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### LEVEL AND EFFECTIVENESS OF USE OF DELIVERY TRUCKS AND TRUCKS IN THE SELECTED HORTICULTURAL FARMS

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#### ABSTRACT

*The objective of the paper was to analyse the level and effectiveness of using delivery trucks and trucks in horticultural farms. The scope of the paper covers delivery trucks and trucks, which constitute the equipment of 60 agricultural farms, which produce vegetables and fruit, located on the territory of Świętokrzyskie and Małopolskie Voivodeship. The following, inter alia, was determined: annual use, yield, structure of transport works and the use of capacity. It was determined, inter alia, that in the vegetable farms there are more both delivery trucks and trucks per one farm than in the horticultural farms. The transport efficiency of vehicles in the vegetable farms is lower in comparison to vehicles in the horticultural farms.*

### Introduction

According to the estimations in agriculture, annually 800-1000 million tonnes of loads are transported which in relation to the structure and intensity of production gives an index from 20 to 70 t·ha<sup>-1</sup> of agricultural land (Kokoszka and Tabor, 2006). Horticulture plays a significant role in the national agriculture and constitutes one of the most important branches of agricultural production. Although, horticultural production is carried out only on 3.4% area, its value is two times higher for grains, although they are cultivated as much as on 63.5% area taken by plant production (Hołownicki, 2006). Specialist horticultural farms, in particular vegetable farms, in Poland are located mainly near big city agglomerations, which constitute an outlet for the produced vegetables and fruit. Vicinity of outlets considerably influences the use of the transport means and as a result the costs of production in farms (Kowalczyk, 2001). However, a serious problem which negatively affects functioning of the horticultural farms, inter alia, through the increase of the transport costs is improper organization of the wholesale market of vegetables and fruit (Kowalczyk, 2011). Other impediment for the fruit and vegetable market is high fragmentation of the horticultural farms and as a result a small scale of production, which to a high degree limits a possibility for single producers e.g. big hypermarkets chains. Due to the above problems, the transport means are one of the most important technical means in a horticultural farm.

Their number and quality selection is reflected in the efficiency of the performed transport works but also in the inputs incurred for transport (Kokoszka, 2011). Also, acc. to Marczuk (2011), selection of proper organization of the transport means work at relatively low inputs may bring considerable advantages for a farm.

### Objective, scope, methodology of work

The objective of the paper was to analyse the level and effectiveness of using delivery trucks and trucks in the selected horticultural farms. The scope of the paper covers: delivery trucks and trucks which constitute the equipment of 60 farms which deal with production of vegetables and fruit located on the territory of Świętokrzyskie and Małopolskie Voivodeships. The research was carried out in the form of a guided survey entailing filling out the questionnaire. The collected information, except for general data which characterize farms, such as the structure of the land use, the size and structure of production concerned mainly organization of the transport works, that is work timing of the transport means, their age, capacity, etc. The coefficient of using the capacity was calculated as percentage quotient of the amount of load transported one time and the capacity of the transport mean. Coefficient of using operation time  $K_{07}$  determines participation of the effective work time –  $T_1$  to operation time  $T_{07}$  (which includes also time losses due to the organizational reasons) where:  $T_1$  – driving time with a load,  $T_{07}$  – includes: driving time with a load, driving time without the load, time for loading activities, time for crossings to and from the work place and technical stopovers, time of technical service, time of removing technical and technological faults, rest time, operation time of accompanying machines carried out in the presence of a transport mean, time of stopovers independent from the mean (e.g. organizational and others). Efficiency of the transport means work was calculated based on the operation time.

The analysis of the obtained results was carried out in two farm groups, that is: vegetable and horticultural, separately for delivery trucks and trucks.

### Research results

The size and structure of production constitute the basis for a rational selection of the transport means. As table 1 shows, the average area of agricultural land of farms included in the research exceeded the average for the entire Małopolska region and was respectively for vegetable and horticultural farms: 9.47 and 7.51 ha.

Table 1  
*The structure of land use in agricultural farms*

Specification	Area of agricultural land (ha)	Area of arable land (%)	Area of grasslands (%)	Area of orchards (%)
Vegetable farms				
– average	9.47	91.90	7.83	0.27
– standard deviation	8.38	6.46	6.24	2.16
Horticultural farms				
– average	7.51	4.97	2.70	92.26
– standard deviation	5.29	5.44	2.95	8.05

Level and effectiveness...

Table 2 presents the size of the produce crop in groups of farms. In case of vegetables and fruit a decisive majority of crop is transported by cars into the outlet that is the most frequently to the agri-food fair in Cracow. Obviously, in a total mass of crops horticultural products prevail, but total crops of produce are higher in vegetable farms and are at the average 241 tonnes per a farm, while in horticultural – 152 tonnes.

Table 2  
*Crops of produce (t·farm<sup>-1</sup>)*

Specification	Vegetables	Fruit	Others	Total
Vegetable farms				
– average	167	2	72	241
standard deviation	138	2	104	217
Horticultural farms				
– average	1	142	9	152
– standard deviation	1	118	12	159

Table 3 includes information concerning the transport means covered by the research thus delivery trucks and trucks. The stock of cars both delivery trucks and trucks per a farm, is higher in case of the vegetable farms, and is respectively: 0.85 and 0.73 item·farm<sup>-1</sup>, while in the horticultural farms this stock is 0.79 and 0.11 items·farm<sup>-1</sup>. The equipment in the form of delivery trucks with reference to the area of agricultural land for both groups is at a similar level of 10.4 and 10.7 item·100 ha<sup>-1</sup>AL. For comparison in other horticultural farms of the Małopolska region, the stock of delivery trucks is 9.0 items·100 ha<sup>-1</sup>AL whereas of trucks – 5.3 items·100 ha<sup>-1</sup>AL (Kowalski et al., 2002).

Table 3  
*Characteristics of the selected transport means*

Specification	Stock (item·farm <sup>-1</sup> )	Stock (item·100 ha <sup>-1</sup> AL)	Age (years)	Capacity (t)	Annual use (h·year <sup>-1</sup> )
Vegetable farms					
– delivery truck	0.85	10.4	13	1.6	1050
– truck	0.73	8.9	16	3.8	1285
Horticultural farms					
– delivery truck	0.79	10.9	15	1.4	955
– truck	0.11	1.7	18	3.9	1014

Taking into consideration the age of cars, the vegetable farms, which have cars at the average two years younger are more favourable in comparison to the horticultural farms. When analysing the data included in table 3, one may see very high use of both type of cars not related to the type of the business activity, which is within the range 955-1285 h·year<sup>-1</sup>. Such high loading with work results mainly from often and sometimes very long stays at the agri-food fairs. Unfortunately, organization of the transport processes also influences negatively prolongation of this time, i.e. both loading of vegetables and fruit as well as

unloading of goods, which were not sold, was performed manually in majority of farms. It is influenced by the lack of specialist devices such as fork lifts as well as specificity of goods. Some vegetables, such as e.g. cauliflowers, broccoli – are sold without group packages so they are arranged in a loose state in a car, which impedes mechanization of loading and unloading. Kuboń's research (2007) proves that the use of delivery trucks in horticultural farms shaped at the level of 582 h·year<sup>-1</sup>, and trucks – 101 h·year<sup>-1</sup>.

Table 4 presents, inter alia, majority of the transported load and as it can be seen in both groups of farms, delivery trucks transport a bigger mass of the collected produce, which due to their higher capacity is understandable. According to Kokoszka's research (2007) special attention should be paid to the size of single transported batches of load at execution of transport tasks, because increase of the use of capacity causes savings of time and decrease of the transport costs, even by 70% in case of the set composed of a tractor and a trailer. Table 4 presents also a coefficient of the capacity use, which constitutes a percentage quotient of the amount of a load which is transported singularly and the capacity of the transport mean. As one can see, loads which are transported one time are almost comparable to the capacity of cars, and in case of delivery trucks used for transport of vegetables - the mass of the transported load was sometimes higher than the capacity of a car, which is proved by the coefficient of using capacity which is 104%. The cars, which are possessed by farms are characterized with especially low operational capacity of  $W_{07}$  which is from 0.12 to 0.18 t·h<sup>-1</sup> in the vegetable farms and from 0.13 to 0.20 t·h<sup>-1</sup> in case of the horticultural farms, which in calculation per tkm·h<sup>-1</sup> is respectively: 5.6-11.7 (vegetable farms) and 7.6-14.1 (horticultural farms). From among the presented values - delivery trucks show lower efficiency. It is also worth to pay attention to the particularly low values of operational time use coefficient  $K_{07}$  of cars, which is included within 7.3-7.6% - in case of transport of vegetables and 9.8-10.4% – referred to the fruit transport. So low operational efficiencies and a low degree of using the operational time results mainly from very time-consuming stopovers on the agri-food fairs. According to Kuboń's research (2004) in case of delivery trucks the use of capacity is 80% and  $W_{07}$  – 0.61 t·h<sup>-1</sup> (Kuboń 2004). Whereas, Kokoszka's and Tabor's research (2006) show that in the vegetable farms, values of coefficients  $K_{07}$  for delivery trucks and trucks were respectively: 90% and 22% but it relates to domestic transport.

Table 4  
*Characteristic of transports*

Specification	Size of the transported load (t)	Coefficient of capacity use (%)	Efficiency $W_{07}$ (t·h <sup>-1</sup> )	$K_{07}$ (%)	Performance $W_{07}$ (tkm·h <sup>-1</sup> )
Vegetable farms					
– delivery truck	127	104	0.12	7.3	5.6
– truck	233	96	0.18	7.6	11.7
Horticultural farms					
– delivery truck	118	99	0.13	9.8	7.6
– truck	180	95	0.20	10.4	14.1

Figure 1 presents the structure of using operation time of cars divided into internal and external transport. When analysing the above figure, a decisive prevail of cars in the external transport, which consists mainly in delivery of vegetables and fruit to outlets, can be reported. In case of vegetable farms, external transport constitutes as much as 93% to 97% of car use, while in horticultural farms, external transport involves from 88% to 93% of work time of cars.

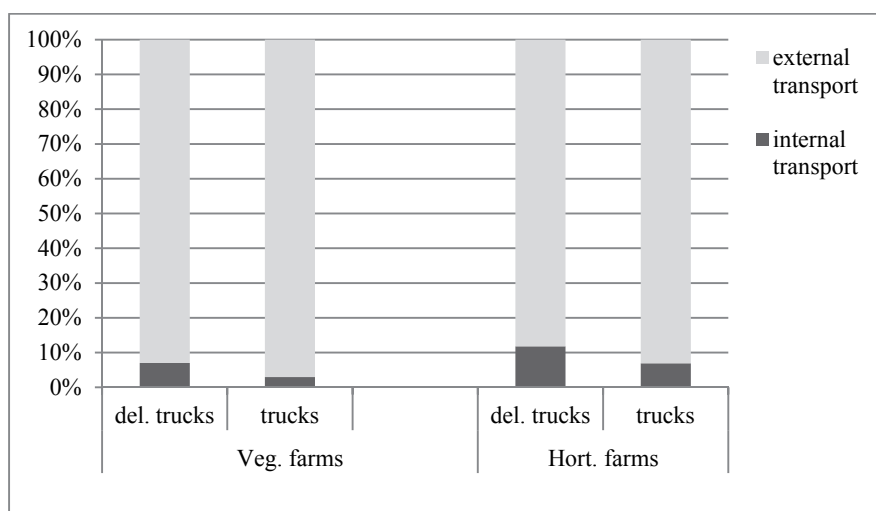


Figure 1. Structure of use of operation time of cars

## Conclusions

Based on the analysis of the research, it was determined that:

1. The vegetable farms have a higher stock of delivery trucks and trucks in comparison to the horticultural farms, but this difference is particularly visible in case of delivery trucks, the number of which in vegetable farms is over six times higher.
2. Despite a high number of delivery trucks and trucks in farms (average stock is within 0.11 to 0.85 item·farm<sup>-1</sup>), their age, which is within 13-18 years is important. In the vegetable farms, in comparison to horticultural, at the average two years younger cars occur.
3. Cars, which are the subject of the research, were used decisively for internal transport, thus their operational efficiency is very low, at the average 0.12 to 0.20 t·h<sup>-1</sup>. The reasons for this state of matters should be looked for in improper organization of the sale of vegetables and fruit, which consequently prolongs the time of cars stay on the agri-food fairs.
4. A relatively high use of cars capacity, which is within 95 and 104% is a positive fact; however, undoubtedly necessity of double transport of the same goods to fairs is a negative phenomenon, which takes place in case of difficulties with finding a client.

## References

- Hołownicki, R. (2006). Miejsce agroinżynierii w rozwoju produkcji ogrodniczej w Polsce. *Inżynieria Rolnicza*, 11(86), 135-146.
- Kokoszka, S.; Tabor, S. (2006). Postęp technologiczny a struktura czasu pracy, koszty i efektywność nakładów w transporcie warzyw. *Inżynieria Rolnicza*, 11(86), 185-191.
- Kokoszka, S. (2007). Ocena wielkości jednorazowo przewożonych ładunków w zależności od rodzaju transportu i wielkości gospodarstwa rolniczego. *Inżynieria Rolnicza*, 6(94), 65-71.
- Kokoszka, S. (2011). Analiza wyposażenia w środki transportowe w kontekście wielkości gospodarstwa rolniczego. *Inżynieria Rolnicza*, 4(129), 127-133.
- Kowalczyk, Z. (2001). Poziom intensywności produkcji a efektywność postępu naukowo-technicznego w różnych typach gospodarstw. *Praca doktorska*. Kraków. Maszynopis.
- Kowalczyk, Z. (2011). Poziom i struktura zużycia technicznych środków trwałych w różnych typach gospodarstw rolniczych, *Inżynieria Rolnicza*, 2(127), 5-120.
- Kowalski, J. i in. (2002). *Postęp naukowo-techniczny a racjonalna gospodarka energią w produkcji rolniczej*. PTIR i KMR AR Kraków. ISBN 83-905219-9-7.
- Kuboń, M. (2004). Ocena techniki przewozu w transporcie rolniczym. *Inżynieria Rolnicza*, 3(58), Kraków, 277-285.
- Kuboń, M. (2007). Wyposażenie i wykorzystanie środków transportowych w gospodarstwach o różnym typie produkcji rolniczej. *Inżynieria Rolnicza*, 8(96), Kraków, 141-148.
- Marczuk, A.; Misztal, W. (2011). Optymalizacja transportu produktów rolniczych w warunkach nierównowagi rynkowej. *Inżynieria Rolnicza*, 4(129), 221-226.

## POZIOM I EFEKTYWNOŚĆ WYKORZYSTANIA SAMOCHODÓW DOSTAWCZYCH I CIĘŻAROWYCH W WYBRANYCH GOSPODARSTWACH OGRODNICZYCH

**Streszczenie.** Celem pracy jest analiza poziomu i efektywności wykorzystania samochodów dostawczych i ciężarowych w gospodarstwach ogrodniczych. Zakresem pracy objęto: samochody dostawcze i ciężarowe stanowiące wyposażenie 60 gospodarstw zajmujących się produkcją warzyw i owoców położonych na terenie województw: świętokrzyskiego i małopolskiego. Określono m. in.: wykorzystanie roczne, wydajność, strukturę prac transportowych, wykorzystanie ładowności. Stwierdzono m. in., że w gospodarstwach warzywniczych występuje większa liczba zarówno samochodów dostawczych jak i ciężarowych w przeliczeniu na jedno gospodarstwo. Wydajność przewozowa samochodów w gospodarstwach warzywniczych jest niższa w porównaniu z samochodami w gospodarstwach sadowniczych.

**Słowa kluczowe:** samochód dostawczy, samochód ciężarowy, transport, wykorzystanie, wiek