STOWARZYSZENIE EKONOMISTÓW ROLNICTWA I AGROBIZNESU
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Sławomir Kocira[*], Maciej Kuboń[**]

[*] University of Life Sciences in Lublin, Poland, [**]University of Agriculture in Krakow, Poland

THE OPERATING COSTS MACHINES AND GENERAL TYPE OF FARMING

KOSZTY EKSPLOATACJI MASZYN A TYP GŁÓWNY GOSPODARSTWA ROLNEGO

Key words: operating costs of machines, type of farm, agricultural farm
Słowa kluczowe: koszty eksploatacji maszyn, typ gospodarstwa, gospodarstwo rolne

Abstract. In paper the analysis of operating costs of machines was occured in agricultural farms grouped according to main type definite on ground of the Standard Gross Margin. It was ascertain that with growth of economic size of farm grow the operating costs of machines together. The smallest operating costs convert on 1 hectare of arable area occur in the Mixed crops – livestock farms. The largest operating costs of machines convert on 1 ESU bear the Mixed cropping farms.

Introduction

Farms to lead productive activity costs bear. The costs of production in farm and in every enterprise can divide on two groups. Direct costs make up first group, and second indirect costs. The expenses in direct costs the largest part have borne on the circulating means of production like fertilizer, means of the plants' protection, concentrated feeding stuff. The operating costs of machines in indirect costs the largest part have. The equipment of farm in machines is the determining the level of operating costs factor, which it depends from kind and size of led production mainly. It operating costs of machines, which bears farm, have significant influence on efficiency farming. Therefore it's important the cognition of size and structure of operating costs of machines in different types of farms as well as search possibility of their reduction peaceably on principle rational farming. The numerous papers with the domain of analysis of operating costs and mechanization of agricultural production [Kowalik, Grześ 2006, Malaga-Toboła 2007, Kocira, Sawa 2005, Lorencowicz 2005, Muzalewski 2009, Tomczyk 2005] testify about significant meaning this component in analyses of profitability production.

Aim of work

Realization the analysis of size and structure of operating costs of machines in grouped according to main type farms is the aim of work. The range of work contains:
– calculation SGM and on her ground of grouping farms,
– calculation and the analysis of size as well as structure of operating costs of machines.

Material and methods

The material comes from the developmental project NCBiR of No. the N R 12 0043 06/2009. It to analysis choose of the thirty farms in which the list of assets, sources of their funding in 2009 year was accomplished as well as led production together with receipts and costs. It the repartition of farms on main types was accomplished in agreement with based on the Standard Gross Margin (SGM) typology definite with calculator used by Agency for Restructuring and Modernization of Agriculture.

It the operating costs of machines (K_e) the balance and calculation method was counted [Wójcicki 2007], in which the variable costs were defined on basis the born expenditure in fact, and the calculation method was counted the fixed costs. The operating costs of machines were counted according to equation:

$K_e = K_{utrz} + K_{uż}$

where:

K_{utrz} – the fixed costs [PLN/year],

$K_{uż}$ – the variable costs [PLN/year].

$K_{utrz} = K_a + K_p + K_u$ [PLN/year]

where:

K_a – the amortization costs [PLN/year],

K_p – the storage and maintenance costs [PLN/year],

K_u – the insurance costs [PLN/year].

It the straight-line method was counted the amortization costs accepting for every the machine of the duration of exploitation since twenty till thirty years maximum period.

$K_a = C_m/T$ [PLN/year]

where:

C_m – the gross replacement value [PLN],

T – the duration of exploitation [year].

It reduced method was counted the storage and maintenance costs on the basis of the following equation:

$K_p = 0{,}01 * C_m$ [PLN/year]

The insurance costs were accepted from born expenses in fact on insurance of machines, tools and vehicles peaceably. The insurance costs were defined on basis the born expenditure in fact on insurance of machines. The variable cost ($K_{uż}$) – it's the sum of expenses for year born on: reparations, fuels, oils, greases and auxiliary materials.

Results of the research

The area of analysed farms amounted from 14.87 to 85.00 hectare of arable area (Tab. 1). All farms were equipped at least in one farm tractor and basic machines to tillage. It studied farms were grouped according to main pattern receiving of five groups:

- Specialist grazing livestock,
- Specialist granivores,
- Mixed cropping,
- Mixed livestock holdings,
- Mixed crops – livestock.

Definite for farms the European Size Unit enlarged together with growth of farm's area (Fig. 1). Statistical dependence between these variables is average and the value of coefficient of linear correlation amount to $r^2 = 0.351$. However counting the European Size Unit occurring on one hectare of arable area has not clear dependences.

In studied group of farms the structure of operating costs represent Figure 2. The amortization costs have the largest part – 48% and together with storage, maintenance and insurance costs make up 61% of all operating costs. The least but only 5% part have the costs of auxiliary materials.

Table 1. The general characteristic of analysed farms
Tabela 1. Ogólna charakterystyka analizowanych gospodarstw

Specification/*Wyszczególnienie*	**Minimum/ *Min.***	**Maximum/ *Max.***	**Average/ *Średnia***	**Standard deviation/ *Odchylenie standardowe***
Arable area/*Powierzchnia UR*	14.87	85.00	39.85	20.34
European Size Unit (ESU)/*Europjska Jednostka Wielkosci (ESU)*	12.05	61.86	31.91	16.12
Number of machines/*Liczba maszyn*	17.00	47.00	29.00	9.00
Number of tillages/*Liczba upraw*	1.00	8.00	3.95	1.94
Livestock Unit (LU)/*Duża Jednostka Przeliczeniowa (DJP)*	4.52	16.60	40.90	27.08

Source: own study
Źródło: opracowanie własne

With growth of economic size of farms grow together with costs born on utilization of machinery and agricultural devices. The coefficient of linear correlation amount to $r^2 = 0.347$, which testifies about average positive correlation among operating costs of machines and the European Size Unit (Fig. 3).

In all types of farms the amortization costs had in structure of operating costs of machines the largest part (Fig. 4). The fixed costs (amortization costs + storage and maintenance costs) in every of analysed types of main farms exceed 50% of operating costs. In the variable costs predominated outlays born on fuel and greases. The part of repairs and auxiliary materials costs had contained since 10% in the Specialist granivores and the Mixed crops – livestock farms to 20% in the Mixed cropping farms.

The lowest annual operating costs occur to one hectare of arable area (1158.7 PLN per arable area) bore the Mixed crops – livestock farms (Tab. 2). This results mainly with the lowest amortization costs amounted to 550.2 PLN per arable area and the costs of fuels and greases which amounted to 348.9 PLN per of arable area. The also remaining components of costs in this group of farms were the lowest. The highest operating costs of machines bore the Mixed cropping farms. It was connected with the highest outlays on fuel, greases and auxiliary materials.

Analysing of annual operating costs of machines occur to 1 ESU can ascertain that the Mixed cropping farms bear over twice as large costs then the Mixed livestock holdings farms (Tab. 3).

So the high costs resulted with costs of fuels and greases, costs of repairs and the costs of auxiliary materials. Also the amortization and maintenance costs were the almost highest from among all groups of farms.

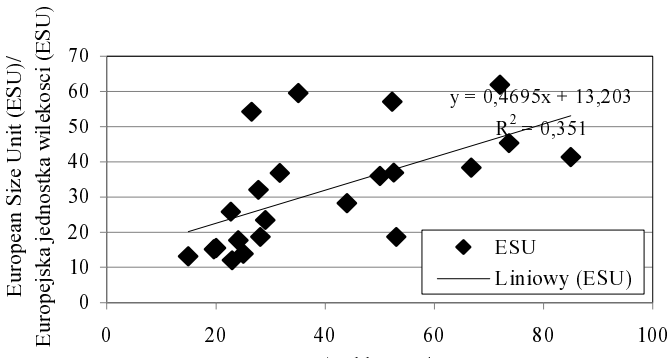


Figure 1. The European Size Unit and farm's area
Rysunek 1. Wielkość ekonomiczna a powierzchnia gospodarstwa
Source: own study
Źródło: opracowanie własne

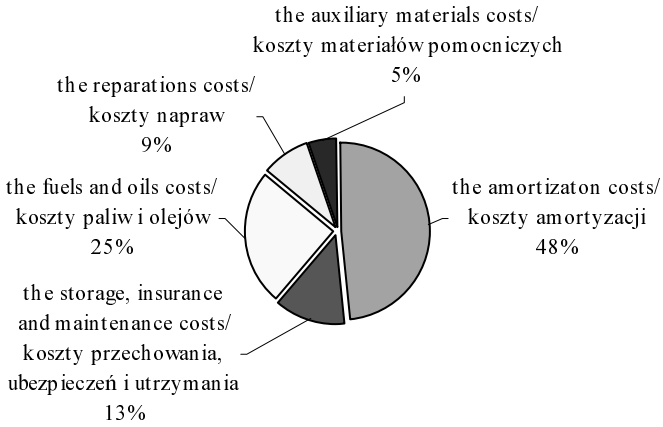


Figure 2. Structure of operating costs of machines in studied farms
Rysunek 2. Struktura kosztów eksploatacji maszyn w badanych gospodarstwach
Source: own study
Źródło: opracowanie własne

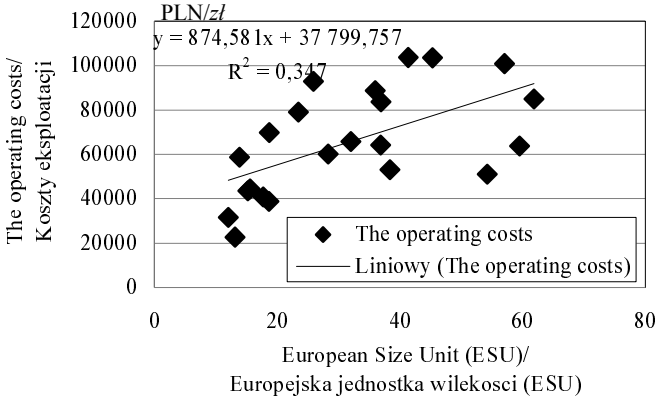


Figure 3. The operating costs and the European Size Unit of farm
Rysunek 3. Koszty eksploatacji a Europejska Jednostka Wielkości
Source: own study
Źródło: opracowanie własne

Table 2. Annual operating costs in different types of main farms occur to one of arable area
Tabela 2. Roczne koszty eksploatacji w różnych typach głównych gospodarstw przypadające na 1 ha UR

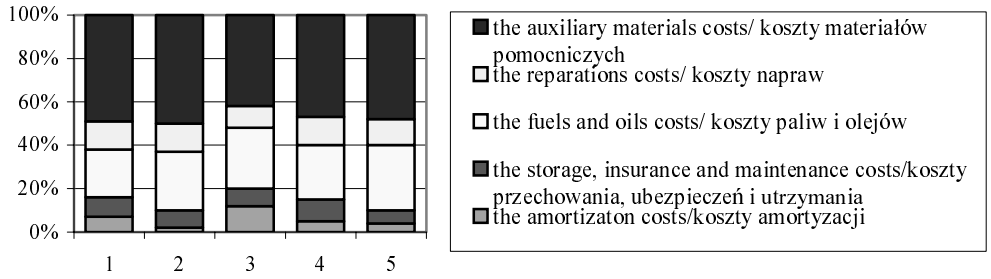
General type of farming/ *Typ główny gospodarstw*	Costs/*Koszty*					
	Ka	***Kk***	***Kp***	***Kn***	***Kmp***	***Ke***
Unit/*Jednostka*	**PLN per arable area/*zł/powierzchnię areału***					
Specialist grazing livestock/*Specjalizujące się w chowie zwierząt żywionych w systemie wypasowym*	782.9	214.8	361.5	155.4	97.5	1612.1
Specialist granivores/*Specjalizujące się w chowie zwierząt żywinych paszami treściwymi*	985.6	275.3	501.8	172.8	28.6	1964.1
Mixed cropping/*Specjalizujące się w różnych uprawach łącznie*	845.5	241.3	535.5	188.1	230.7	2041.2
Mixed livestock holdings/*Specjalizujące się w hodowli różnych zwierząt łącznie*	892.6	269.9	475.0	188.0	104.1	1929.5
Mixed crops-livestock/*Specjalizujące się w hodowli różnych zwierząt i upraw łącznie*	550.2	149.5	348.9	62.3	47.8	1158.7

Explanations/*Objaśnienia: Ka* – amortization/*amortyzacja*, *Kp* – storage and maintenance/*przechowywania i konserwacji, Kk* – fuels and oils/*paliw i smarów*, *Kn* – reparations/*napraw*, *Kmp* – auxiliary materials/*materiałów pomocniczych*, *Ke* – operating/*eksploatacji*
Source: own study
Źródło: opracowanie własne

Table 3. Annual operating costs in different types of main farms occur to 1 ESU
Tabela 3. Roczne koszty eksploatacji w różnych typach głównych gospodarstw przypadające na 1 ESU

General type of farming/ *Typ główny gospodarstw*	Costs/*Koszty*					
	Ka	***Kk***	***Kp***	***Kn***	***Kmp***	***Ke***
Unit/*Jednostka*	**PLN per ESU/*zł/ESU***					
Specialist grazing livestock/*Specjalizujące się w chowie zwierząt żywionych w systemie wypasowym*	1277.6	350.5	589.9	253.6	159.1	2630.8
Specialist granivores/*Specjalizujące się w chowie zwierząt żywinych paszami treściwymi*	863.1	241.1	439.5	151.3	25.1	1720.1
Mixed cropping/*Specjalizujące się w różnych uprawach łącznie*	1248.5	356.3	790.7	277.7	340.7	3013.9
Mixed livestock holdings/*Specjalizujące się w hodowli różnych zwierząt łącznie*	631.4	190.9	336.0	133.0	73.7	1365.0
Mixed crops-livestock/*Specjalizujące się w hodowli różnych zwierząt i upraw łącznie*	906.3	246.2	574.6	102.6	78.7	1908.5

Explanations: see tab. 2/*Objaśnienia: jak w tab. 2*
Source: own study
Źródło: opracowanie własne



Explanations/*Objasnienia:* 1 – Specialist grazing livestock/*Specjalizujące się w chowie zwierząt żywionych w systemie wypasowym;* 2 – Specialist granivores/*Specjalizujące się w chowie zwierząt żywinych paszami treściwymi;* 3 – Mixed cropping/*Specjalizujące się w różnych uprawach łącznie;* 4 – Mixed livestock holdings/*Specjalizujące się w hodowli różnych zwierząt łącznie;* 5 – Mixed crops-livestock/*Specjalizujące się w hodowli różnych zwierząt i upraw łącznie*
Figure 4. Structure of the operating costs of machines in individual groups of farms
Rysunek 4. Struktura kosztów eksploatacji maszyn w poszczególnych grupach gospodarstw
Source: own study
Źródło: opracowanie własne

Conclusions

Analysed farms characterized by large changeability of operating costs resulting mainly with differences in equipment and utilization of machines. With growth of economic size of farm grow the operating costs of machines together. The smallest operating costs convert on 1 hectare of arable area occur in the Mixed crops – livestock farms.

The largest operating costs of machines convert on 1 ESU bear the Mixed cropping farms. So the high costs result with a large number of tillages what the necessity of commitment the different machines in technological process causes.

The costs of maintenance (the sum of costs of amortization and the storage as well as the insurance and the preservation) they make up over 60% costs of exploitation of machines. So large part of this group of costs should influence search possibility of their reduction.

The fixed costs (the sum of amortization, storage, insurance and maintenance costs) make up over 60% operating costs of machines. So large part of this costs group should influence on search possibility of their reduction.

Bibliography

Kocira S., Sawa J. 2005: Koszty mechanizacji w gospodarstwach o różnej wielkości ekonomicznej. *Inż. Rol.*, 6(66), 321-328.

Kowalik I., Grześ Z. 2006: Wpływ wykorzystania maszyn rolniczych na koszty mechanizacji w gospodarstwach rolniczych o różnej powierzchni. *Inż. Rol.*, 13(88), 201-208.

Lorencowicz E. 2005: Koszty eksploatacji zestawów maszyn w gospodarstwach rodzinnych. *Rocz. Nauk. SERiA*, t. VII, z. 1, 156-160.

Malaga-Toboła U. 2007: Koszty produkcji w małopolskich rozwojowych gospodarstwach rolniczych. *Inż. Rol.*, 9(97), 149-155.

Muzalewski A. 2009: Koszty eksploatacji maszyn rolniczych. IBMER, Warszawa.

Tomczyk W. 2005: Koszty użytkowania parku maszynowego na przykładzie Kombinatu Rolnego KIETRZ sp. z o.o. *Probl. Inż. Rol.*, 4, 109-116.

Wójcicki Z. 2007. Wpływ wyposażenia technicznego na efekty działalności gospodarstwa rodzinnego. *Probl. Inż. Rol.*, 3, 5-12.

Streszczenie

W artykule dokonano analizy kosztów eksploatacji maszyn w gospodarstwach rolnych pogrupowanych według typu głównego określonego na podstawie standardowej nadwyżki bezpośredniej. Stwierdzono, że wraz ze wzrostem wielkości ekonomicznej gospodarstwa rosną koszty eksploatacji maszyn. Najmniejsze koszty eksploatacji w przeliczeniu na 1 ha UR występują w gospodarstwach, hodujących różne zwierzęta i prowadzących produkcję różnych gatunków roślin uprawnych. Największe koszty eksploatacji maszyn w przeliczeniu na 1 ESU ponoszą gospodarstwa specjalizujące się w produkcji różnych roslin uprawnych.

Corresponding address:
Dr Sławomir Kocira
University of Life Sciences in Lublin
Department of Machinery Exploitation and Management in Agricultural Engineering
Poniatowskiego Str. 1
20-060 Lublin, Poland
tel. +48 81 531 83 21
e-mail: slawomir.kocira@up.lublin.pl