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KOMBINATSIYALASHGAN MASHINALARDA QO'LLANILADIGAN G'ALTAKMOLALARNING AYLANISH O'QLARI ORASIDAGI BO'YLAMA MASOFANI ULARNING ISH KO'RSATKICHLARIGA TA'SIRI

Eshmatova G Q

Institute of Ground Forces of the University of Military Security and Defense of the Republic of Uzbekistan, Uzbekistan e-mail: g.eshmatova@mail.ru

Annotatsiya: *Ushbu maqolada kombinatsiyalashgan mashinalar tarkibida qo'llaniladigan tandem g'altakmolalarning aylanish o'qlari orasidagi bo'ylama masofani ularning ish ko'rsatkichlariga ta'sirini asoslash bo'yicha nazariy tadqiqotlarning natijalari keltirilgan. Tajribalarni o'tkazishda tandem g'altakmolalarning aylanish o'qlari orasidagi bo'ylama masofa 45 cm dan 65 cm gacha har 5 cm oraliqda o'zgartirildi. O'tkazilgan eksperimental tadqiqotlar asosida tuproqning uvalanish sifati va zichligi agrotexnik talablar darajasida bo'lishi va g'altakmolalarning tortishga qarshiligi minimal bo'lishini ta'minlash uchun g'altakmolalar aylanish o'qlari orasidagi bo'ylama masofaga 60 cm bo'lishi lozimmligi aniqlandi.*

Kalit so'zlar: *tandem g'altakmola, aylanish o'qlari, bo'ylama masofa, plankali g'altakmola, trubali g'altakmola, tuproq fraktsiyalari, tuproqning zichligi, tortishga solishtirma qarshilik.*

Аннотация: *В данной статье представлены результаты теоретических исследований по обоснованию влияния продольного расстояния между осями вращения тандемных катков, используемых в составе комбинированных машин, на их показатели работы. При проведении экспериментов продольное расстояние между осями вращения тандемных катков изменялось от 45 cm до 65 cm через каждые 5 cm. На основе проведенных экспериментальных исследований установлено, что для обеспечения качества крошения и плотности почвы на уровне агротехнических требований и минимального тягового сопротивления катка продольное расстояние между осями вращения катка должно быть 60 cm.*

Ключевые слова: *тандемный каток, оси вращения, продольное расстояние, планчатый каток, трубчатый каток, фракции почвы, плотность почвы, удельное тяговое сопротивление.*

Annotation: *This article presents the results of theoretical studies to substantiate the influence of the longitudinal distance between the axes of rotation of tandem rollers used in combined machines on their performance indicators. During the experiments, the longitudinal distance between the axes of rotation of the tandem rollers was changed from 45 cm to 65 cm every 5 cm. Based on the conducted experimental studies, it* *was established that to ensure that the quality and density of soil crumbling are at the level of agrotechnical requirements and the draft resistance of the rollers is minimal, the longitudinal distance between the axes of rotation of the rollers should be 60 cm.*

Keywords: *tandem roller, rotation axes, longitudinal distance, planar roller, tubular roller, soil fractions, soil density, specific traction resistance.*

INTRODUCTION

Currently, planar, toothed planar, segmented, tubular, flat-surfaced, toothed, and ring-toothed rollers are widely used in combined machines [1]. However, this type of roller has several technical and technological shortcomings that affect their performance indicators. In order to eliminate these shortcomings, existing rollers have been improved in the direction of increasing performance indicators, on this basis, a two-row (tandem) roller has been developed, and scientific and innovative research is being conducted to substantiate its parameters.

Research methodology. The tandem roller consists of an N-shaped frame 1 with plank 2 and tubular 3 rollers installed in a row, as well as rods 4. Pulls 4 connect frame 1 to the machine [2]. The rollers are mounted on the frame using bearings, the pulls are hinged to both the frame and the machine, which allows the rollers to work in accordance with the terrain.

During operation, the plank roller installed in the first row loosens the topsoil, crushes and partially compacts the clods, the tubular roller installed in the second row further crushes the clods and compacts the soil to the required degree.

This article presents the results of studies to determine the influence of the longitudinal distance between the axes of rotation of rollers used in combined machines on their performance indicators, in which the influence of this parameter on the degree of soil crumbling ($\Phi_{<25}$), i.e., the amount of soil fractions smaller than 25 mm, density (ρ), and specific tractive resistance (R_c), i.e., its tractive resistance per meter of working width, was studied. When conducting experimental studies, O‘zDSt 3412:2019 “Testing of agricultural machinery. Machines and implements for surface tillage. Test Program and Methods” and O‘zDSt 3193:2017 “Testing of Agricultural Machinery. Method of Energy Evaluation of Machines” [3,4].

Analysis of the research results. Experimental studies were conducted to study the influence of the longitudinal distance between the axes of rotation of the rollers on the degree of soil crumbling, i.e., the amount of soil fractions smaller than 25 mm, soil density, and the specific draft resistance of the rollers, i.e., the draft resistance per meter of the device's working width.

During the experiments, this distance was changed from 45 cm to 65 cm every 5 cm. This was achieved by moving the rollers forward and backward in the holes made in the side beams of their frame (Fig. 1). In this case, the diameter of the roller base D = 35 cm, the number of planks and pipes n = 10 pieces, the installation angle of the planks and pipes α = 15°, Q = 3.0 kN/m, and the speed of the unit 6 and 8 km/h were determined.

Figure 1. View of the field installation during operation

The results obtained in the experiments are presented in Table 4.6, Figure 4.10.

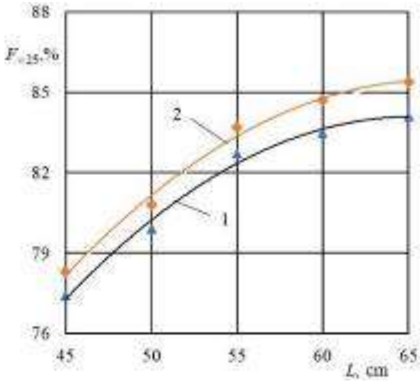
Table 1.

Influence of the longitudinal distance between the axes of rotation of the rollers on their performance indicators

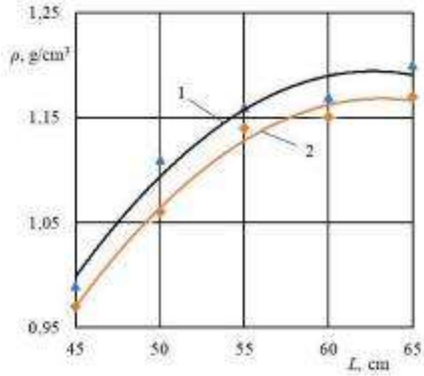
Longitudinal distance between the axes of rotation of the rollers, cm	Soil density, g/cm³	Content of soil fractions, %			Specific draft resistance of the device, kN/m
		Fraction sizes, mm			
		50›	50-25	25›	
6 km/h					
45	0,99	6,3	16,3	77,4	0,98
50	1,11	4,4	15,7	79,9	0,96
55	1,16	3,1	14,2	82,7	0,94
60	1,17	2,8	13,7	83,5	0,93
65	1,20	2,3	13,6	84,1	0,93
8 km/h					
45	0,97	6,5	15,2	78,3	1,0
50	1,06	4,4	14,8	80,8	0,98
55	1,14	3,2	13,1	83,7	0,95
60	1,15	2,4	12,9	84,7	0,94
65	1,17	2,0	12,6	85,4	0,94

From them it can be seen that at both speeds, with an increase in the distance between the axes of rotation of the rollers from 45 cm to 65 cm, the degree of soil crumbling and soil density increased. For example, at a speed of 6 km/h, with an increase in the distance between the axes of rotation of the rollers from 45 cm to 65 cm, the degree and density of soil crumbling, i.e., soil fractions smaller than 25 mm, increased from 77.4% to 84.1% and from 0.99 to 1.20 g/cm³. The same results were obtained at a speed of 8 km/h.

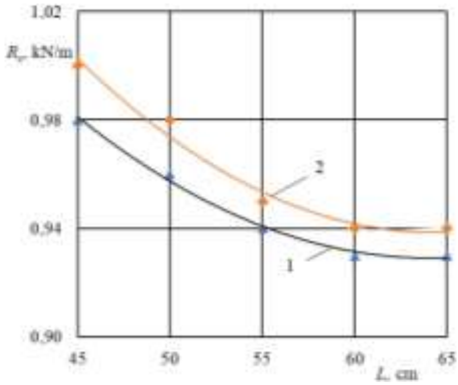
This is due to the fact that with an increase in the distance between the axes of rotation of the rollers, large clods of soil are wedged between them, and the soil pile decreases. With an increase in the longitudinal distance between the axes of rotation of the rollers, the specific tractive resistance decreased for the above-mentioned reasons.



a)



b)



v)

1) at V=6 km/h; 2) at V=8 km/h

Figure 2. Changes in the degree of soil crumbling (a), density (b), and tractive resistance (c) of the roller depending on the longitudinal distance between its axes of rotation

The relationships shown in table 1 and figure 2 can be represented by the following empirical formulas, determined by the least squares method:

a) by the degree of soil crumbling (%):

at V=6 km/h $F_{<25}=-0{,}01666L^2+2{,}1629L+13{,}52$, $(r^2=0{,}9916)$ (1)

at V=8 km/h $F_{<25}=-0{,}0157L^2+2{,}0906L+15{,}92$; $(r^2=0{,}9924)$ (2)

b) by soil density (g/cm³):

at V=6 km/h $\rho=-0{,}0006L^2+0{,}0787L-1{,}272$, $(r^2=0{,}9699)$ (3)

at V=8 km/h $\rho=-0{,}0006L^2+0{,}0758L-1{,}226$; $(r^2=0{,}9884)$ (4)

v) by specific tractive resistance of the roller (N/m):

at V=6 km/h $R_c=0{,}1914L^2-23{,}837L+1068$, $(r^2=0{,}9858)$ (5)

at V=8 km/h R_c=0,1886L^2-24,263L+1115. (r^2=0,9964) (6)

An increase in the speed of movement from 6 km/h to 8 km/h leads to a decrease in soil density, an increase in the quality of soil crumbling and specific gravity resistance.

According to the data presented in Table 1 and Figure 2, the longitudinal distance between the axes of rotation of the rollers should be 60 cm.

Conclusion. Thus, based on the conducted experimental studies, it can be concluded that to ensure that the quality and density of soil crumbling are at the level of agrotechnical requirements and the draft resistance of the rollers is minimal, the longitudinal distance between their axes of rotation should be 60 cm.

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