EFFICIENCY IN THE USE OF AGRICULTURAL TECHNIQUE

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ARTICLE INFO	ABSTRACT
	The objective of the paper was to determine appropriate relations between efficiency and effectiveness of implementing the scientific and technical progress and work organization with the use of the EU funds. In 2004-2009 70 selected family farms from the province of Biłgoraj, which benefit from the EU funding for technical modernization, were investigated. The period prior to and after obtaining the aid was analysed. Efficiency of using agricultural engineering referred to the amount of aid and the net commodity production was the highest in farms, which were big with respect to the area and economy. The costs of obtaining grain units (GU) were decreasing along with the increase of the economic size of farms, while the net commodity production was rising in these farms. Efficiency of using the EU funds for technical modernization was presented in each investigated group of farms, but these funds were the most effectively used in farms with the area up to 70 ha of AL, which is mainly determined by the AL area, economic size, level of the obtained farming effects and the level of providing the work station with infrastructure. In farms with smaller areas, a high level of the employment infrastructure, at the simultaneous loading with high costs of mechanization means, was proved. Modernization of farms, considerably influences the production process, all mechanization rates increase including: the replacement value of mechanization means, the level of technical infrastructure of employment, installed power, objectified work inputs, human labour expenditures, employee infrastructure, energy infrastructure of employment, mechanization degree and the net commodity production (GU·ha^{-1} AL).

Introduction

Various projects, also called the EU funds, related to funding economic activity with regard to the production technology quality or social and environmental activities are the most frequently used form of aiding agriculture, next to extensive forms of counselling (Program rozwoju…, 2007). These operations aim at the improvement of the agrarian structure of rural areas, shift in the production organization, limitation of work tiresomeness, maintaining biodiversity in the natural environment and even vocational retraining of agricultural producers. Majority of these activities may be carried out through the improvement

of organization and mechanization of work processes in agriculture (Malaga-Toboła, 2006). Technical and scientific progress in the commodity and developing farms (businesses) results in the increase (Δ) of specific effects (advantages). Most often these are the production effects ($+\Delta GU \cdot ha^{-1}$ AL), energy effects ($-\Delta MJ \cdot GU^{-1}$), economic effects ($-\Delta$ PLN$\cdot GU^{-1}$) and ecological effects ($-\Delta$ of the environment degradation) (Wójcicki, 2008). The manner of the production organization, which is expressed in the increase of its intensity ratio is a factor, which enables smaller farms to obtain a family income (Sawa, 1998). Family farms, as a rule, intensively organize the production process and along with the increase of the farm area decrease of intensity of production business activity takes place. Efficiency of technical modernization of farms is related to the farming system, which includes rationality and effectiveness in the use of the production factors (external and internal) in order to increase the production size (Encyklopedia..., 1984). Provided that efficiency is related to minimization of costs or maximization of effects, then effectiveness of operation, which is understood as the ability to achieve aims in a rationally determined time, is a factor that favours this process. Efficiency and effectiveness of operations are elements of the management process and influence production capacities e.g. of a family farm. The increase of manufacturing capacities results from the efficient management and implementation of the mechanized production technologies, which shape appropriate work and living conditions of agricultural population, enabling reduction of differences in the technical and economic conditions of production between regions, group of farms and branches of agricultural production branches but limiting negative ecological threats resulting from agricultural production processes. The dynamics of this process, defined as efficiency of operations is expressed with realization of the objectives (in the rationally determined period of time) with the use of available capital resources, which allow increase in the level of infrastructure and the degree of the work process mechanization. Presently, access to the EU funds enables technical modernization of the process in family farms, but the problem consists in ensuring efficiency in the realization of those modernization processes (Wójcicki, 2009; Szeląg-Sikora, Kowalski, 2010). Increase of productivity in agriculture enables mechanization of production processes, which also causes improvement of working conditions (Pawlak, 2010; 2011). However, in order to decrease the costs of agricultural production, attention should be paid to the rational and effective use of the possessed machinery park.

The objective of the paper was to determine appropriate relations between the efficiency and effectiveness of implementing a scientific and technical progress and work organization with the use of the EU funds.

Material and methodology of research

In 2004-2009 70 agricultural farms from the province of Biłgoraj, which benefit from the EU funding for technical modernization, were investigated. The investigated group of farms was divided acc. to the criterion of the aid amount, the AL area and the economic size unit (ESU). It was assumed that the technical effectiveness is expressed by the net commodity production for technical equipment of farms. Whereas presenting the value of its equipment referred to the aid amount expresses the economic effectiveness. Grouping farms acc. to the AL area allowed assessment of the production scale effectivenessand acc. to the ESU - the allocation effectiveness. The effectiveness ratio is determined by the pro-

duction level (P) and the amount of the incurred expenditures (N) (Pawlak and Wójcicki, 1993). Proportions between elements of the effectiveness ratio ($E = P \cdot N^{-1}$) depend on the production factors. In the research, which was carried out, the amount of the aid is a production effect, strictly related to the level of the net commodity production. Evaluation of the effectiveness of the technical modernization of family farms was based on the technical and economic ratios including: the replacement value of the mechanization means, the level of technical infrastructure of employment, installed power, inputs of the objectified work, expenditures of human labour, the employee infrastructure, energy infrastructure of employment, mechanization degree acc. to Zaremba (1985) and the net commodity production ($GU \cdot ha^{-1}$ AL). Particular technical and economic indexes describe the family farms modernization efficiency fractionally. In order to verify whether it is high or low, whether is is improving or deteriorating, the basis for referral is necessary. In the investigated farms, the period before purchase of mechanization means was assumed as a basis (before funding - the basic year).

Research results

Analysis of efficiency in the agricultural engineering referred to the amount of aid and the net commodity production proved that it is the highest in farms, which are big with respect to the area and economy. However, there is a great difference between the level of the obtained net commodity production ($GU \cdot ha^{-1}$ AL) and the amount of the incurred production expenses, which mainly consist in production circulating assets and the costs of using mechanization means. The costs of obtaining GU (fig. 2) were dropping along with the increase of the economic size of farms (from 48.9 to 25.7 $PLN \cdot GU^{-1}$). Whereas, net commodity production in those farms increased (from 46.5 to 148.4 $GU \cdot ha^{-1}$ AL).

The research show that the highest commodity production is obtained when the ratio of the costs of using mechanization means to the expenditures on production circulating assets does not exceed 40% (Sawa, 1998). Agricultural engineering enables their better use. The level of production is strictly related to the efficiency ratio of using the agricultural engineering, which is visible in farms with the highest economic viability. The production scale and the production system of a farm as well as its rational engagement in the production process have a considerable impact on the efficiency of agricultural engineering (Lorencowicz, 2005). Efficiency of mechanization of the agricultural production process is determined with efficiency of using the EU funds, which increases the net commodity production (Wasąg, 2011).

Efficiency of technical modernization of the investiagted farms (table 1) was described including the AL area. In the targeted year, the replacement value of the mechanization means increased in all groups of farms divided acc. to the AL area. The biggest difference in comparison to the base year (before funding) was reported in the smallest farms with regard to the area (18%) and the biggest farms (32%). It proves more rational use of machines by farms with bigger AL area (Wasąg, 2011). The ratio of the level of technical infrastructure of employment was increasing proportionally to the area (AL ha) and the highest value in comparison to the base year achieved in farms with the area of 70 ha AL

(61.7%). The highest increase of power installed was reported in farms up to 10 and from 10-30 ha AL (46.4 and 35.5%) and above 70 ha AL (26.1%).
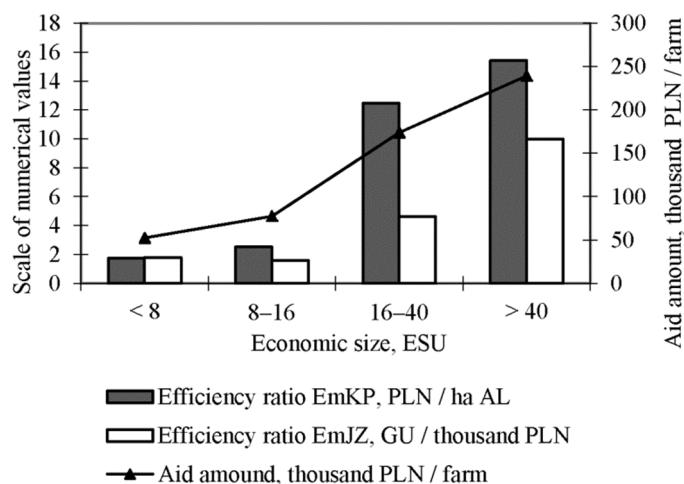

Figure 1. Efficiency in the use of agricultural engineering with reference to the aid amount
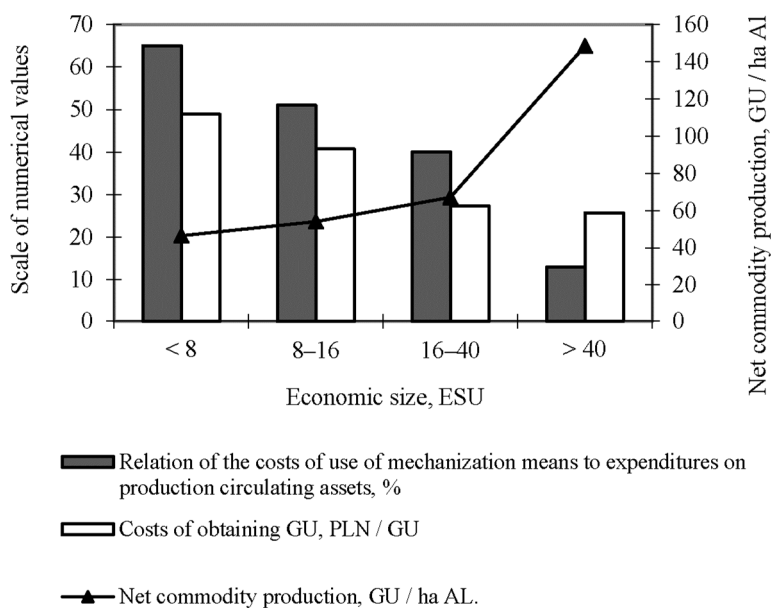

Figure 2. Efficiency in the use of agricultural engineering with reference to the net commodity production

Table 1

Efficiency and effectiveness of technical modernization of the investigated family including their area

Specification	Measure unit	Farm area (ha AL)										Average	
		< 10		10–30		30-50		50-70		> 70			
		by.	ty.	by.	ty.	by.	ty.	by.	ty.	by.	ty.	by.	ty.
Number of farms	number	11		41		6		3		9		70	
Replacement value of mechanization means	(thousand PLN · ha^{-1} AL)	43.9	52.0	32.6	39.4	19.3	20.3	16.3	16.9	11.4	15.1	24.7	28.7
Changes in the replacement value of mechanization means	(%)		118.5		121.1		104.8		103.3		131.9		116.3
Index of the technical level of work infrastructure	(PLN · manhour^{-1})	6.6	9.0	11.5	14.9	12.2	17.8	13.8	20.0	14.3	23.2	11.7	17.0
Change of technical level of work infrastructure	%		137.0		129.8		145.6		144.5		161.7		145.2
Installed power	(kW ·100 ha^{-1} AL)	848	1241	673	912	461	526	472	424	360	454	563	712
Change in the installed power	%		146.4		135.5		114.0		89.8		126.1		126.4
Inputs of the objectified work	(kWh·ha^{-1} AL)	2562	3197	1735	2033	1285	1151	1425	999	880	1398	1577	1756
Change of the inputs of the objectified work	%		124.8		117.2		89.6		70.1		158.8		111.3
Inputs of human labour	(manhour·ha^{-1} AL)	475	477	227	207	109	95	122	77	77	68	202	185
Change of the inputs of the objectified work	(%)		100.5		91.1		87.0		63.3		87.8		91.5
Infrastructure provided to an employee	(thousand PLN·opz^{-1})	262	359	460	597	488	711	553	799	573	927	467	679
Change in the infrastructure provided to an employee	(%)		137.0		129.8		145.6		144.5		161.7		145.2
Energy infrastructure of work	(kWh·manhour^{-1})	9.2	12.3	14.5	18.0	20.6	25.7	27.9	32.8	33.8	51.5	21.2	28.0
Change in the energy infrastructure of work	(%)		133.4		123.6		124.4		117.5		152.2		132.1
Index of the mechanization degree acc. to Zaremba	(% acc to Zaremba)	47.8	57.7	59.4	66.8	69.5	71.2	67.4	73.2	70.8	75.3	63.0	68.8
Change in the index of the mechanization degree acc. to Zaremba	(%)		120.6		112.5		102.4		108.5		106.4		109.3

by. – the basic year (before funding) = 100% ty. – the targeted year (after funding)

The inputs of the objectified work were shaping similarly to the replacement value of the mechanization means. However, farms with the area 30-50 and 50-70 ha AL, were in comparison to the base year (before funding) lower respectively by 10.4 and 29.9%. Whereas, the human labour expenditures in both periods were the highest in the smallest farms and decreased along with the increase of the AL area. Technical infrastructure of an employee and the energy infrastructure of employment increased propotionally to the increase of the area (ha AL) and the aid amount (thousand PLN·farm^{-1}). It was stated that in the targeted year, the index of the mechanization degree (which characterizes the work process), except for farms below 10 ha AL (57.7%) was at the high level (from 66.8 to 73.2%). It was the highest in the biggest farms with respect to the area, and in each investigated group (ha AL) its increase was reported in comparison to the base year.

Conclusion

Efficiency in the use of agricultural engineering referred to the amount of aid and the net commodity production is the highest in farms, which were big with respect to the area and economy. The costs of obtaining grain units (GU) were decreasing along with the increase of the economic size of farms, while the net commodity production was rising in these farms. Efficiency of using the EU funds for technical modernization was presented in each investigated group of farms, but these funds were the most effectively used in farms with the area up to 70 ha of AL, which is mainly determined by the AL area, the economic size, the level of the obtained farming effects and the level of the work station infrastructure. Technical infrastructure considerably influences the agricultural production process since it enables better use of the production circulating asset. In farms with smaller areas, a high level of the employment infrastructure, at the simultaneous loading with high costs of mechanization means, was proved. Modernization of farms considerably influences the production process, all mechanization rates increase, including: the replacement value of mechanization means, the level of the employment technical infrastructure, installed power, objectified work inputs, human labour expenditures, employee infrastructure, energy infrastructure of employment, the mechanization degree and the net commodity production (GU·ha^{-1} AL).

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EFEKTYWNOŚĆ STOSOWANIA TECHNIKI ROLNICZEJ

Streszczenie. Celem pracy było określenie właściwych relacji pomiędzy sprawnością a skutecznością wdrażania postępu naukowo-technicznego i organizacji pracy, przy wykorzystanie funduszy UE. W latach 2004-2009 przebadano 70 wybranych gospodarstw rodzinnych z powiatu biłgorajskiego korzystających z dofinansowania UE na modernizację techniczną. Analizowano okres przed i po otrzymaniu pomocy. Efektywności stosowania techniki rolniczej w odniesieniu do kwoty pomocy i produkcji towarowej netto była najwyższa w dużych obszarowo oraz ekonomicznie gospodarstwach. Koszty uzyskania jednostek zbożowych (JZ) malały wraz ze wzrostem wielkości ekonomicznej gospodarstw, natomiast produkcja towarowa netto w tych gospodarstwach wzrastała. Efektywność wykorzystania funduszy UE na techniczną modernizację wykazano w każdej z badanych grup gospodarstw, ale środki te były najskuteczniej wykorzystywane w gospodarstwach do 70 ha UR, co jest determinowane przede wszystkim powierzchnią UR, wielkością ekonomiczną, poziomem uzyskiwanych efektów gospodarowania oraz poziomem uzbrojenia stanowiska pracy. W mniejszych obszarowo gospodarstwach wykazano wysoki poziom uzbrojenia pracy, przy jednoczesnym obciążeniu wysokimi kosztami środków mechanizacji. Modernizacja gospodarstw rolnych znacząco wpływa na proces produkcji, wzrastają wszystkie wskaźniki mechanizacji, w tym: wartość odtworzeniowa środków mechanizacji, poziom uzbrojenia technicznego pracy, moc zainstalowana, nakłady pracy uprzedmiotowionej, nakłady pracy ludzkiej, uzbrojenie pracownika, uzbrojenie energetyczne pracy, stopień mechanizacji i produkcja towarowa netto (JZ·ha^{-1} UR).

Słowa kluczowe: gospodarstwo rodzinne, technika rolnicza, sprawność, skuteczność, powierzchnia UR, wielkość ekonomiczna, kwota pomocy