UDC 631.33.024

THE STUDY OF THE WAY OF THE COST PRICE OF THE TRANSPORTATION OF AGRICULTURAL SLIPPING LUGGAGE FROM SMALL LAND PLOTS, THE EXPLOITATION CRITERIA OF AUTO VEHICLE

S.Kh. Papyan[1], A.S. Hakobyan[2], A.A. Pogosyan[2]
[1] *National Agrarian University of Armenia*
[2] *Shushi Technological University*

The problems connected with the crop transportation on the small land plots are analyzed, particularly, the reasons of high cost price of transportation which do not support the rise of the efficiency of crop cultivation on those plots. One of the main reasons is that each rural farm crop is transported by separate way which results in incomplete use of body volume and carrying capacity and the number of marches required for the transportation of the crop of equal amount also increases in vain.We suggest to divide the truck of the vehicle into three parts belonging to different people for crop transportation from small land plots which enables to use the carrying capacity of the vehicle fully, consequently, to reduce the cost price of the transportation significantly and also support the crop cultivation process on such land plots.

Key words: carrying capacity, volume, corn, truck, transportation, cost price

Introduction

The efficiency of any farming is connected with the correct organization of transport, particularly, with the correct organization of the vehicle work which is the guarantee of efficient use of rolling stock.

Today the condition of the transportation of agricultural cargo is low leveled in Armenia for different reasons one of which is the bad organization of the transportation of agricultural cargo which results directly on the agricultural development, particularly, in the case of crop cultivation on small land plot.

Plot and methods `

One of the intensive labour processes of cereal crops / wheat, barley, corn / and other similar crop cultivation is the transportation of the crop from the field. According to recent studies in the Republic of Armenia, the average crop yield per hectare is 2 to 3 tons [2].

As a result of the privatization of the Republic of Armenia, the smaller crops vary from 0.05 to 1 hectare of agricultural land, the grain harvest yield comprises maximum 0.15-3.0 tonnes per field. Moreover, related to crop rotation, various types of cereal crops are often sown on these plots whose crop transportation in the same body is incompatible.

The studies conducted by us have shown that inner economic transportation of the crop in the communities of the republic within the range of 1 to 15 km is carried out by the internal contractor of the farmers and is not related to the harvest quantity. The transportation of each farm's crop is carried out in a single march, for the reason the coefficients of vehicle body weight and the carrying capacity are significantly low. As a result, the vehicle's operational indicators deteriorate, the number of marches and the cost of transportation increase. However, at present, due to the lack of small trucks, grain transportation in the republic is carried out by mid-loaded trucks, in particular, ZIL-MM3-554M tipper with a capacity of 5,5 tons, the width of the body is 2.3 m, length is 3.35 m, depth of the body is 0.9 m with risen sides and the body volume is 7.0 m^3 [3]. Therefore, we choose this vehicle as the object of our further study.

The factual capacity of the vehicle is determined by the following popular formula $q_f = \rho V_b k$, t, where ρ is the volume of weight of cargo, t/m^3, V_b is the volume of the body, m^3, k is the coefficient of using /filling/ the body volume [1].

Practice has shown that during the harvest the volume weight of the crop fluctuates between 0.6-0.8 t/m^3, and the coefficient of using body volume fluctuates between 0.85-0.92, consequently, the maximum factual capacity of the chosen vehicle will be $q_f = \rho V_b k = 7 \cdot 0.8 \cdot 0.84 = 5.2\ , t$.

The static coefficient of using the the vehicle capacity is defined by $\gamma = \frac{q_f}{q_n}$ formula,where q_n is the namely capacity of the vehicle of 5.5 t. Consequently, $\gamma = \frac{5,2}{5,5} = 0.94$.

Let's define the coefficients of the static capacity of the vehicle and using the body volume when the crop of every plot is transported separately. Marking the surface of the plot with S, hectare, yield with g/hectare,we can write

$$\gamma = \frac{Sg}{q_n} \quad , \quad k = \frac{V_f}{V_b} \cdot 100\% = \frac{q_f}{\rho V_b} \cdot 100\% = \frac{gS}{\rho V_b} \cdot 100\%, \tag{1}$$

where V_f is the factual volume of the grain filled into the body, m^3, and V_b is the body volume, m^3.

The dependence of the coefficients of the carrying capacity and using the body volume of ZIL-MM3-554M from the surface of the plot for the values of 2.5 t/hectare and 0.8 t/m^3 is shown in Fig.1.

The analysis of the graphics show that the capacity and body volume are used completely in the case of the plot having more than 2.01 hectare surface while most of the surface of small plots is from 0.5 hectare to one hectare. Consequently, it is not difficult to understand from the graphics that in case of plots of 0.5-1 hectare 21-42 % of the body volume is used, and the static coefficient of using the capacity is 0,227-0,454. It is evident that these indicators are lower for 0.1 till 0.5 hectare. So, the static coefficient of using capacity fluctuates between 0.045 to 0.224 and the coefficient of using body volume between 4.2-21 % as well.

Thus, we may conclude that the use of ZIL-MM3-554M tipper is not appropriate for transporting the grain crops from the mentioned areas. On the other hand, it is not appropriate for small rural farmers to buy modern cars with large body and small capacity, because, unlike those cars, ZIL-MMZ-554M tipper truck is widely used to transport other cargo after grain harvest. It should also be noted that these cars which were mainly produced during Soviet times, have a relatively low cost and, above all, a high technical characteristics.

Taking into account the above mentioned, we plan to make structural featuring in the chosen truck body for the purpose of to fully use its carrying capacity and body use coefficients, minimize useless driving, increase operating rates and to lower the cost of grain transportation. Using the crop indicators of small rural farms and the data of Fig. 1,we found out from the primary calculations that in order to ensure high operating data, it is expedient to divide the car body of ZIL-MM3-554M tipper into three equal parts, i.e. to put two dislocated partitions in the body /Fig.2/. Obviously, in case of partitioning, the coefficient of utilization of the 1st and 2nd divisions should be chosen in such a way that while downloading the grain it should not fall into the adjacent section.

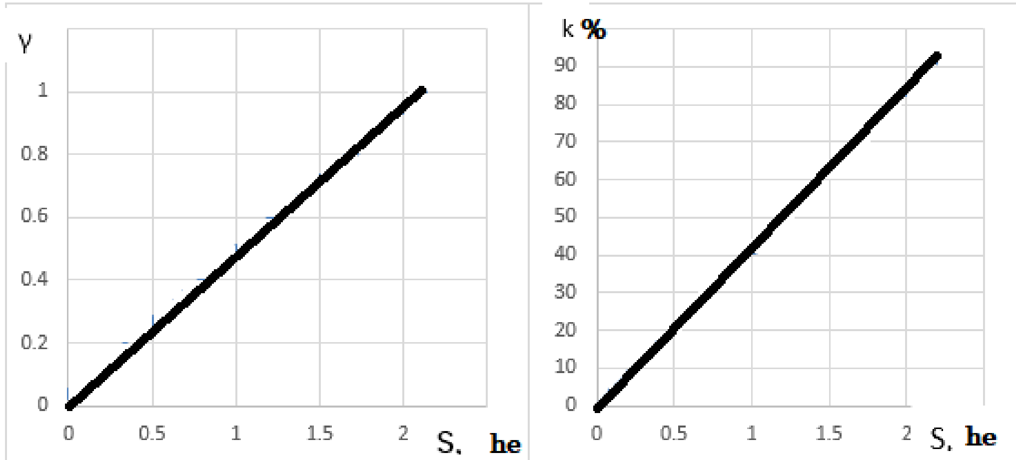

Fig.1. The dependence of the coefficients of carrying capacity of the truck ZIL-MM3-554M (γ) and using of body volume (k) from the surface of the plots (g=2.5 t/h:ρ=0.85 t/m³)

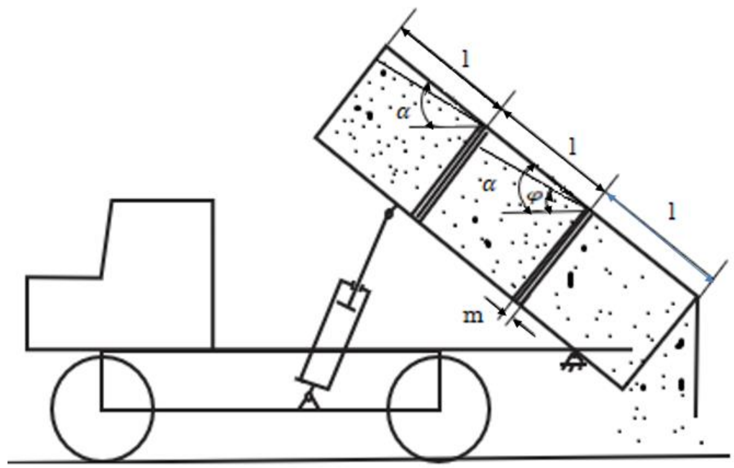

Fig. 2. The scheme of defining the coefficient of the use of the body volume of vehicle

It is natural that in this case the coefficient of using the volumes of the first and second sections will be smaller than that of the third.

Taking into account the case that turning the truck in α angle the grain will slip and will stand under the angle of natural bending φ=35-40^0, we will define the maximum filling height of the grain.

$$h_{max} = h_b - \left(l_s - \frac{m}{2}\right) tg(\alpha - \varphi), sm \tag{2}$$

where h_b=90 cm, is the depth of the body, $l_s = \frac{l_b}{3} = \frac{3.362}{3} = 112, sm$, the length of each section is m=4uɩ́ , the thickness of section, α=50° is the maximum angle of turning the body. Verifying the values, we will have

$$h_{max} = 90 - \left(112 - \frac{4}{2}\right) tg(50 - 40) = 78sm \tag{3}$$

Thus, the volume of the grain poured into each of the first and second sections will be $V_{s12} = 0{,}78 \cdot 1{,}12 \cdot 2{,}3 = 2{,}01m^3$, and the volume of the third section will be $V_{s3} = 0{,}9 \cdot 1{,}1 \cdot 2{,}3 \cdot 0{,}94 = 2{,}14m^3$, and the total volume of the grain in body will be

$$V_b = V_{s1} + V_{s2} + V_{s3} = 2{,}01 + 2{,}01 + 2{,}14 = 6{,}16m^3, \quad (4)$$

The weight of the grain in this case will be $q_f = 6{,}16 \cdot 0.8 = 4.93t$.

The maximum value of the coefficient of body volume will be $k = \frac{6{,}16}{7} = 0.88$or 88%, and the maximum value of the static coefficient of capacity use will be static $\gamma = \frac{4{,}93}{5{,}5} = 0{,}89$, i.e. it will be reduced correspondingly by 6% and 0,04.

The coefficients of capacity use and body volume use will be defined after such changes by $\gamma = 3 \cdot \frac{q_f}{q_{n-500}}$; $k = 3 \cdot \frac{V_f}{V_b} \cdot 100\%$ formulas.

It is clear from the formulas that despite of namely capacity is reduced by 0,01% and the body volume is reduced by 6 %, the factual capacity increases by 3 times.

It is evident that using the modular volumes we can make the using coefficients of capacity and body volume maximum while loading crop or other food from plots with different surfaces.

The change graphs of static coefficients of using the capacity and body volume by the mentioned formulas are given in Fig. 3.

It is clear from the graph that the static coefficient of capacity is 0.94 for 3 land plots of approximately 0.65 hectares, but it does not mean that in case of larger plots, the efficiency of the vehicle will decrease. Using the two dimensions of the body combined, without partial use, the maximum values for the use and exploitation of individual land and expected harvest modulation trucks will be maintained.

As a result of this structural change, the high values of coefficients of body volume and carrying capacity will not only be kept but the amount of required transportation marches of the crop of the same amount will also be reduced.

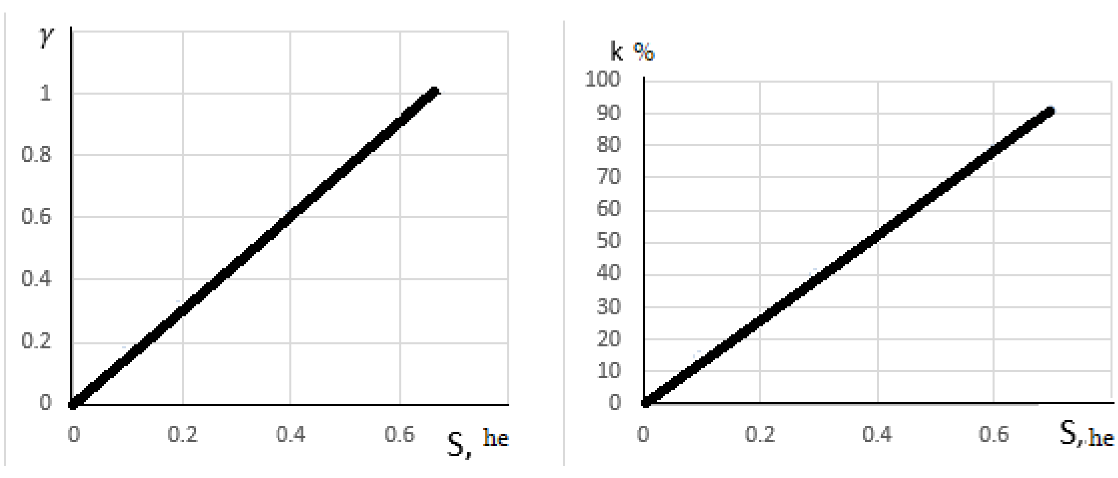

Fig. 3. The static coefficients of carrying capacities of the truck with transformed body and volume use in the case of lands with different surfaces

It is seen from the graph that the number of marches decreases up to 3 times for the lands with 0.65 hectares per day and twice for the lands up to 2.1 hectares.

Obviously, the exploitation cost of transportation and the cost of transportation will also be reduced correspondingly.

Preliminary calculations and production experience have shown that, due to the increase in the static coefficient and the decrease of the number of marches, the cost price of the crop transportation decreases for plolts up to 0.65 hectares by about 9 times compared with the statistical data, and by 4 times for the plots of up to 2.1 hectares.

Conclusions

1. Vehicles with middle carrying capacities are still widely used in the communities in the RA for crop transportation, particularly tipper ZIL-MMZ-554M, the exploitation of which becomes inefficient while transporting separately each of the farm crop of small plots because of incomplete use of carrying capacity and body volume and unnecessary marches.
2. When transporting crops separately from plots having 0,1 hectare to 1 hectare surface with tipper ZIL-MMM-554M, the carrying capacity coefficient is 0.045-0.454, the body-weight ratio is 4.2-242% in case of 1.1-2.05 plots respectively 0.5-0.92 and 46.2-86% and the data foreseen by technical characteristics are provided in case of having 2.1 hectares of land.
3. In order to increase the efficiency of ZIL-MMZ-554M tipper, it is necessary to perform a structural change of body, in particular, to divide the body into three equal parts, as a result of which the value of the static coefficient of using the carrying capacity of the vehicle reaches 0.94 and the body weight ratio reaches 92%, the number of marches during the day decreases 3 times in case of three divisions, two times in case of two divisions and an opportunity is given to transfer different cereal crops during one march.
4. Due to complete use of body volume and carrying capacity and decrease of marches of the vehicle the cost price of crop transportation from up to 0.65 hectare plots decreases for about 9 times and for about 4 times from the plolts up to 2.1 hectares.

References

1. Բալայան Ռ.Մ., Բազիկյան Ն.Ա., Եսոյան Ա.Մ., Սիմոնյան Ա.Ռ., Տրանսպորտային փոխադրումներ և բեռնման բեռնաթափման աշխատանքներ, ՀԱԱՀ, Երևան, 2013, 300 էջ:
2. ՀՀ Ազգային վիճակագրական ծառայություն. Գյուղատնտեսական մշակաբույսերի ցանքային տարանածությունները և համախառն բերքը 2011 թվականին,Տեղեկագիր, Երևան-2012թ. 37 էջ:
3. Համացանց. ЗИЛ-ММЗ-554М տեխնիկական բնութագրեր:

References

1. Balayan R. M., Bazikyan N. A., Yesoyan A. M., Simonyan A. R., Trasportation and uploading and downloading activities», Yerevan, 2013, p. 300.
2. The National Service of Statistics of the RA, « Norms of crops», The cultivation fields and growth harvest for agricultural crops in 2011, Bulletin, Yerevan, 2012, p.37.
3. The Internet, The technical characteristics of tipper ZIL-MMZ-554M.

ՓՈՔՐ ՀՈՂԱԿՏՈՐՆԵՐԻՑ ԳՅՈՒՂԱՏՆՏԵՍԱԿԱՆ ՍՈՐՈՒՆ ԲԵՌՆԵՐԻ ԻՆՔՆԱՐԺԵՔԻ, ԱՎՏՈՄՈԲԻԼԱՅԻՆ ՓՈԽԱԴՐԱՄԻՋՈՑԻ ՇԱՀԱԳՈՐԾԱԿԱՆ ՑՈՒՑԱՆԻՇՆԵՐԻ ԵՂԱՆԱԿՆԵՐԻ ՈՒՍՈՒՄՆԱՍԻՐՈՒՄ

Ս.Խ. Պապյան[1], Ա.Ս. Հակոբյան[2], Ա.Ա. Պողոսյան[2]
[1]Հայաստանի ազգային ագրարային համալսարան
[2]Շուշիի տեխնոլոգիական համալսարան

Վեր են լուծված փոքր հողակտորների վրա հացահատիկի փոխադրման հետ կապված խնդիրները, մասնավորապես, փոխադրման բարձր ինքնարժեքի պատճառները, որոնք չեն նպաստում այդ հողակտորների վրա հացահատիկի մշակման արդյունավետության բարձրացմանը: Ամենահիմնական պատճառներից մեկը կայանում է նրանում, որ յուրաքանչյուր գյուղացիական տնտեսության բերք փոխադրվում է առանձին երթով, որի պատճառով լիարժեք չի օգտագործվում փոխադրամիջոցի բեռնատարողությունը և թափքի ծավալը:

Առաջարկվում է տարբեր անձանց պատկանող փոքր հողակտորներից հացահատիկի փոխադրման համար փոխադրամիջոցի թափքը բաժանել երեք հավասար մասերի, ինչը հնարավորություն է տալիս լիարժեք օգտագործելու փոխադրամիջոցի բեռնատարողությունը, հետևաբար նաև զգալիորեն իջեցնելու փոխադրման ինքնարժեքը, նպաստում նման հողակտորների վրա հացահատիկի մշակման գործընթացի խթանմանը:

Բանալի բառեր. բեռնատարողություն, ծավալ, վազք, բեռնատար ավտոմոբիլ, փոխադրում, ինքնարժեք

ИССЛВДОВАНИЕ СПОСОБА ПОВЫШЕНИЯ ЭКСПЛУАТАЦИОННЫХ ПОКАЗАТЕЛЕЙ САМОСВАЛА ПРИ ПЕРЕВОЗКЕ СЕЛЬСКОХОЗЯЙСТВЕННЫХ СЫПУЧИХ ГРУЗОВ ИЗ МАЛЫХ ЗЕМЕЛЬНЫХ УЧАСТКОВ

С.Х. Папян[1], А.С. Акобян[2], А.А. Погосян[2]
[1] Армянский национальный аграрный университет
[2] Шушинский технологический университет

Выявлены проблемы перевозки сыпучих сельскохозяйственных грузов, в частности, зерна из малых земельных участков, которые мешают масштабному возделыванию зерновых на таких участках. Основной причиной повышения себестоимости перевозки и низких эксплуатационных показателей транспортных средств является то, что урожай каждого хозяйство перевозится отдельно, в результате чего значительно низки уровень использования грузоподъёмности и объёмакузова автомобиля.

Предлагается кузов автомобиля разделить на три отсека, которые принадлежат разных людей, для перевозки зерна из малых земельных участковчто способствует в три раза повысить эти показатели, укоротить качество рейсов и значительно уменьшить себестоимость перевозки.

Ключевые слова: грузоподъёмность, объём, пробег, грузовая машина, перевозка, себестоимость