Paweł KOŁOSOWSKI, Tomasz K. DOBEK
Szczecin West Pomeranian University of Technology
The Chair of Technical Equipment Construction and Use
e-mail: tomasz.dobek@zut.edu.pl

COMPARISON OF ECONOMIC EFFICIENCY RELATED TO THE PRODUCTION OF WINTER TRITICALE IN FARMS WHICH USE DIFFERENT VARIANTS OF FERTILIZATION

Summary

The intensification of livestock production in our country, forces farmers to search for optimum manners to manage by-products such as slurry or manure. The traditional manner consists in their use as fertilizer. Although such an approach has obvious advantages, well known for many years, it involves an increase in operating costs, which may outweigh the profitability of the use of natural fertilizers. Based on the results of the economic analysis related to the production of winter triticale, in two neighbouring farms, an increase in production costs of winter triticale was found out, arising from the application of slurry. However, the farm using slurry, owing to higher crop, achieved more profit and in consequence featured a factor of economic efficiency on average higher by 0.1.
***Key words**: pig slurry, winter triticale, economic efficiency*

PORÓWNANIE EFEKTYWNOŚCI EKONOMICZNEJ PRODUKCJI PSZENŻYTA OZIMEGO W GOSPODARSTWACH STOSUJĄCYCH RÓŻNE WARIANTY NAWOŻENIA

Streszczenie

Intensyfikacja produkcji zwierzęcej w naszym kraju, zmusza producentów rolnych do poszukiwania optymalnych sposobów zagospodarowania powstających produktów ubocznych takich jak: gnojowica czy obornik. Tradycyjnym sposobem ich wykorzystania jest wykorzystanie nawozowe. Pomimo niewątpliwych, znanych od wielu lat zalet takiego podejścia, wiąże się to ze wzrostem kosztów eksploatacyjnych, które mogą zaważyć na opłacalności stosowania nawozów naturalnych. Na podstawie wyników analizy ekonomicznej produkcji pszenżyta ozimego, w dwóch sąsiadujących ze sobą gospodarstwach stwierdzono wzrost kosztów produkcji pszenżyta ozimego na skutek stosowania nawożenia gnojowicą. Jednak gospodarstwo stosujące gnojowicę dzięki wyższym uzyskiwanym plonom osiągało większy zysk, a w konsekwencji cechowało się wyższym średnio o 0,1 współczynnikiem efektywności ekonomicznej.
***Słowa kluczowe**: gnojowica świńska, pszenżyto ozime, efektywność ekonomiczna*

1. Introduction

Pig breeding is an important branch of the development of Polish agriculture. However, the pig population in Poland has been steadily declining [1]. Such factors as: the archaic structure of Polish agriculture, unsatisfactory level of education of a significant percentage of young farmers, and high cereal prices, and entailed by them also prices of feeds [2] foster this phenomenon. It needs noting that the lower limit of the production scale at which the farmer can count on profitability will be shifted up [3]. This is the consequence of the intensification of production. Increased animal stocking raises the problem of natural fertilizers managing, slurry included. Slurry shall be considered as a good-quality fertilizer, however, its use with disrespect for the need to protect the natural environment is a serious threat to the environment [4, 5]. Natural fertilizers can be used in the production of cereals to some extent [6]. Triticale is one of the cereals species, whose fertilizing may be supplemented with slurry. The plant is of great economic importance. In the structure of crops in Poland, it is in the second place, second only to wheat [7]. Winter triticale has significant nutritional needs, which can be ensured only with the use of high doses of fertilizers [8]. The alternative chance to use slurry is particularly valuable in the light of steadily rising prices of fertilizers [9]. However, organic fertilization involves high outlays, which could outweigh the profitability of this operation.

The aim of the study is to determine the economic efficiency of the production of winter triticale in farms, using different variants of fertilization.

2. Materials and Methods

An analysis of the economic production of winter triticale was carried out in two farms located in the West Pomeranian Province. The study was conducted in the seasons of 2012/2013, of 2013/2014 and 2014/2015. The analyzed farms operate in similar soil and climatic conditions. The plots of land, they use, adhere to each other. They belong mainly to soil quality class V and VI. Their development is made difficult by the low productivity and, in addition, by their mosaic nature. They use machinery and equipment of comparable parameters. In addition, they closely cooperate while buying fuel and the means and materials for production, thus, the necessary raw materials are of a similar class, acquired at similar prices. Due to a similar type of machines held, similar technologies of crop production are applied in the analyzed farms, which also refers to the organization of work. One farm has 52 hectares of arable land (farm A) and the other 48 hectares (Farm B).

Table 1. Comparison of winter triticale production technologies in the analyzed farms

Farm A		Farm B	
Deadline	Treatment	Deadline	Treatment
August/2	Harrow	August/2	Harrow
August /3	Ploughing	September/1	Slurry fertilizing
September/2	Spreading fertilizers	September /1	Ploughing
September/2	Sowing	September /2	Spreading fertilizers
October/2	Herbicide treatment	September /2	Sowing
March/1	Top fertilizing I	October/1- October /3	Herbicide treatment
March/3-April/1	Fungicide treatment I	March/1	Top fertilizing I
March/3	Top fertilizing II	March/3-April/1	Fungicide treatment
May/2	Top fertilizing III (season: 2013/2014 and 2014/2015)	April/1	Top fertilizing II
May/3	Fungicide treatment II	May/2	Fungicide treatment II (season: 2013/2014 and 2014/2015)
August/1	Harvest	August/1	Harvest

Source: own work

Table 2. Direct costs incurred by the farms analyzed

Farm	Season	Fuel	Labour	Operation	Materials	Sum
		$zł \cdot ha^{-1}$	$zł \cdot ha^{-1}$	$zł \cdot ha^{-1}$	$zł \cdot ha^{-1}$	$zł \cdot ha^{-1}$
Farm A	2012/2013	279,59	53,54	528,12	865,29	1726,53
Farm B		347,53	71,13	650,65	1046,00	2115,31
Farm A	2013/2014	300,72	64,27	543,52	1257,07	2165,57
Farm B		365,74	85,18	694,49	1252,78	2398,19
Farm A	2014/2015	243,64	68,20	555,39	1294,50	2161,72
Farm B		296,31	77,20	741,53	1225,98	2341,03

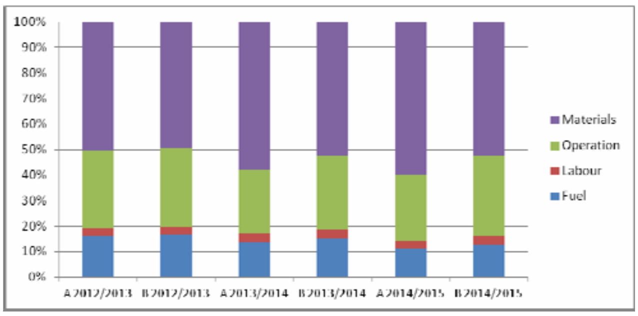
Source: own work

The main feature, distinguishing to a large extent, crop production technologies in both farms is pre-sowing application of pig slurry by one of them (Farm B, brought from a pigs fattening unit in the neighbourhood while farm A used only mineral fertilizers (Table 1).

An economic analysis of winter triticale production technologies was carried out in accordance with the methodology developed by Muzalewski [10]. It included the calculation of direct costs incurred by both analyzed farms, revenue derived from the sale of the obtained raw materials and then, their list. Expenses incurred for the purchase of fuel and materials as well as operational costs of machinery and equipment and labour costs were specified in the analysis. In order to picture the differences in the cost structure of the machinery and equipment operation, they were broken down, into costs of various treatments running, including the cost of fuel and human labour used. After the costs incurred were collated with the revenue from the sale of grain, the coefficient of production of winter triticale economic efficiency was calculated along with the profit of both farms.

3. Results

The production costs of winter triticale in the analyzed farms were at different levels. The use of slurry by farm B resulted in an increase in almost all elements of the structure of production costs. In both farms most outlays referred to the purchase of materials and raw materials for production. On average, in farm A, they made up about 56% of the total cost, while in farm B approximately 51%. High top fertilizing with nitrogen on farm B in season 2012/2013 contributed to a substantial increase in its cost level indicator. In consequence, the costs of materials incurred by farm B exceeded by 200 zloty those incurred by farm A. In the next season, these outlays are almost the same, and then, the spending of farm A on materials and raw materials exceeds that incurred by farm B. Another group of costs incurred by both farms were expenses connected with the operation of machinery and equipment. On average, in both farms, they made up 29% of the outlays incurred. On farm B, applying natural fertilizer machinery and equipment operating costs were higher by 153 zl/ha. Fuel costs were higher in farm B, like the operating costs of machinery and equipment. In both farms, fuel was also an important expense of about 14%, but farm B had to spend on it an average of 53 $zl \cdot ha^{-1}$ more of its resources. The least element of production of triticale cost structure concerns the costs of human labour.

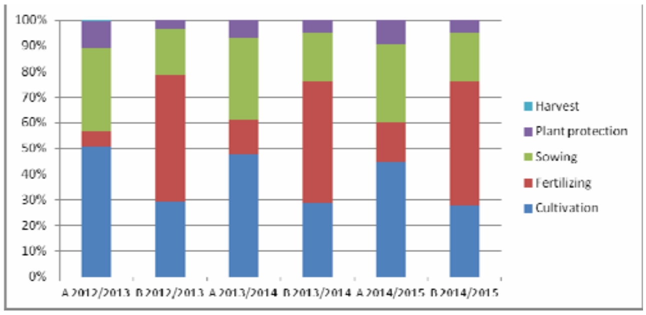


Source: own work

Fig. 1. Structure of direct costs of winter triticale production incurred by the farms analyzed

Analyzed farms featured varied levels of expenses related to the operation of machinery and equipment. The biggest differences can be observed with regard to fertilization. Organic fertilization carried out by farm B resulted in an increase in the level of expenses for this group of treatments from 54 $zł \cdot ha^{-1}$ to 344 $zł \cdot ha^{-1}$. In the case of farm B, the fertilization cost constituted as much as 31% of the total costs related to the operation of machinery and equipment, while on farm A, they made up only 6% of the total operating costs. On both farms, the most important element of the cost structure of the operation of machinery and equipment were the costs related to the harvest. On farm A, they amounted to 446 zł · ha^{-1} on average which made up almost 50% of the total cost, while on farm B 396 zł · ha^{-1} which made up 36% of total operating costs. Much smaller differences in spending levels were found in the cultivation. To do the necessary procedures to prepare the land, Farm A spent an average of 212 zł · ha^{-1}, while farm B, 7 zł · ha. It was also a similar case with sowing where Farm B spent 141 zł · ha^{-1}, and farm B spent 8 zł · ha^{-1} more. On both farms, the smallest element of the cost structure related to the operation of machinery and equipment was the plant protection treatment which on Farm A made up 5% of the total cost sum, while on farm B it was 3%.

Based on the analysis of the economic efficiency of the production of triticale, it shall be noted that the cultivation of triticale in both the analyzed farms is profitable. Farm B, applying slurry within three years of research gained higher yields than farm A. The average yields on farm B were 1 t · ha^{-1} higher than on farm A. Consequently, at similar prices of the crop sold, this farm earned on average an income higher by 537 zł · ha^{-1} than Farm A. The result was a higher profit on the farm, applying slurry despite of high outlay that it bore on organic fertilizers. The biggest difference in the profits gained by both the farms was ascertained in the 2013/2014 season, when it was 482 zł · ha^{-1}, while the smallest was in the season 2014/2015 when it amounted to 33 zł · ha^{-1}. On the other hand, in season 2012/2013, winter triticale production on Farm A reached the limit of profitability. The low coefficient of economic efficiency at the level of 1.02 testifies to a very weak result of this Farm. On the farm, applying the slurry, this ratio was 0.14 higher, and in the next season it was 0.17 higher. In the recent season, the coefficients of economic efficiency attained by the both farms were equal, at 1.18.



Source: own work

Fig. 2. Structure of machinery and equipment operating costs broken down into individual groups of treatments

Table 3. Machinery and equipment operating costs, including fuel and labour costs, broken down into individual groups of treatments

Farm	Season	Cultivation	Fertilizing	Sowing	Plant protection treatment	Harvest	Sum
		zł·ha^{-1}					
Farm A	2012/2013	212,47	25,44	135,06	44,82	443,47	861,24
Farm B		199,81	333,26	121,56	23,83	390,85	1069,31
Farm A	2013/2014	212,04	60,40	143,45	30,26	447,22	893,38
Farm B		216,35	355,36	142,79	36,32	394,60	1145,41
Farm A	2014/2015	212,04	76,20	143,45	45,39	447,22	924,31
Farm B		197,99	344,18	134,64	35,29	402,94	1115,05

Source: own work

Table 4. Economic efficiency of oil seed rape production in the analyzed farms

Farm	Season	Costs zł·ha^{-1}	Yield t·ha^{-1}	Price zł·t^{-1}	Revenue zł·ha^{-1}	Profit zł·ha^{-1}	Coefficient of efficiency
Farm A	2012/2013	1726,53	3,6	490,00	1764,00	37,47	1,02
Farm B		2115,31	5,0	490,00	2450,00	334,69	1,16
Farm A	2013/2014	2165,57	5,0	550,00	2750,00	584,43	1,27
Farm B		2398,19	6,3	550,00	3465,00	1066,81	1,44
Farm A	2014/2015	2161,72	4,8	530,00	2544,00	382,28	1,18
Farm B		2341,03	5,2	530,00	2756,00	414,97	1,18

Source: own work

Conclusions

1. The use of winter triticale pre-fertilization with slurry was linked with an increase in machinery and equipment operating costs.
2. The farm, using slurry yielded every year a higher crop of winter triticale, which largely determined a better financial result gained by the farm's production.

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