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The use of production potential of vehicles on farms of different sizes

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Summary. The results of studies comparing the use of potential production capacity of means of transport in the context of farm size are presented. In the studied objects the level of annual use of the production potential is low, the lowest on average for trucks – 4.53 %, and the highest for delivery vans – 5.80 %. 67.11% of tractors are now fully depreciated. Among the most commonly used means of transport - box trailers, as much as 64.79% of trailers with an average load capacity (range 3-5 tons) are now fully depreciated.

Key words: transport, means of transport, tractors, trailers, cars, exploitation, production potential.

INTRODUCTION

One of the main farm activities is transportation. Hence the correct, both qualitative and quantitative, selection of vehicles – which are one of the basic technical means – is directly reflected in the efficiency of transport works, but also in the expenditures incurred on a farm [2,6,1]. Reduction of expenses incurred for transport can be achieved by proper selection of the means and effective organisation of transport processes, and also by an optimum use of the resources [7,8,10]. The results of studies, presented by many authors, on the use and the associated level of effort clearly indicate that the volume of work and equipment, transport means and their use is usually characterized by considerable variability depending on the context of analysis [9,5]. Based on previous research, it can be concluded that the efficiency of means of transport varies considerably, and it results, among others, from the use of the potential and the ways in which such potential is used [2,3,11,13,12].

SCOPE AND PURPOSE OF THE STUDY

The effectiveness of management and the expenses for production depend not only on the technical resources - including means of transport – but also on their use in the production process. Therefore, the objective of this study is to assess the use of the potential of means of transport, available on farms with various sizes of arable area. The subject of the study is multipurpose box-type means of transport available in selected farms in Małopolskie voivodship. 166 farms from Małopolskie voivodship were studied. The study included farms in the range of the secondary and vocational agricultural schools – children of the farm owners attend those schools and declare to take over the farms after graduating. It should therefore be presumed that the farms are developing entities. Due to large variations of the basic technology of agricultural production - agricultural areas of the surveyed farms were divided into three groups:

- A – up to 10.00 ha – 61 farms –36.75%;
- B – 10.01 – 50.00 ha – 83 farms – 50.00%;
- C – above 50.01 ha – 22 farms – 13.25%.

RESEARCH METHODS

The research was conducted with the aid of a guided interview, and the objects of studies were selected deliberately – declaration to continue agricultural production at the same level or, which is quite frequent, increasing it. One of the basic questions of the interview concerned the available means of transport, their types and characteristics (load capacity, utilisation, year of manufacture and purchase). To evaluate the use of potential production capacity of means of transport, the ratio of production capacity utilisation was assumed after Tabor [Tabor 2008] as follows:

$$K_{wp} = \frac{W_{rz}}{n} \cdot 100, \qquad [\%]$$

where:

K_{wp} – the level of utilization of the production potential [%];

W_{rz} – the actual utilization per annum [h];

n – resource – normative utilization of the resources during the lifetime [h];

Resource – the normative use during the lifetime according to the Swiss data, after Lorencowicz [5].

RESULTS

Table 1 characterises the farms under study. An average size of the studied farms was 26.24 ha of arable area, with considerable variability between the area groups A–6.46 to C – 97.14. A high level of permanent grassland is also remarkable, on average almost 27 %, as well as a considerable share of hired land – 38.83 % on average. These facts prove that the farm owners see their future in agricultural production. Farm size and livestock density, as the primary factors generating traffic volume are crucial for the equipment and structures of the owned means of transport. Another basic element is the distance of transport operations. The average distance for home transportation - 2.91 km - (2.04 Group A and 3.50 km Group B) is very high.

The considerable distance in the external transport, on average 15.25 km is characterized by low variability. Purchase of means of production and sales, in the case of commercial farms, shows no significant variations.

The number of tractors per 100 ha of arable land shows that the smallest farms are best equipped, this group can even be found over-invested in this respect. Average tractor power in all the area groups is very similar.

Similar differences are found in the means of transport as in the case of tractors. It has to be noted that the studied farms also owned special means, such as feed wagons, volume trailers and trailers for bales. Their average number per farm was 0.21, with the average load capacity 3.67 t. At the same time, each farm had dung spreaders, 0.94 pcs on average, with average load capacity 3.93 t. The index of tons of load capacity per 1 ha of arable land, with the average of 0.33 tons in the smallest farms, is almost 13 times higher than that of the largest farms. This may be perhaps due to the fact that the largest farms, because of the volume of purchasing of the production means and sales, hire companies which provide combined sales, purchase and transport.

Expenditures in transport depend not only on the equipment quantities, but mainly on the types of means.

Table 1. Description of the studied farms

Specification	unit	Farm size			
		average	Group A	Group B	Group C
Arable area	ha	26,24	6,46	21,98	97,14
% of AL share	%	73,09	62,69	60,24	86,01
% of hired arable land	%	38,82	11,76	29,27	51,97
Livestock	SD·100ha^{-1}AL	69,18	61,22	79,05	49,77
Installed power (tractors+trucks)	kW·1ha^{-1}AL	9,45	8,04	14,24	18,03
Internal transport distance	km	2,91	2,04	3,50	3,05
External transport distance	km	15,25	15,56	14,24	18,03
Tractors					
Number per 100 ha of arable land	pcs.	6,90	29,64	7,83	2,11
Average tractor power	kW	50,01	49,59	51,63	45,93
Means of transport*					
Number per 100 ha of arable land	pcs·100ha^{-1}AL	10,78	32,5	10,24	2,57
∑tons of load capacity per farm	t·farm^{-1}	8,64	7,92	9,07	9,00
Tons per 1 ha of arable land	t·1ha^{-1}AL	0,33	1,29	0,41	0,10
Average load capacity	t	3,88	3,78	4,03	3,60
Share of means of transport in their load capacity per farm					
Trucks	%	4,64	3,41	3,83	10,60
Delivery vehicles	%	6,26	5,65	5,67	10,02
Box trailers	%	82,38	84,63	82,68	75,74
Tractor cars	%	6,72	6,31	7,82	3,64

Source: own studies.

As the data presented clearly shows, the quality of transport fleet, expressed as a share of vehicles with total load capacity, increases with the area of farm. This is a very beneficial trend, since the transport needs and related expenditure in larger farms can be reduced by the use of more efficient means of transport.

In the studied objects (Table 2), the index of production potential use of tractors, with an average annual use of 527 h per tractor, is from 2.81 % in the medium-sized farms, to 10.85 % in the largest farms.

Comparing the number of years till full depreciation with the current age of tractors used after being fully depreciated, there are 68.11 % tractors in the studied population. In the group of box trailers, the average annual use of the production potential is 5.35 % and increases with the area of farms. In this group of vehicles, 42.15 % are fully depreciated – requiring replacemet. In spite of the low use of production potential in the group of trucks, all vehicles have not achieved the full depreciation level, and those are the youngest ones. In the group of delivery vans, only 23.21 % are fully depreciated.

The utilization of tractors depends on their basic technical parameter – engine power. For the analysis, division of tractors into so called operating groups has been adopted after Kuczewski. [Kuczewski J., Majewski Z. 1999].

Table 2. Utilization of production potential

Specification	Unit	Farm size			
		Average	Group A	Group B	Group C
Tractors					
Operating hours p/a, field+ transport	h	527	281	479	1085
The most beneficial resource	h	10000	10000	10000	10000
Use of productivity	%	5,27	2,81	4,79	10,85
No. of years to depreciate	years	19	36	21	9
Current age	years	17	21	16	20
% of means after resource	%	67,11	93,10	51,23	73,07
Box trailers					
Operating hours p/a	h	294	161	288	479
Resource	h	5500	5500	5500	5500
Use of productivity	%	5,35	2,93	5,24	8,71
No. of years to depreciate	years	19	34	19	9
Current age	years	21	22	20	19
% of means after resource	%	42,15	9,72	54,55	54,39
Trucks					
Operating hours p/a	h	725	593	753	867
Resource	h	16000	16000	16000	16000
Use of productivity	%	4,53	3,71	4,71	5,42
No. of years to depreciate	years	22	27	21	18
Current age	years	12	15	10	10
% of means after resource	%	0,00	0,00	0,00	0,00
Delivery vehicles					
Operating hours p/a	h	545	536	549	570
Resource	h	9400	9400	9400	9400
Use of productivity	%	5,80	5,70	5,84	6,06
No. of years to depreciate	years	17	18	17	17
Current age	years	14	17	11	16
% of means after resource	%	23,21	23,81	11,76	33,33

Source: own studies.

Table 3. Utilization of the production potential in context of power

Specification	Unit	Operating group of tractors			
		Light	Medium	Heavy	Very heavy
Operating hours p/a, field+ transport	h	400	446	583	1306
Resource	h	10000	10000	10000	10000
Use of productivity	%	4,00	4,46	5,83	13,06
No. of years to depreciate	years	25	22	17	8
Current age	years	24	18	12	5
% of means after resource	%	55,17	63,87	36,05	15,38

Source: own studies.

Table 4. Utilization of the production potential of trailers in context of their load capacity

Specification	Unit	Trailer load capacity [t]			
		Up to 3,0	3 - 5	5 - 8	Above 8
Operating hours p/a	h	163	232	274	306
Resource	h	5000	5000	6000	6000
Use of productivity	%	3,26	4,64	4,57	5,10
No. of years to depreciate	years	31	22	22	20
Current age	years	19	23	18	7
% of means after resource	%	19,30	64,79	45,83	14,29

Source: own studies.

The results shown in Table 3 indicate a clear trend – the annual use of the potential of tractors significantly increases with the increase of their power. The most commonly used are the medium-sized universal tractors – 63.97 % are already fully depreciated.

The basic technical indicator of a transport vehicle, crucial for its applications and efficiency, is its load capacity. In general, it can be presumed that the use of the potential of the means of transport increases with the increase of load capacity.

This is a positive phenomenon, since vehicles with higher load capacity usually generate higher cost of use. The worst situation is in the group of medium trailers where, with the annual index of use 4.64 %, as much as 64.79 % trailers are already fully depreciated.

CONCLUSIONS

Based on the results of the studies, it can be concluded that in the studied objects the level of annual use of their productivity is low, the lowest on average for trucks – 4.53 %, and the highest for delivery vans – 5.80 %. 67.11% of tractors are now fully depreciated, and for the trailers, the index is 42.15 %. Analyzing the use of tractors in context of their power, the medium-universal tractors were found to be the most commonly used ones. Among the most commonly used means of transport - box trailers, with the average annual use of the potential of 5.35 %, as much as 64.79% of trailers with an average load capacity (range 3-5 tons) are now fully depreciated.

REFERENCES

1. **Kokoszka S. 2009:** Postęp technologiczny a wydajność i koszty w transporcie zwierząt. Problemy Inżynierii Rolniczej. Nr 4 (30). 37-43.
2. **Kokoszka S., Tabor S. 2000:** Postęp technologiczny a struktura czasu pracy i efektywność nakładów w transporcie ziarna. Problemy Inżynierii Rolniczej. Nr 4 (30). 91-98.
3. **Kokoszka S., Tabor S. 2006:** Postęp technologiczny a koszty transportu płodów rolnych. Inżynieria Rolnicza. Nr 11 (86). 177-182.
4. **Kuczewski J., Majewski Z. 1999:** Eksploatacja maszyn rolniczych. WsiP. W-wa 57-59.
5. **Lorencowicz E. 2007:** Poradnik użytkownika techniki rolniczej w tabelach. Wydawnictwo APRi A APRA sp. Z o.o. Bydgoszcz. 83-96.
6. **Lorencowicz E. 2007:** Okresy użytkowania i wykorzystanie środków energetycznych w gospodarstwach rodzinnych. Inżynieria Rolnicza. Nr 7 (95). 123-128.
7. **Muzalewski A. 2007:** Ekspertyza wyciąg dostosowany przez ARiMR dla potrzeb działania „Modernizacja gospodarstw rolnych" w ramach PROW 2007-13). IBMER. Warszawa. 1-110.
8. **Muzalewski A. 2010:** Koszty eksploatacji maszyn ITP. Nr 25. 377-383.

9. **Parafiniuk S. 2006:** Nakłady transportowe w badanych gospodarstwach rodzinnych. Inżynieria Rolnicza. Nr 13. 377-383.
10. **Sawa J., Parafiniuk S. 2003:** Efektywność nakładów pracy w wybranych systemach produkcji rolniczej. Motrol Lublin Nr 5, 101-166.
11. **Tabor S. 2008:** Wykorzystanie zdolności produkcyjnych parku maszynowego w wybranych gospodarstwach sadowniczych. Inżynieria Rolnicza. Nr 6 (104). 211-217.
12. **Tabor S. 2008:** Wykorzystanie zdolności produkcyjnych parku maszynowego w wybranych gospodarstwach sadowniczych. Inżynieria Rolnicza. Nr 6 (104). 211-217.
13. **Tabor S., Kmita W., 2007:** Wykorzystanie potencjalnych zdolności produkcyjnych parku maszynowego w gospodarstwach sadowniczych. Inżynieria Rolnicza. Nr 9 (97). 239-246.

WYKORZYSTANIE POTENCJAŁU PRODUKCYJNEGO POJAZDÓW NA FARMACH O RÓŻNYCH ROZMIARACH

S t r e s z c z e n i e. Artykuł prezentuje wyniki badań porównujących stosowanie potencjalnej zdolności produkcyjnej środków transportu w kontekście wielkości gospodarstw są prezentowane. W badanych obiektach poziom rocznego wykorzystania potencjału produkcyjnego jest niski, najniższy od średniej dla samochodów ciężarowych - 4,53%, a najwyższy dla samochodów dostawczych - 5,80%. 67,11% ciągników są to maszyny w pełni zamortyzowane. Wśród najczęściej wykorzystywanych środków transportu - przyczep skrzyniowych, 64,79% przyczep o średniej nośności (zakres 3-5 ton) jest w pełni zamortyzowane.

S ł o w a k l u c z o w e: transport, środki transportu, ciągniki, przyczepy, samochody, eksploatacja, potencjał produkcyjny.