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Determine the Parameters of the Improved Coil Winding

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Abstract: In the article, in order to increase the work efficiency of the temporary ditch digger, disk blades and a reel are installed on the front part of the dumper in order to soften the soil, reduce its resistance, improve the quality of the soil fraction and slope, and reduce water absorption and the results of theoretical research on determining the diameter of the reel, the coverage width, and the vertical load applied to the reel are presented.

Keywords: Irrigation, temporary ditch, disc, channel digger, deformation, overturning, lemex.

Introduction.

Improving land reclamation and increasing crop yields depends on irrigation. Irrigation networks are used for crop irrigation. According to the period of use, irrigation networks are divided into permanent and temporary. Temporary irrigation networks are removed at the beginning of the irrigation season and levelled at the end of the irrigation season. Sewer planners are used for digging temporary networks: they are selected according to the ditch's ability to pass water from 20 - 40 1/sec to 100 - 200 1/sec. To enable farm machinery to pass through the temporary nets, the ditch should not be deeper than 30 cm and the walls should be horizontal, i.e. the slope should be about 1:4. Ditch diggers КОП-500А, КЗУ-0,5, КПУ-2000А, КБН-0,35, КЗУ-0,3 are used for creation of temporary irrigation networks for crop irrigation in irrigated agriculture of our republic. In addition to digging the soil, lifting the excavated soil and laying and pushing it on the canal bank, it is necessary to perform works on levelling and smoothing of its surface and provision of slope. The analysis of trencher data shows that trenching on hard areas requires large energy inputs, on areas with low humidity the number of large clods increases and the working equipment loses its geometric shape as a result of deformation, the weight of the working equipment during the trenching process requires a large amount of energy, the lack of compaction of the trench bottom in the required volume and, as a consequence, high water absorption, the value of soil resistance.

Analyses and results.

In view of the above, to improve the efficiency of the trench digger, disc mouldboards and a roller were installed to soften the soil, reduce its resistance, improve the quality of the soil fraction and slope, and reduce watering. absorption in the front of the tipper..

As a result of our research, let us determine the diameter of the roller by the following expression, based on the condition that it cuts through the pieces spilled on the bottom of the ditch during the operation of the ditch digger [1; 104-p, 2; 46-p]:

$$D_{g'} \geq d_k ctg^2 \frac{\varphi_1 + \varphi_2}{2}, \qquad (1)$$

at this d_k - diameter of slurry spilled to the bottom of the ditch during ditching operation, m;

φ_1, φ_2 - respectively external and internal, i.e. friction angles of the ground against the metal and against the ground, $^\circ$.

(1) if the condition is fulfilled, the roller presses down and crushes the pieces spilled on the bottom of the trench during operation, otherwise, i.e. (1) if the condition is not fulfilled, the pieces on the bottom of the trench pile up. the front of the roller and the specified technological process are violated, i.e. are not fulfilled. Based on our research d_k = 0,1 m and from data reported in the literature φ_1 = 30° va φ_2 = 40° [3; 40-42-p., 4; 244-p.] taking, and according to expression (1) we determine that the diameter of the coil should be at least 20 cm. So, according to our research, the diameter of an improved argykazgich coil should be 20 cm.

The width of the roller coverage is assumed to be equal to the width of the trench bottom opened by the improved cuvette collector, i.e $B_{g'}$ = 30 cm [5; 58-p.].

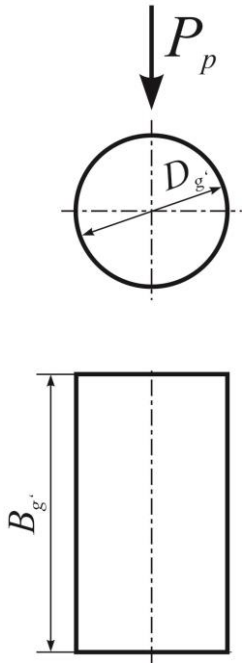

Figure 1: Investigated parameters of the improved ditching roller.

Methods and Conditions of Testing.

The vertical load applied to the roller is determined by the following expression, provided that it compacts the bottom of the gravel excavated by the auger to the required level [2; 50-p.].

$$Q_{g'} = \frac{1}{8} q_c \left(1 + kV^2\right) B_{g'} D_{g'}^2 \times \left[\arccos \frac{D_{g'} - 2h_0}{D_{g'}} - \frac{2\sqrt{D_{g'} h_0 - h_0^2}\left(D_{g'} - 2h_0\right)}{D_{g'}^2} \right], \qquad (2)$$

at this h_0 - the depth of roller immersion at the bottom of the ditch, ensuring compaction of its soil at a given level, m.

Based on previous studies [6; 119-p.].

$$h_0 = h_1 \left(1 - \frac{\rho_0}{\rho}\right), \qquad (3)$$

at this h_1 - thickness of compacted soil layer, *m*;

ρ_0 - initial soil density (ditch bottom), i.e. before compaction by the roller, $\frac{g}{cm^3}$;

ρ - soil density (ditch bottom) after compaction with a roller, $\frac{g}{cm^3}$.

Taking into account the value of h_0 according to expression (3), expression (2) will have the following form.

$$Q_{g'} = \frac{1}{8} q_c \left(1 + kV^2\right) B_{g'} D_{g'} \times$$

$$\times \left\{ \arccos \frac{D_{g'} - 2h_1\left(1 - \frac{\rho_0}{\rho}\right)}{D_{g'}} - \frac{2\sqrt{D_{g'} h_1\left(1 - \frac{\rho_0}{\rho}\right) - h_1^2\left(1 - \frac{\rho_0}{\rho}\right)^2}}{D_{g'}^2} \left(D_{g'} - 2h_1\left(1 - \frac{\rho_0}{\rho}\right)\right) \right\}, \qquad (4)$$

From this expression we can see that the vertical load applied to the roller varies depending on its parameters ($B_{g'}, D_{g'}$), thickness of the compacted part of the soil (h_1) and its physical and mechanical properties.

(4) to the expression $q_c = 2 \cdot 10^6$ N/m^3, k = 0,08 s^2/m^2, $B_{g'}$ = 0,3 m, $D_{g'}$ = 0,2 m, h_1 = 0,1 m, ρ_0 = 1000 kg/m^3, ρ = 1200 kg/m^3 assigning values 1,7-2,2 m/s it is determined that the vertical load applied to the roller at speed is between 461.8 and 520.3.

Summary.

Our research shows that a roller installed at the back of our proposed temporary ditch provides compaction of the ditch bottom at a given level, and the vertical load applied to the roller at travelling speeds of 1.7-2.2 m/s. It was found to be in the range of 461,8-520,3 N.

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