Scientific Papers Series Management, Economic Engineering in Agriculture and Rural Development
Vol. 15, Issue 3, 2015
PRINT ISSN 2284-7995, E-ISSN 2285-3952

THE COSTS OF WINTER WHEAT CULTIVATION IN RADOMSKO MUNICIPALITY IN YEARS 2011-2014

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Abstract

The level of profitability of production of certain agricultural products is the basis for the decision whether to grow the crop on the farm. The revenues of farms in Poland are highly diversified as confirmed by the results of Polish FADN (Farm Accountancy Data Network). The income level is influenced by several factors the most important of which are: natural conditions, farm production potential, intensity of production as well as payments under the Common Agricultural Policy. The increase in wheat growing popularity in Poland consists in a comprehensive use of the harvested grain, large production capacity in the climate and soil conditions of our country and the fact that wheat is a commercial commodity. The paper presents the results of studies performed in years 2011 - 2014 which aimed at comparing the production and economic effect of growing winter wheat on a farm in Radomsko municipality. The necessary information to calculate profitability came from the reports held by the farm to determine the profitability of new cultivation techniques for which the indirect and direct costs as well as profit were calculated.

Key words**:** *costs, cultivation, profitability, winter wheat*

INTRODUCTION

Implementation of progress in the economy is the main source of achieving better production results and performance, thus improving the living standards of the population [3,9]. The progress can be characterized as quantitative and qualitative changes which, in economic terms, mean reducing social expenditure per unit of finished product [1,2].

Implementation of innovations that contribute to increasing the economic efficiency in agricultural activity is just as important as in the whole economy. The obtained reduction in the unit costs of production translates directly to the end result i.e. an increased income and improved competitiveness of the farm [25,18,24].

The implementation of new solutions, however, is usually very expensive and not every farm can afford it. The implementation cost, next to the awareness and educational background of the farms' managers is the main factor that limits innovation. From the economic perspective the farm is most importantly expected to: increase production, reduce manufacturing costs and increase economic potential. Additionally, the implementation of innovations is usually accompanied by working conditions improvements and the reduction of negative influence of agricultural production on the natural environment. The decisive factor for cultivation of a new species is the income that the farm can obtain from a hectare. Profitability of cereal crops depends on the level of yield achieved and the dynamics of changes in grain prices vs. production costs. Profitability of cereal production is also significantly influenced by sale prices [4,5,6].

The search for methods to reduce the energy intensity of the growing and harvesting of cereals, while increasing productivity and efficiency simultaneously, has become a necessity due to the rising costs of inputs [10]. As wheat is of great importance in human nutrition and is one of the most widely cultivated cereals in Poland (representing approximately 26% of the total cereal crops) [16], and the primary factor influencing the energy intensity of production is plowing, the

authors decided to analyze cultivation systems in terms of the profitability of production [11,12]. The yield of each cultivated crop is a derivative of its genetically conditioned productivity potential and the level of fulfillment of the biological needs of the plant with a composition of environmental and agro-technical factors [17,23]. Cereal crop architecture affects the growth processes of plants, their assimilation activity, the pace of accumulation of assimilates and the development of generative organs [7,22]. High yields of winter wheat can be expected under optimal composition of the yield's structure. This demonstrates complex interactions among plants – composing elements of the crop, as well as between plant organs, which highlights the need for skilful control over plant crop during vegetation. Improperly performed agro-technical practices may worsen biometric features and yield structure, and this in turn may reduce the amount and the quality of harvested crops. The yield of wheat grain and its technological quality depend on the varietal characteristics, habitat factors and the applied agricultural technology. Important technological features are also the density and alignment of grain and the total ash content[14,15]. The yield and quality of wheat grain is significantly influenced by fertilization with nitrogen and the timetable and methodology of its application. With the trend of declining grain prices and increased prices of production means (in recent years, particularly the prices of fertilizers and pesticides) the cutting of costs is one of the few opportunities for improving economic performance in farms engaged in commercial production of winter wheat, which is often the basis for their living[13,21].

MATERIALS AND METHODS

The paper presents the results of studies from years 2011 - 2012 aimed at comparing the profitability of winter wheat cultivation on an individual farm in Radomsko municipality located in the south - eastern part of the Łódź Province. The total area of the farm is 150 hectares, where dominating is the cultivation of winter wheat in cereals group next to root crops and rape. The necessary information to calculate profitability came from the reports held by the farm to determine the profitability of new cultivation techniques or new means of production. Indirect and direct costs as well as profit were calculated [19]. The adopted working hypothesis assumed that the profitability of winter wheat in individual years varied depending on domestic and global prices of grain and weather factors that determined the amount of obtained yields [24,20]. The purpose of this study was to determine and compare the profitability of winter wheat in 2011-2014 for different sales prices, varying weather conditions and for stable prices of production means.

Table 1. Average air temperature (°C).

Month	Years				Average in 1956 - 2006
	2011	2012	2013	2014	
I	-4.2	-2.8	-3.1	-2.6	-2.9
II	-1.7	-2.2	-2.1	1.5	-1.9
III	1.9	2.1	2.0	2.7	2.1
IV	8.0	7.6	7.2	8.1	7.6
V	13.4	12.3	12.9	12.7	13.1
VI	16.1	15.9	15.6	17.1	16.0
VII	17.8	16.9	17.5	18.2	18.0
VIII	16.7	15.7	16.9	17.0	17.4
IX	13.2	12.8	12.5	13.7	13.5
X	6.8	7.1	7.2	8.1	8.4
XI	2.0	3.1	2.5	2.8	3.0
XII	-0.8	-1.1	-0.5	-0.8	-0.9
Average	7.4	7.3	7.4	8.2	7.8

Source: the author's own elaboration

Table 2. Precipitation (mm)

Month	Years				Average in 1956 - 2006
	2011	2012	2013	2014	
I	21.7	15.4	49.5	35.4	31.1
II	38.9	38.8	46.1	42.9	31.0
III	15.6	27.0	38.5	30.6	33.3
IV	26.8	59.4	12.0	39.5	39.4
V	67.1	47.5	49.7	51.9	52.7
VI	18.9	14.3	53.1	66.1	65.1
VII	62.9	20.1	91.3	101.2	88.5
VIII	65.9	92.1	62.1	62.9	65.3
IX	47.3	40.1	23.7	46.3	49.8
X	5.1	41.7	22.9	37.8	39.4
XI	19.2	36.4	51.6	44.2	45.4
XII	84.5	31.9	25.4	36.9	39.6
Average	473.9	464.7	525.9	595.7	580.6

Source: the author's own elaboration

RESULTS AND DISCUSSIONS

The yield of wheat crops in individual years depended on weather conditions during the growing season and above all on the

distribution of temperatures and precipitation in the critical period of development for cereals, i.e. from the earing phase until milky-wax ripeness phase[8]. Similar dependences are indicated in previous studies by other authors. Low precipitation in season 2012, especially in January and March, was compensated in April and May. More favorable precipitation conditions were recorded in 2013. Despite more favorable weather conditions in 2014 (higher temperatures) the obtained yield was not significantly higher than in 2012. Table 4 shows the costs and profitability of winter wheat cultivation in years 2011 - 2014.

Table 3. Farming technology of winter wheat

List	Years		
	2011/2012	2012/2013	2013/2014
Fore crop	Winter rape	Early season potato	Oats
Soil treatment			
Disking	12.08.2011	17.08.2012	25.08.2013
Tillage	16.09.2011	10.09.2012	16.09.2013
Harrowing	16.09.2011	11.09.2012	17.09.2013
Cultivation machine	17.09.2011	16.09.2012	19.09.2013
Pre-sowing fertilization			
N 60 kg · ha^{-1} – ammonium nitrate	19.09.2011	17.09.2012	21.09.2013
P_2O_5 40 kg · ha^{-1}	19.09.2011	17.09.2012	21.09.2013
K_2O 60 kg · ha^{-1}	19.09.2011	17.09.2012	21.09.2013
Sowing	20.09.2011	18.09.2012	22.09.2013
Weed regulation in autumn and spring			
Maraton 375 SC – 4dm^3 · ha^{-1}	26. 10.2011	04. 11.2012	28.11.2013
Lancet Plus 125 WG – 0.5 kg · ha^{-1}	12.04.2011	10.04.2013	07.04.2014
Mustang 306 SE 0.6 dm^3 · ha^{-1}	07.05.2011	29.04.2013	05.05.2014
Nitrogenous fertilization in spring			
N 60 kg · ha^{-1} – ammonium nitrate	07. 03.2012	04.03.2013	06.03.2014
N 40 kg · ha^{-1} – urea	11. 04.2012	14.04.2013	09.04.2014
Pests and disease control in spring			
Cerone 480 SL – 1.0 dm^3 · ha^{-1} + Duett Star 334 SE – 1.0 dm^3 · ha^{-1}	18. 04.2012	115.04.2013	21.04.2014
M o n d a t a k 450 EC	15.05.2012	13.05.2013	18.05.2014
Amistar 250 SC – 0.9 dm^3 · ha^{-1}	02.06.2012	30.05.2013	04.06.2014
Karate Zeon 050 CS – 0.1 dm^3 · ha^{-1}	12. 06.2012	11.06.2013	14.06.2014
Harvest	04.08.2012	07.08.2013	09.08.2014

Source: the author's own elaboration

In both the first and the third years under study the cost of purchasing seed took the largest share in the direct costs. This cost was associated with the high price of seed in 2011 and 2013. According to the methodology for calculating this economic category the cost did not include the assessed labor cost of the farmer and his family. Apart from the valuation of outlays, the profitability of wheat production was estimated based on the grain price in a given year which largely depended on the yield and the volumes of purchased grain for the whole country. Indirect costs accounted for 43.9% to 46.0% of the total costs. Total indirect costs of the farm ranged from PLN 1,457.32 to 1,702.84.

Table 4. Production and economical result (in PLN) for winter wheat grown on a farm located in Radomsko municipality in Łódź Province.

List	Years		
	2011/2012	2012/2013	2013/2014
Seed	340.00	280.00	390.00
Mineral fertilizer	1,068.00	1,306.00	1,361.00
Plant protection	303.54	422.21	374.34
Other direct costs	0.00	0.00	0.00
Total direct costs	1,711.54	2,008.21	2,125.34
Total indirect costs	1,457.32	1,702.84	1,662.13
Total costs	3,168.86	3,711.05	3,787.47
Direct production cost 1dt	34.23	44.63	40.10
Total production cost 1dt	63.38	82.47	71.46
Yield in dt per hectare	50	45	53
Production value	4,500.00	4,150.00	4,780.00
Other financial revenues	1,247.43	1,104.86	1,241.18
Total revenues	5,747.43	5,254.86	6,021.18
Financial result per 1ha	2,578.57	1,543.81	2,233.71
Total income per 1ha excl. EU grant	1,414.69	520.24	1,069.95

Source: the author's own elaboration.

CONCLUSIONS

The level of production costs for winter wheat depends mainly on the applied technology of cultivation, grain variety and vegetation conditions which man has no influence on. The purchase cost of seed on the farm in the analyzed years ranged from PLN 280 to 390

and depended on whether the farmer used his own material or purchased material. The difference here is small, as farmers who buy certified seed receive a grant in the amount of PLN per hectare from the Agricultural Market Agency. The farmer considered it reasonable to use the purchased seed as it guaranteed higher yield and better quality of the obtained grains (better parameters - better price), the material is properly treated (elimination of cumbersome treatment process and treatment cost). On the analyzed farm the costs related to the use of mineral fertilizers ranged from PLN 1,068.00 to 1,361.00. The difference in the cost of fertilization in years 2011 - 2014 is significant and depended mainly on fertilizer prices (wholesale orders or orders made by a group of several farmers with fertilizers delivered direct to the farms is a less expensive solution with the negotiable margins). The costs of purchase of chemical plant protection products on the concerned farm in years 2011 - 2014 ranged from PLN 303.54 to 422.21. The largest gap in the direct cost was noted for the costs of the applied plant protection products. This is due to the price of each group of products against the same weeds or diseases, although the farmer did not notice any difference in their effectiveness.

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