is the gross final production index. It is production category which illustrates the production size of the studied producer groups, informs on the value of the main products and side products, determined according to market prices increased by the payment value and with subtraction of all incurred losses.

The mean gross final production value of agricultural lands in the studied groups is 23.80 PLNthousand·ha^{-1} AL. The difference in the mean values of the examined index between both groups is as much as 25.86 PLN thousand·ha^{-1} AL. The main differentiating element was the value of gross final production from the animal production. Two remaining components of the total value of the discussed production category, i.e. gross final animal production and the value of obtained payments, were at similar levels.

MATERIALS AND METHODS

The study was conducted in the form of directed interview, during which a beforehand questionnaire was used, allowing for collection of the necessary source data for the production year 2013/2014. The study encompassed two producer groups, associating farmers whose production was directed at live pig breeding.

Then, calculations of the selected indices characterizing the productivity of technical operation resources and energy saturation were made. However, for these to be possible, firstly the output indices were calculated, i.e. gross final production, gross machine stock replacement value, the index of the power installed in technical operation resources, and the selected data were compared (agricultural land area, livestock size, quantitative equipment of the machine stock). This allowed to illustrate the farming conditions of the producer groups, i.a. in order to conduct the comparative analysis within the studied groups.

Calculated indices:

Gross final production (in PLN) – constitutes the sum of the obtained plant and animal production value, it included: value of the main product, value of the side product (only in the case when it constituted marketed goods), value of internal crop consumption, payments for the product or the area of its cultivation, production value in the case of individual operation of plant production was calculated for 1 ha AL (Augustyńska-Grzybek, 1999).

Large conversion unit (LU) – conventional unit corresponding to animal with body weight of 500 kg or a number of animals with total body weight of 500 kg.

Quantitative machinery equipment (qty·farm^{-1}, qty×ha $^{-1}$ AL), was assumed as a summary of basic machines used in individual technological processes, both in plant and animal production.

Gross machine stock replacement value (PLN thousand×ha^{-1} AL) the current value of new or similar fully operational machines without taking into consideration of their physical and economic wear (Kowalski *et al.*, 2012).

Energy saturation index (kW×ha $^{-1}$ AL) of farm is the total power of tractors, self-propelled machines, with which farm was equipped and other devices with own energy source was assumed, converted into the AL surface area unit.

Fixed resource productivity index, a dimensionless index determines – what gross final production value corresponds to 1 unit of fixed assets value expressed by the index of gross replacement value (Szeląg-Sikora 2014).

Energy saturation productivity index (PLN thousand×kW**)** of farm is the ratio of gross final production value to energy saturation index value.

STUDY RESULTS

Productivity of selected technical operation resources in the studied producer groups

Table 2 demonstrates, i.a. quantitative equipment of the studied producer groups with individual machines and devices, with which they were equipped. All the farms have at least 2 agricultural tractors in their machine stock (mean 2.24 qty·farm^{-1}), one trailer (1.40 qty·farm^{-1}) and plough (1.12 qty·farm^{-1}). Such a number of tractors is not accidental, because in the majority of field work a cooperation between two tractors is necessary, leading to a significant reduction in time intended for the field work. Within the compared groups, a considerable discrepancy between the number of some machines, such as: manure spreader, seeder, rotary mower, collecting balers, is observed. This difference primarily stems from the run plant production, since in the producer group of Książ Wielki the mean AL size was 30.80 ha, whereas in the second studied group 17.30 ha.

By analyzing the frequency of the occurrence of technical resources in the individual groups it can be observed, that in the group from Książ Wielki machines such as: agricultural tractor, combine harvester, trailer, plough, cultivation aggregator, manure spreaders, fertilizer sower and seeder constituted the equipment of each farm.

Table 2. Characteristics of selected machines and tools which constitute elements of the machine stock (qty·farm^{-1})

Specification	Mean	Producer group:	
		G1	G1
Agricultural tractors	2.24	2.07	2.50
Combine harvester	0.87	0.73	1.00
Trailers	1.40	1.07	1.90
Ploughs	1.12	1.00	1.30
Cultivation aggregators	0.84	0.73	1.00
Manure spreaders	0.76	0.53	1.10
Fertilizer sowers	0.76	0.60	1.00
Seeders	0.70	0.40	1.00
Precision seeders	0.40	0.60	0.10
Automated planters	0.52	0.53	0.50
Sprayers	0.88	0.93	0.80
Rotary mowers	0.16	0.07	0.30
Chaff cutters	0.05	0.00	0.10
Collecting balers	0.45	0.20	0.70
Potato harvesters	0.52	0.53	0.50
Gross machine stock replacement value (PLN thousand·ha^{-1} AL)			
Total	31.80	35.00	23.30
Tractor	14.80	17.00	7.20
Self-propelled	7.83	12.50	4.80
Other	8.10	5.50	11.30
Energy saturation index (kW·ha^{-1}AL)			
Total	8.10	9.97	6.80
Tractor	5.87	6.78	4.50
Self-propelled	1.83	2.79	2.00
Other	0.40	0.40	0.30

Farmers associated in the pig producer groups direct their plant production at the cereal cultivation. As an effect, the harvested crops constituted the main component of fodder for the breeding stock. However, in the producer group of Pałecznica some farmers did not have the equipment needed for this cultivation. As declared by individual farmers, this state resulted from the considerable co-operation between individual members, who mutually carried out services for their partners from the group. Such cooperation has advantages i.a. the financial capital in is not "frozen" the technical operation resources, which is often used for the maximum of only several hours each season (this particularly applies to the most expensive self-propelled machines, i.e. combine harvesters). The farmers from the group of Książ Wielki (G2) worked individually, each possessed the equipment needed for cultivation. In this group, no physical cooperation between members was declared, which was linked to the greater scale of own crops and the possession of the equipment necessary for given cultivation direction in own machine stock. Thus, the sole objective of the creation of the group was joint distribution of the live pigs to markets.

Each farm should include basic agricultural machines. The most important element of a machine stock is the tractive force, which is indispensable for the usage of the remaining machines and agricultural devices. The total replacement value of the tractors and self-propelled machines and other machines and devices possessed in the farms for both groups was average 30.11 PLN thousand·ha^{-1}AL. almost half of which (14.18 PLN thousand·ha^{-1} AL) were agricultural tractors, quarter for the self-propelled machines (7.83 PLN thousand·ha^{-1} AL) and quarter for the other machines (8.10 PLN thousand·ha^{-1} AL). By comparing both studied groups, the greatest differences can be observed in the value of tractors and self-propelled machines. For comparison, in G1 the values of individual components of the index were higher by: 64% in the case of tractors and 35% in the case of self-propelled machines. In the case of the analyzed unit replacement value, a significant role was played by the surface area of agricultural lands in a group, i.e. the assumed conversion unit, which was significantly higher in G2.

According to studies of numerous authors (Mróz, 2006; Szeląg-Sikora, 2013, Sikora 2014) the share of individual machines is diverse in the structure of energy saturation, but the dominant role is played by tractors. The group of energy resources includes agricultural tractors, cars, combine harvesters and other field self-propelled machines, but also loaders and lifters, microtractors, electric thermal devices. The above resources should be adjusted to the production circumstances and also fully ensure the assumed work technologies. Given that the most important technical index characterizing the possessed mechanical tractive force is the value of power installed in agricultural tractors, a comparative analysis of this index was conducted. Almost all agricultural machines and devices (passive and active) found in a machine stock of each farm require mechanical tractive force for their usage. A detailed structure of power installed in machine

stock is presented in Table 2. The mean power of machine stock remains at the level of 8.10 kW·ha^{-1} ha AL, out of which number tractors account for 68% of total power. Self-propelled machines obtained 1.83 kW·ha^{-1} ha AL, and other machines only 0.40 kW·ha^{-1} ha AL.

Table 3. Productivity of selected technical operation resources

Specification	Mean	Producer group:	
		G1	G1
Fixed resource productivity index	0.75	1.07	0.50
Energy saturation productivity index (PLN thousand·kW^{-1})	2.94	3.77	1.72

The Pałecznica group (G1) can be assessed more favourably for the fixed resource productivity (Table 3). In this group, the fixed resource productivity index indicates, that 1.07 PLN thousand·ha $^{-1}$ AL of production value corresponds to 1 unit of fixed resource value, i.e. 1 PLN thousand·ha^{-1} AL. For comparison, on farms in the second group the "capabilities" of the assets invested in the machine stock for the income generation was at the level of only 0.50 PLN thousand·ha^{-1}AL. Analogously, a favorable situation was observed by analyzing the productivity index of the energy saturation. The conducted production of the G1 producer group with the use of energy saturation index of 9.91 kW·ha^{-1} AL allowed for the obtainment of energy saturation productivity index of 3.77 PLN thousand·kW^{-1} and it was 2.05 PLN thousand·kW^{-1} higher than on the farms of the G2 group (Table 3).

CONCLUSIONS

1. By conducting the comparative analysis it was determined, that the producer group G1 run a more efficient production, which as an effect, translated into higher productivity of the financial resources invested in the possessed machine stock.
2. Although the G1 group had smaller agricultural land area, it also possessed higher power resources installed in the machines and devices used in the agricultural production, and thus the energy saturation productivity index also exhibited more favourable value (2.05 PLN thousand·kW^{-1} higher).
3. The basic and most common resource enabling the production intensification are land resources. However, the farms from Pałecznica (G1), while having lower farming area (AL) at their disposal as compared to the compared group from Książ Wielki (G2) and smaller machine

stock, were characterized by better cost-effectiveness which is demonstrated by the calculated values of individual indices, particularly the gross final production.

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Dr hab. inż. Anna Szeląg-Sikora,
Dr inż.Jakub Sikora
Dr hab. inż. Urszula Malaga-Toboła,
Dr hab. inż. Sylwester Tabor prof. UR,
University of Agriculture in Krakow
Institute of Agricultural Engineering and Informatics
Balicka str. 116 b,
30–149 Kraków,
Anna.Szelag-Sikora@ur.krakow.pl, Ph. +48 12 662 46 18

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