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DETERMINATION OF THE LONG PLANK DIAMETER OF AN IMPROVED LEVELLER OF A COMBINED DISC HARROW

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M.M. Ergashov
PhD., Senior Researcher at the Scientific Research Institute of Agriculture Mechanization
Sh.A. Soatov
PhD student at the Scientific Research Institute of Agriculture Mechanization

Annotation. *This article presents the results of the theoretical and experimental studies conducted on the basis of the diameter of the long plank of the improved roller of the combined disc harrow. In the conducted studies, it was determined that the diameter of the long plank of the roller should be 38 cm in order to ensure that the density of the soil and the quality of compaction meet the agrotechnical requirements and that the resistance of the rollers is minimal.*

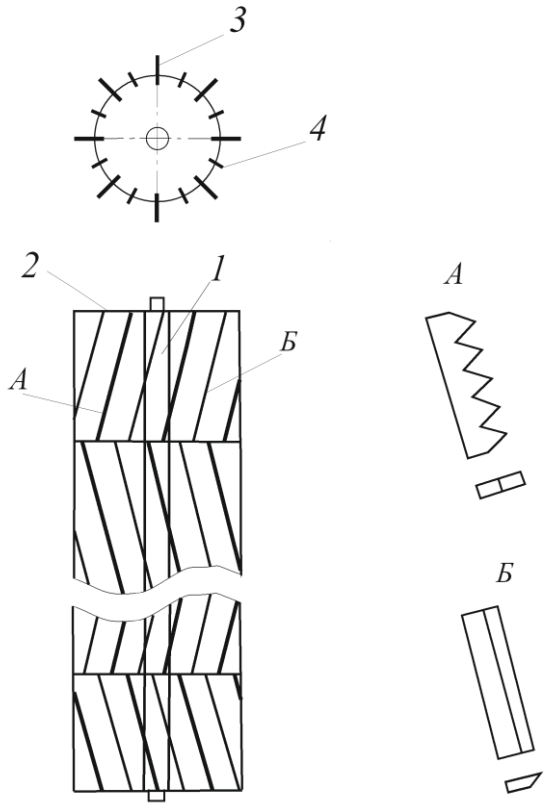
Key words. *Combined disk harrow, an enhanced leveller, diameter and radius of the long plank of the roller, laboratory-field device, the grinding quality of the soil, soil density, resistance.*

INTRODUCTION

In most farms of our republic preparation open fields under ovenable wheat and wheat-free land for sowing re-crops in most cases consists of plowing, scraping, replanting and grinding, Most of the machines and equipment used in cotton cultivation are used such as plowing the ground LD-100, PL-4-35, P-3-35, P-4-45, O'P-3/4-40 with scratching, tapping its surface layer with CHC-4A, CHC-3,0, disc bars BDT-3,0, TB-3/5, BTX-1,0; BZT-1,0; Notched grooves BBZ-4A1.0, and the alignment and compaction of the field surface are carried out by the PWR-8.5 planner-sealer, the VP-8, MW-6 and MV-6.5 skidders. However, the cultivation of land in this way leads to increased costs, loss of soil moisture, destruction of its structure and excessive compaction, lengthening the time of planting.

Based on the above, our institute has developed a combined disc harrow for use in preparation of wheat and replanting soils as well as pre-cultivation of dry land, Research is carried out to improve the wheel in its composition and justify its parameters [1,2]. The article presents results of theoretical and experimental studies on the effect of the diameter of long plates of an improved roller of a combined disc harrow on its performance.

Research methods. Axis of leveller 1, reliances attached to axis 2 and long 3 and short 4 planks alternately attached to them (1-figure). Triangular teeth are cut on the working



1-figure. An enhanced leveller

part of long planks, and the working part of short planks is sharpened on one side.

The improved roller allows cutting 900 teeth in the working part of long boards, single-sided grinding of short board workpieces, good grinding of dry and high-strength cuts.

Methods. The research is based on rules and laws of theoretical mechanics and agricultural mechanics and UzDSt 3412:2019 «Testing of agricultural machinery». The research is based on rules and laws of theoretical mechanics and agricultural mechanics and UzDSt 3412:2019 «Testing of agricultural machinery». Machines and tools for surface soil treatment.

Test program and methods» and UzDSct 3193:2017 «Agricultural machinery tests. The method of energy evaluation of machines» [3, 4] was carried out using regulatory documents.

Results of the study and discussion. We determine the diameter of the improved roller according to the following expression, which is derived from the condition that the diameter of the long planks passes through the cuts found on the roller's path.

$$D_u \geq \frac{d_k\left[1+\cos\left(\varphi_1+\varphi_2\right)\right]+2h_u}{1-\cos\left(\varphi_1+\varphi_2\right)} \qquad (1)$$

or

$$R_u \geq \frac{r_k\left[1+\cos\left(\varphi_1+\varphi_2\right)\right]+h_u}{1-\cos\left(\varphi_1+\varphi_2\right)}, \qquad (2)$$

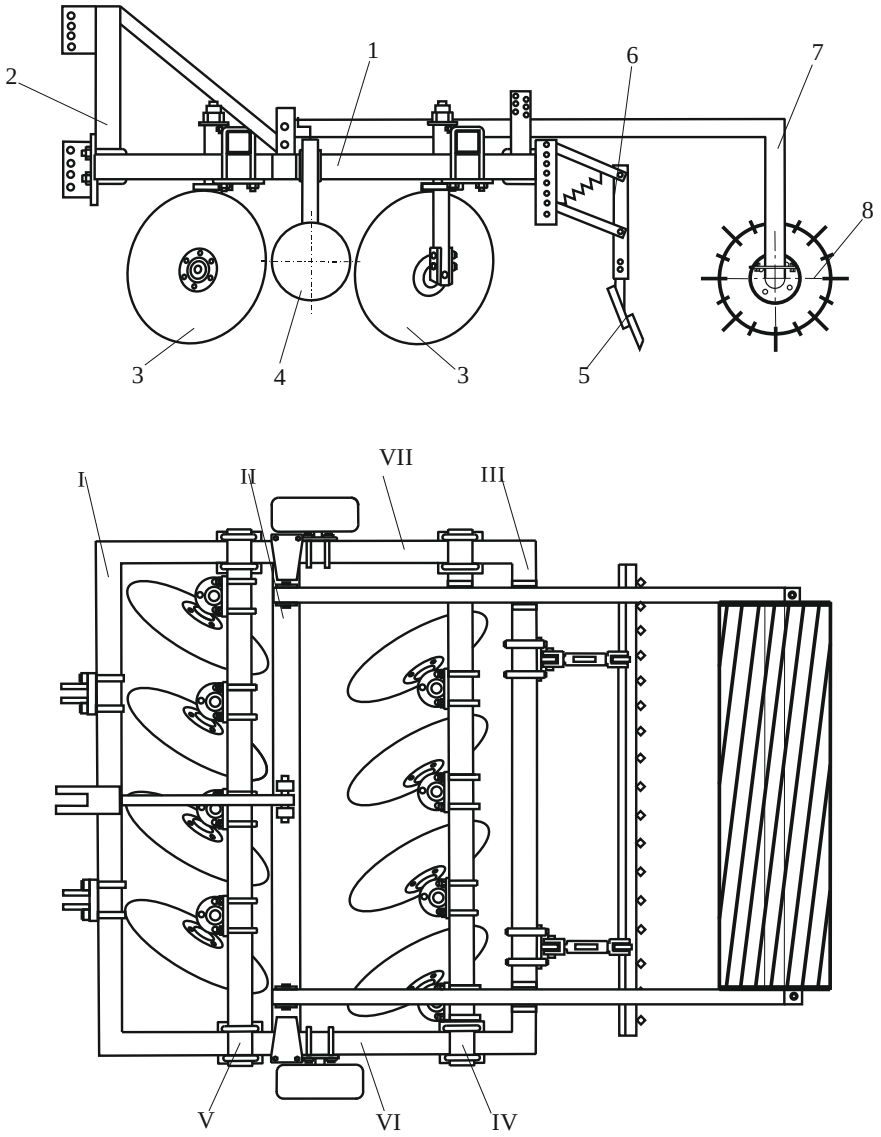
Whereas, R_u – is the radius of the long plate of the improved roller, m; K_c – is the slip coefficient of the roller; h_u – is the height of the long plank, m; φ_1, φ_2 – are the external (i.e. metal) and internal (i.e. soil) friction angles of the pieces, degrees.

K_c=0,1, R_u=0,18 m, h_u=0,05 m, φ_2=30^0, φ_1=40^0, d_k=0,1 m [5] calculations according to the expression (1) improved long planks of the coil showed that the diameter should be at least 38 cm.

In order to verify the results of theoretical studies, experimental studies were conducted. Whereas, the soil compaction quality, the density of the soil in the 5-15 cm layer and the traction resistance of the leveller were accepted as evaluation criteria. Experimental studies of an improved leveller carried out in laboratory-field device

developed in cooperation “Machines and mechanisms projecting” department on Scientific Research Institute of Agriculture.

Figure 2, shows the construction scheme of the laboratory-field device, Figure 3, shows its general view.



1 – frame; 2 – suspension device; 3 – disc softeners;

4 – support wheel; 5 – leveler-compressor;

6 – parallelogram mechanism; 7 – towbar; 8 – improved coil

I, II, III, IV, V – transverse bruses; VI and VII – longitudinal brushes

Figure 2. Structural scheme of the laboratory-field device

Figure 3. Overview of the laboratory-field device

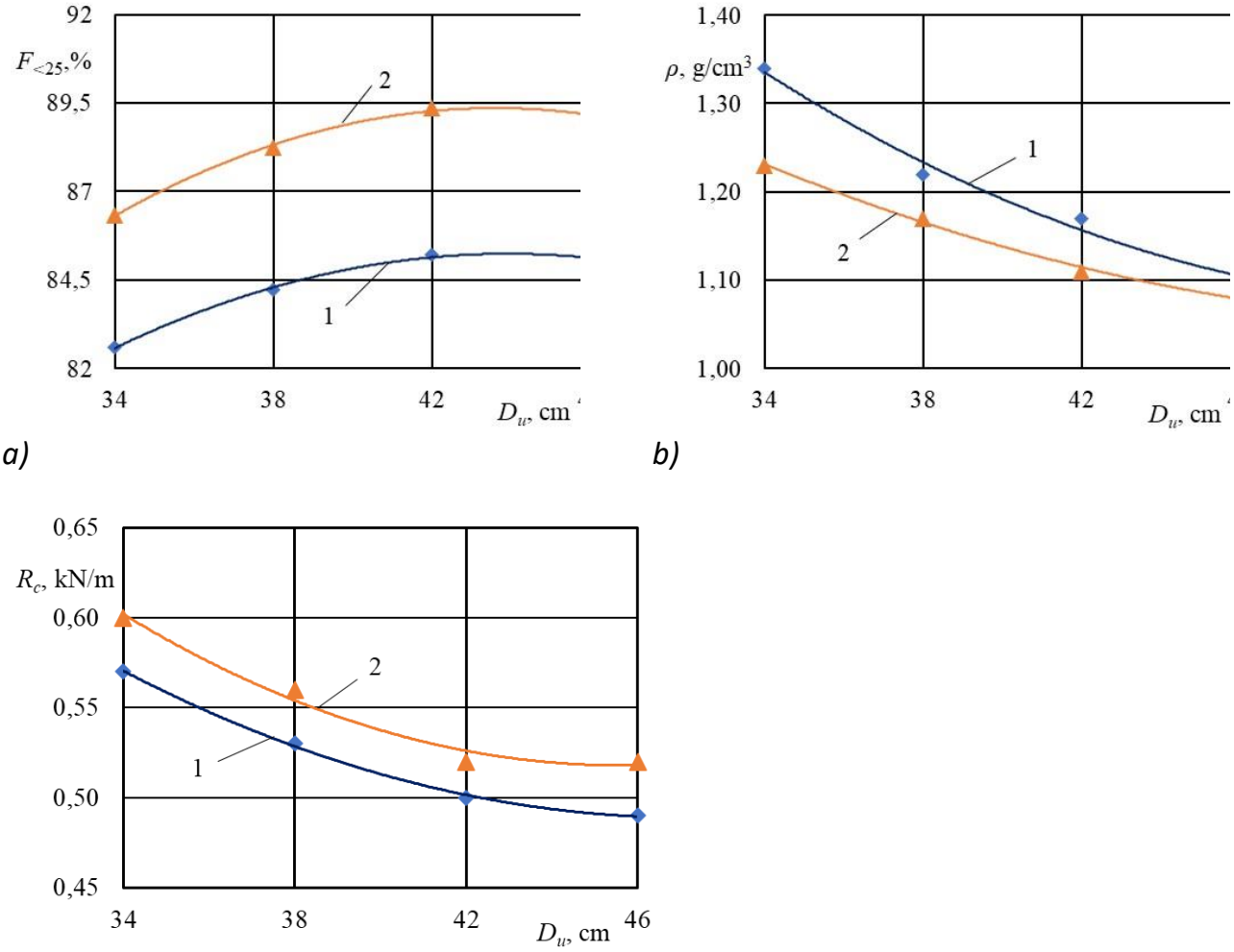
In the experiments, the laboratory-field device was used in combination with the TTZ 812 tractor (Figure 4).

а) *б)*

Figure 4. Views of the field device hanging on the TTZ-812 tractor (a) and in operation (b)

Studies on the effect of the diameter of long plates of roller-grommets of combined disc type on its performance were carried out at uniform speeds of 6 and 9 km/h. Based on theoretical studies, this parameter was changed from 34 cm to 46 cm with an interval of 4 cm. The remaining parameters remained unchanged, i.e. the number of long and short coil plates was 9 respectively, their angles of installation relative to the axis of rotation of the coil were 20°, and the relative vertical load applied to the coil was 20°. set at 1800 /m.

The results of the experiment are presented in Figure 5.



1) *V*=6 km/h ; 2) *V*=9 km/h

Figure 5. Variation of soil compaction degree (a), density (b) and roller specific resistance to traction (v) depending on the diameter of the long planks of the roller

The analysis of field experiments shows that when the diameter of the long plates of the advanced rolling mill was increased from 34 cm to 42 cm, the increase in the number of fractions less than 25 mm in the ground was accelerated at both speeds. , and the number of fractions larger than 50 mm has decreased. This happened due to the activation of the process of interaction of the roller planks with the soil, that is, they pass over the bumps encountered on the way of the roller without getting stuck. When the diameter of the long plates increased from 42 cm to 46 cm, the soil treatment quality of the roller slightly decreased, that is, the amount of fractions smaller than 25 mm in the soil decreased, and the amount of fractions larger than that increased. This is due to the fact that the distance between the planks of the roller increases with the increase in diameter, and their impact on the soil decreases.

It should also be noted that the level of soil compaction increased with the increase in aggregate movement speed. The main reason for this is that with an increase in speed, the impact effect of the roller plates on the soil increases, and as a result, the level of soil compaction improves.

The density of the soil and the relative resistance to traction are 0.24 g/cm^3 and 0.8 kN/m respectively at a speed of 6 km/h and at a speed of 9 km/h as the diameter of the long plates of the roller increases from 34 cm to 46 cm. decreased by 0.15 g/cm^3 and 0.8 kN/m, respectively. This can be explained by the fact that with an increase in diameter, the distance between the plates and the zone of influence of the roller on the soil increases. As a result, the pressure exerted by it on the soil is reduced and the roller does not sink well into the soil.

With the increase of the working speed from 6 km/h to 9 km/h, the density of the soil decreases and the relative resistance to traction increases due to the increase of the resistance forces acting on the roller by the soil and the reduction of the contact time of the roller plates with the soil.

It follows from this that the diameter of the long plates of the roller should be in the range of 38-42 cm in order to ensure that the compaction quality and density of the soil meet the agrotechnical requirements and to ensure that the resistance of the roller is minimal.

Conclusion. According to theoretical and experimental studies, it was shown that the diameter of the long plates of the roller should be 38 cm in order to ensure that the density of the soil and the quality of compaction meet the agrotechnical requirements and that the resistance of the rollers is minimal. These obtained results are consistent with the results of theoretical studies.

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