ANNALS OF THE POLISH ASSOCIATION
OF AGRICULTURAL AND AGRIBUSINESS ECONOMISTS

received: 05.04.2019
acceptance: 19.05.2019
published: 03.06.2019

Annals PAAAE • 2019 • Vol. XXI • No. (2)

JEL codes: Q10, Q12, Q14

DOI: 10.5604/01.3001.0013.2068

JERZY KOPIŃSKI, ADAM BERBEĆ, ANDRZEJ MARKOWSKI

Institute of Soil Science and Plant Cultivation – State Research Institute in Puławy, Poland

COMPARISON OF MANAGEMENT INTENSIFICATION TENDENCIES OF GROUPS OF FARMS OF DIFFERENT PRODUCTION PROFILES[1]

Key words: direct costs, production value, gross margin, production profile, agricultural farms

ABSTRACT. The study compares the trends of changes in the intensity of management (direct costs incurred) in relation to changes in the value of production in groups of farms with different production profiles. The basis for comparative analysis were the results of surveys conducted in 2004-2017, in several dozen large, market-oriented farms. The specific structure of gross commodity production was the main criterion for the division of farms into groups. The analysis showed that in all groups, production intensification, justified by economic results (without subsidies or direct payments) (type I), was effective and based on current prices. The most intensive production, in terms of incurred costs as well as land productivity and labor productivity, was carried out on pig farms – farm type least dependent on available land resources. Direct costs incurred in this group of farms were (in relation to 1 ha of AL) about three times higher than the average in other groups. Also, the highest increase in gross margin without additional payments was observed in this group.

INTRODUCTION

Poland's accession to the European Union had a significant impact on Polish agriculture, the agri-food industry and rural areas [Judzińska, Łopaciuk 2012, Wigry (ed.) 2011]. It significantly affected (through financial resources of the Common Agricultural Policy – CAP) the income of most farms [Adamowicz, Szepeluk 2018, Ziętara, Zieliński 2012], but also had external effects on the state (quality) of the environment, and the value of agricultural production in this environment [Prandecki 2015]. However, payments and subsidies received in various forms only mitigate the negative effects of the uneven pace of changes in prices of means of agricultural production and prices of agricultural products [Józwiak, Mirkowska 2011]. The benefits of this political rent (including subsidies) may also have a negative impact on efforts to improve technical efficiency of production [Kulawik, Wieliczko 2012, Kagan 2018]. The value of global production of agriculture, forestry, hunting and fishing in Poland, in the years 2005-2017, in current prices, increased twice, while in constant prices, this increase did not exceed 25% [GUS 2017-2018].

[1] The paper was developed as part of 2016-2020, 2.1 multiannual programme of IUNG-PIB.

Competitiveness and the production output of farms depends mostly on the relationship between income and costs of means of production [Rembisz 2010]. This affects the profitability of production, determines the assessment of productivity, and also the nature of management intensity [Gałecka 2017, Kopiński 2002, Szymańska 2010]. One of the measures of assessment (comparisons) of direct and indirect effects (including prices) of agricultural production is gross margin – a result of the production value and direct costs necessary to produce it [Skarzyńska (ed.) 2013, Augustyńska (ed.) 2018]. Apart from the price level, it is directly related to the scale (size) of production.

The aim of the study was to determine the trends of changes of management intensity (on the basis of direct costs incurred) in relation to changes in the value of production in groups of farms of different production profiles.

MATERIAL AND METHODS OF RESEARCH

The analysis was based on the results of surveys conducted in 2004-2017, in several dozen (43 on average) large, market-oriented farms. These farms were located in the Dolnośląskie (6), Lubelskie (16), Podlasie (13) and Wielkopolskie (8) provinces of Poland. The basis for the selection of targeted farms, in addition to the willingness to cooperate, was the production profile (degree of specialization), determined by the structure of gross commodity production [Harasim 2006, Klepacki 1997, Wojtaszek 1965]. The following groups of farms were selected:

- multidirectional (mixed) (7 households), in which none of the production types reaches the level of 30% in the structure of gross commodity production (A);
- unidirectional bovine farms (14 households) in which beef cattle or diary cows breeding constituted at least 40% in the structure of gross commodity production (B);
- unidirectional pig farms (7 farms), in which pig production constituted over 40% in the structure of gross commodity production (C);
- farms with unidirectional crop production (without livestock) (15 farms), crops constituted over 40% in the structure of gross commodity production (D).

A comparative analysis of changes in the organizational conditions of farms was conducted for the years 2014-2017 in relation to the years 2004-2007 – the first years of Poland's membership in the European Union (UE). The character (type) of management[2] in selected groups was made on the basis of the difference in slope of trend lines (a, b), direct costs (DC) and agricultural output (Out) excluding internal turnover, direct payments and other payments, according to equation patterns and adopted criteria:

$GM = Out - DC; \quad y(DC) = ax + m; \quad y(Out) = bx + k$

$a > 0$ and $b - a > 0$ effective intensification (rational), type I,
$a < 0$ and $b - a > 0$ efficient extensification (rational), type II,
$a > 0$ and $b - a < 0$ ineffective intensifying (irrational), type III,
$a < 0$ and $b - a < 0$ inefficient extensification (irrational), type IV.

where: *GM* – gross margin, *DC* – direct costs of agricultural production, *Out* – value of agricultural production.

[2] Management intensity consists of production intensity measured by costs incurred and management intensity including the AL and livestock structure.

The comparative analysis included the structure of direct costs, value of agricultural production and value of gross margin without subsidies (in current prices). Isolation of individual income elements and direct cost components of farms was made according to the methodology widely adopted in FADN research [Goraj 2000].

RESEARCH RESULTS AND DISCUSSION

The characteristics of organizational conditions of the surveyed groups of farms in 2014-2017 and their changes in relation to the period - 2004-2007 are shown in Table 1. The individual groups of farms of different production profiles (specialization) were strongly differentiated by natural and organizational conditions and level of production intensity. The average area of agricultural land in tested farms (AL) was 42.6 ha. The smallest, in terms of AL (27.9 ha), were bovine farms, and the largest (57.6 ha of AL) were farms specializing in crop production. The land acreage of crop farms determines, to a significant extent, the size (scale) of production. Crop farms (group D) also had the best quality soil. Over 10-13 years, the area of mixed (A) and pig farms (C) increased slightly by about 3 ha. On the other hand, the AL of D-group farms decreased. This was mainly due to the division of large cooperating farms from the province of Lower Silesia into smaller ones. The share of permanent grasslands and pastures (PGP) in the land use structure for the majority of surveyed farms was an important factor determining the direction of production. Farms of group B had a 23.1% share of PGP on average in AL. The direction of production was determined by the level of employment. By far, the least labor-intensive production was observed in crop (group D) farms (3.4 AWU 100 ha AL). In reference to the period 2004-2007, the labor level decreased in all groups of farms, except for farms belonging to group B.

The organization of plant production and the stocking density of livestock were a reflection of their specialization (production profile). The sowing structure, mainly in groups (B) and (C), was directly linked to the needs of livestock production. Cereals dominated in the crop structure in the majority of surveyed groups. Their share was the highest in the group of pig farms. During the last 10-13 years it has dropped by 9 percentage points (p.p.), but still constitutes ~85% of crop structure. The share of cereals has increased by 12 p.p. in farms of the B group (bovine), which was accompanied by a decrease in the area of fodder crops in this group (by 11 p.p.). The efficiency of fodder crops in these farms have increased due to innovative and more modern technologies as well as better agro techniques, allowing for the use of part of their area for the cultivation of cereals. As a result, these farms were able to increase the amount of available concentrated feed of own production. The intensity of animal production, measured by stocking density, decreased in farms specializing in pig breeding (C), and also in the group of multidirectional farms (A), during the study period. This was a result of a reduction in pig herds. The intensity of crop production, measured by the level of NPK consumption in mineral fertilizers, increased in the majority of surveyed groups. Farms with no livestock were the only exception to this rule, which was in line with general trends at a national level [Kopiński 2018a, 2018b]. Farms with no livestock used the highest amounts of mineral fertilizers in 2014-2017 – on average 246 kg NPK/ha AL. The lowest level of mineral

fertilization was observed in pig farms, which was due to a high availability of manure produced on the farm. A very high NPK consumption – an average of 227 kg NPK/ha AL – was also recorded on bovine farms (group B). This was caused by a large share of intensively cultivated grass and other fodder crops.

Organizational and production conditions were reflected in the structure of direct costs incurred and the value of agricultural production (Figure 1). Pig Farms (Group C) had the most intensive production, in terms of costs incurred as well as land productivity and labor productivity. The level of direct costs, in relation to 1 ha of AL was about three times higher in this group than the average in other groups (A, B and D). It resulted mainly from significant costs incurred for the purchase of feed and costs of young livestock for fattening. The differences in value of production between the compared groups of farms were determined mainly by the differences in the sales value of agricultural products. Pig farms (C) had the highest sales value among all tested groups.

Changes in the value of particular items (sources) of direct costs and agricultural production volume results in a specific level of gross margin of tested groups of farms and its change in relation to the period from 10-13 years ago (Table 2).

The highest gross margin in the years 2014-2017 in relation to 1 ha of AL was observed in pigs farms (nearly PLN 7.5 thousand). It should be noted here that the estimated gross margin refers to the total agricultural production of farms, and not to a specific activity (main production profile), despite the separate specializations. It does not include internal trading costs. The average value of gross margin for all tested farms increased by PLN 533.4, (10%), between 2004-2007 and 2014-2017, the highest increase was visible in pig farms (group C).

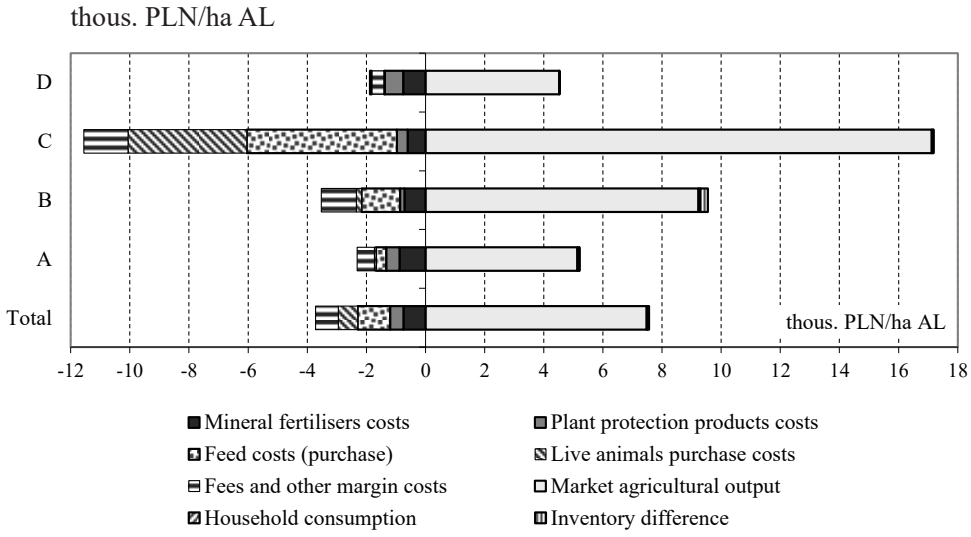

Figure 1. The value structure of direct costs and output sources of agricultural production in selected groups of farms in 2014-2017

Source: own data and study

Table 1. Characteristic of organizational conditions in the analysed groups of farms in 2014-2017 and changes in comparison to 2004-2007*

Specification	Main production profile of farms								Total farms	
	multi-directional (A)		bovine (B)		pigs (C)		crop production (D)			
Agricultural lands (AL) [ha]	39.6	3.1	27.9	-4.1	41.1	3.5	57.6	-15.4	42.6	-4.1
Grasslands and pastures	13.0%	-7.1 p.p.	23.1%	-5.2 p.p.	6.2%	-1.8 p.p.	2.4%	1.0 p.p.	8.8%	-4.0 p.p.
Value index of AL	0.94	-0.01	0.79	-0.07	0.86	0.02	0.99	0.02	0.90	0.00
Employment [AWU/ 100 ha AL]	5.1	-0.9	7.6	0.3	5.2	-1.6	3.4	-0.9	4.8	-0.6
Share of cropping pattern:	%	p.p.	%	p.p.	%	p.p.	%	p.p.	%	p.p.
– cereals	69.3	-5.2	48.6	12.0	84.6	-9.6	62.1	-8.7	64.2	-5.7
– industrial	16.3	4.8	4.6	1.2	8.6	8.3	23.1	-0.5	16.6	1.8
– fodder crops on AL	10.6	2.7	43.3	-10.6	4.8	4.0	4.5	4.4	12.3	2.6
Livestock density [LU/ha of AL], including:	0.55	-0.27	1.30	0.04	1.40	-0.18	0.05	0.02	0.59	-0.06
– bovine	0.43	-0.02	1.29	0.04	0.22	0.16	0.04	0.03	0.39	0.06
– pigs	0.05	-0.18	0.01	0.01	1.18	-0.32	0.00	-0.01	0.18	-0.10
Mineral fertilizers [kg NPK/ha AL]	246.1	48.2	227.2	29.9	194.4	33.3	207.0	-64.2	215.4	-11.8
Productivity of agricultural area [thous. PLN/ha AL]	5.2	0.9	9.5	1.9	17.2	7.7	4.5	1.0	7.6	1.9
Labour productivity [thous. PLN/AWU]	102.5	30.3	124.7	21.6	333.3	192.1	132.0	24.4	156.5	50.0

* absolute difference in values between the years 2014-2017 and 2004-2007
Source: own study

Changes in the direct costs incurred and the value of agricultural production results in changes in the level of gross margin and thus – differences between different groups (profiles) of farms. The value of agricultural production increased at a much faster pace than direct costs in all compared groups of farms in the study period of 14 years (2004-2017) (Table 2). It resulted both from the increase in prices of means of production and agricultural products as well as an increase in the volume of production. Therefore, all tested groups of farms were effectively intensifying agricultural production (intensification type I). This intensification was justified by economic results (without subsidies or payments), in terms of land productivity. The average annual increase of the gross margin (difference in the slope of $b - a$ trends) was on a level of 63 PLN/ha AL, while the highest increase of gross margin was observed on pig farms (156 PLN/ha AL), which were the least dependent on land resources. The smallest, not statistically significant, increase in the value of production was visible in the multidirectional group of farms (group A).

Table 2. Characteristics of gross value of margin and trends and types of intensity of agricultural production in selected groups of farms in 2004-2017

Production profiles	Gross margin GM [PLN/ha AL]		Equation of R^2 trend 2004-2017		Difference in trend inclination between agricultural outputs and direct cost $b - a$	Type of intensity of agricultural production
	2014-2017	change**	direct costs $y(DC) = ax + m$	outputs of agricultural production $y(Out) = bx + k$		
Multidirectional (A)	3,849.7	136.0	$y = 89x + 1{,}214 \quad 0.42^*$	$y = 129x + 3{,}791 \quad 0.16$	40	I =
Bovine (B)	8,024.2	1,039.4	$y = 114x + 2{,}129 \quad 0.69^*$	$y = 216x + 6{,}813 \quad 0.51^*$	102	I +
Pigs (C)	7,491.3	2,272.8	$y = 642x + 5{,}132 \quad 0.58^*$	$y = 798x + 8{,}996 \quad 0.62^*$	156	I =
Crop production (D)	3,531.7	409.4	$y = 63x + 1{,}044 \quad 0.73^*$	$y = 123x + 3{,}281 \quad 0.29^*$	60	I +
Total of all farms	5,109.7	533.4	$y = 154x + 1{,}974 \quad 0.59^*$	$y = 217x + 5{,}159 \quad 0.38^*$	63	I +

* - $R^2 > R^2_{0.05} = 0.2834$, ** absolute value difference between 2014-2017 and 2004-2007

Source: own data and study

SUMMARY

A multi-annual analysis of changes in the level of incurred expenditures (direct costs) and the output level of the production value (in current prices) made it possible to assess the management intensification character of tested farms of different production profiles. The study showed that the organization of crop production and the level of livestock density were a reflection of farm specialization (production profile). In this respect, specific organizational and production conditions of tested groups of farms were reflected in the structure of direct costs incurred and the output value of agricultural production. Pig farms had the most intensive production in terms of costs incurred as well as land productivity and labor productivity. The level of direct costs, in relation to 1 ha of AL, in pig farms (group C) was about three times higher than the average in other compared groups (A, B and D). This resulted mainly from significant financial outlays incurred for the purchase of feed and live fattening animals. The farms in group C also had the highest value of gross margin without subsidies – the first income category.

The analysis of a selected group of 43 farms of different production profiles showed that farms of all groups were effectively intensifying their production (in relation to land productivity), which was justified by economic results (without subsidies or payments), (type I intensification). The average annual growth of the gross margin (difference in the slope of $b - a$ trends) was at a level of 63 PLN/ha AL. Pig farms, which are least dependent on available land resources, had the highest increase of gross margin. Apart from the technical efficiency of farms, it was also influenced by changes in price levels.

BIBLIOGRAPHY

Augustyńska Irena (ed.). 2018. *Produkcja, koszty i dochody z wybranych produktów rolniczych w latach 2016-2017* (Production, costs and income from selected agricultural products in 2016-2017). Warszawa: IERiGŻ-PIB0.

Gałecka Agnieszka. 2017. Efektywność gospodarstw rolnych w Polsce w latach 2012-2015 w zależności od ich wielkości ekonomicznej (Efficiency of agricultural farms in Poland in 2012-2015 depending on their economic size). *Roczniki Naukowe SERiA* XIX (5): 65-71, DOI: 10.5604/01.3001.0010.6207.

Goraj Lech. 2000. *Sieć danych rachunkowości gospodarstw rolnych w Unii Europejskiej* (Farm accountancy data network in the European Union). Warszawa: Foundation of Assistance Programmes for Agriculture.

GUS (CSO). 2017-2018. *Rocznik statystyczny rolnictwa* (Statistical Yearbook of Agriculture). Warszawa: Wydawnictwo GUS.

Harasim Adam. 2006. *Przewodnik ekonomiczno-rolniczy w zarysie* (Economic and agricultural guide in outline). Puławy: Wydawnictwo IUNG-PIB.

Józwiak Wojciech, Zofia Mirkowska. 2011. Trendy w rolnictwie polskim (lata 1990-2009) i próba projekcji na 2013 rok. [W] *Procesy zachodzące w rolnictwie polskim w latach 1990-2010, projekcje na rok 2013 i pożądana wizja rolnictwa w 2020 roku – zagadnienia wybrane* (Trends in Polish agriculture (1990-2009) and an attempt to project for 2013). [In] Processes occurring in Polish agriculture in the years 1990-2010, projections for 2013 and the desired vision of agriculture in 2020 – selected issues), 9-31. Warszawa: IERiGŻ-PIB.

Judzińska Agnieszka, Wiesław Łopaciuk (ed.). 2012. *Wpływ Wspólnej Polityki Rolnej na zmiany w rolnictwie* (The impact of the Common Agricultural Policy on changes in agriculture). Warszawa: IERiGŻ-PIB.

Kagan Adam. 2018. Ocena konkurencyjności towarowych gospodarstw rolnych (Assessment of competitiveness of comodity farms). *Roczniki Naukowe SERiA* XX (4): 67-72, doi: 10.5604/01.3001.0012.2946.

Klepacki Bogdan. 1997. *Wybrane pojęcia z zakresu organizacji gospodarstw, produkcji i pracy w rolnictwie* (Selected concepts from the organization of farms, production and work in agriculture). Warszawa: Wydawnictwo SGGW.

Kopiński Jerzy. 2002. Porównanie wskaźników rozwoju zrównoważonego gospodarstw o różnej intensywności produkcji rolnej (Comparison of the parameters of sustainable development of farms with different intensity of agricultural production). *Roczniki Nauk Rolniczych. Seria G* 89 (2): 66-72.

Kopiński Jerzy. 2018a. Tendencje zmian intensywności gospodarowania azotem w regionach Polski (Tendencies of changing intensity of nitrogen management in the Polish regions). *Roczniki Naukowe SERiA* XX (1): 81-87, DOI: 10.5604/01.3001.0011.7232.

Kopiński Jerzy. 2018b. Zróżnicowanie gospodarki nawozowej azotem w polskim rolnictwie (Diversity of nitrogen management in Polish agriculture). *Polish Journal of Agronomy* 32: 3-16.

Kulawik Jacek, Barbara Wieliczko. 2012. Wybrane finansowe aspekty konkurencyjności rolnictwa (Financial considerations of competitiveness in agriculture). *Zagadnienia Ekonomiki Rolnej* 4: 36-40.

Prandecki Konrad. 2015. Zagrożenia środowiskowe pochodzenia rolniczego jako skutek efektów zewnętrznych. [W] *Efekty zewnętrzne i dobra wspólne w rolnictwie – identyfikacja problemu* (Environmental threats of agricultural origin as a result of external effects. [In] External effects and common values in agriculture – problem identification), ed. Konrad Prandecki, 68-89, Warszawa: IERiGŻ-PIB.

Rembisz Włodzimierz. 2010. *Kwestie efektywności, cen i dochodów producentów rolnych*. (Productivity, prices and farm producers' incomes issues). *Zeszyty Naukowe/Uniwersytet Ekonomiczny w Poznaniu* 150: 289-302.

Skarżyńska Aldona (ed.). 2013. *Nadwyżka bezpośrednia z wybranych produktów rolniczych w 2012 roku oraz projekcja dochodów na 2015 rok* (Gross margin from selected agricultural products in 2012 and agricultural income projection for 2015). Warszawa: IERiGŻ-PIB.

Szymańska Elżbieta. 2010. Efektywność przedsiębiorstw – definiowanie i pomiar (Enterprise effectiveness – defining and measurement). *Roczniki Nauk Rolniczych. Seria* G 97 (2): 152-164.
Wojtaszek Zygmunt. 1965. Kryteria i mierniki klasyfikacji gospodarstw indywidualnych według kierunków i stopni wielostronności produkcji (Criteria and measures of classification of individual farms by directions and levels of production multilaterality). *Roczniki Nauk Rolniczych. Seria G* 78 (1): 69-98.
Ziętara Wojciech, Marek Zieliński. 2012. Efektywność i konkurencyjność polskich gospodarstw rolniczych nastawionych na produkcję roślinną (The effectiveness and competitiveness of Polish crop-oriented farms). *Zagadnienia Ekonomiki Rolnej* 1: 40-61.

***

PORÓWNANIE CHARAKTERU INTENSYWNOŚCI GOSPODAROWANIA GRUP GOSPODARSTW O RÓŻNYCH KIERUNKACH PRODUKCJI

Słowa kluczowe: koszty bezpośrednie, wartość produkcji, nadwyżka bezpośrednia, kierunek produkcji, gospodarstwo rolne

ABSTRAKT

W opracowaniu dokonano porównania tendencji zmian intensywności gospodarowania (według ponoszonych kosztów bezpośrednich) w odniesieniu do zmian wartości produkcji w grupach gospodarstw o różnych kierunkach produkcji. Podstawę analizy porównawczej stanowiły wyniki badań ankietowych prowadzonych w latach 2004-2017 w 43 gospodarstwach rolniczych, większych obszarowo i o dużym powiązaniu z rynkiem. Wyznacznikiem kierunku prowadzonej produkcji, jako kryterium podziału na grupy, była określona struktura produkcji towarowej brutto. Z przeprowadzonej analizy wynika, że we wszystkich grupach następowało uzasadnione wynikami ekonomicznymi (bez dopłat i płatności) efektywne intensyfikowanie produkcji (typ I), według cen bieżących. Najbardziej intensywną produkcję pod względem przepływów pieniężnych oraz produktywności ziemi i wydajności pracy prowadzono w gospodarstwach ukierunkowanych na tucz trzody chlewnej. Jest to kierunek produkcji najmniej uzależniony od posiadanych zasobów ziemi. Poziom ponoszonych kosztów bezpośrednich w odniesieniu do 1 ha UR był w tej grupie 3-krotnie wyższy niż przeciętnie w pozostałych. Także w tej grupie gospodarstw nastąpił najwyższy wzrost wartość nadwyżki bezpośredniej bez dopłat.

AUTHORS

JERZY KOPIŃSKI, DR HAB.
ORCID: 0000-0002-2887-4143
Institute of Soil Science and Plant Cultivation – State Research Institute in Puławy
Department of Systems and Economics of Crop Production
8 Czartoryskich St., 24-100 Puławy, Poland

ADAM KLEOFAS BERBEĆ, PHD
ORCID: 0000-0002-4609-081X
Institute of Soil Science and Plant Cultivation – State Research Institute in Puławy
Department of Systems and Economics of Crop Production
8 Czartoryskich St., 24-100 Puławy, Poland

ANDRZEJ MARKOWSKI, MSC
ORCID: 0000-0003-3676-0856
Institute of Soil Science and Plant Cultivation – State Research Institute in Puławy
Department of Systems and Economics of Crop Production
8 Czartoryskich St., 24-100 Puławy, Poland