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THEORETICAL JUSTIFICATION OF THE PARAMETERS OF THE COMBINED AGGREGATE WINDING

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Annotation. In the article, the parameters of the combined aggregate roller, which prepares the soil for the planting of field crops, are theoretically based.

Keywords: gourds, support wheel, body, flat cutter, disc coulter, irrigation furrow, coulter ripper, lancet share, soil.

Introduction.

The problems of high-quality cultivation of the soil with minimal energy costs for planting cash crops have been considered in many scientific works[1]. V.G.Abezin [2], V.I.Malyukov, A.D.Em, V.N.Zhukov [3] and others have conducted research on the creation of machines for police, justification of their construction, and justification of the parameters of their working bodies. The construction and parameters of the machines that till the soil before planting and planting in the cultivation of polys crops are based on V.G. Abezin, N.V. Aldoshin and V.I. Malyukov. Ya.P.Lobachesky, F.M.Mamatov and I.T.Ergashev studied the processes of turning the blade by 180 degrees at the limit of its edge [4]. These studies did not consider the issues of preparing the soil for planting poly crops in one pass with minimal tillage.

The purpose of the study is to theoretically justify the parameters of the combined aggregate roller, which prepares the soil for planting polys crops.

Materials and methods. A combined aggregate (machine) that works the soil and prepares it for planting in one pass was proposed by the scientists of the Karshin Institute of Engineering and Economics [5].

Combined machine (Fig. 1) disk-shaped blades 1, softeners (flat cutters) 2, screw housings 3 and 4 installed on the axis of symmetry to turn left and right, screw guides 5, deep softeners installed on the handle of the housings 6, fertilizer feeding device equipped with gills, softener consists of roller 7, ditch opener and support wheels. The roller is hinged to 7 frames.

Based on the provided technology [6], the unit should process a 2.8 m wide field in one pass. In this case, it is necessary to overturn the plows on the soil of the aggregate planting area at

the border of its edge, and at the same time soften the soil and form an irrigation ditch. The soil of the rest of the row interval is loosened with flat harrows to a depth of 8-10 cm and weeds are killed. The width of the row spacing in which polys crops are planted can be 60, 70 or 90 cm.

The following requirements are imposed on the reel:

- the coil should be light;
- the coverage width of the roller should be equal to the width of the planting area;
- the roller must be hinged to the frame of the unit;
- on the surface of the rolling mill, the area where the planting device works should be leveled. The height of unevenness should not exceed ±5 cm;
- the roller should not resist the complete sinking of the deep softener to the specified depth.

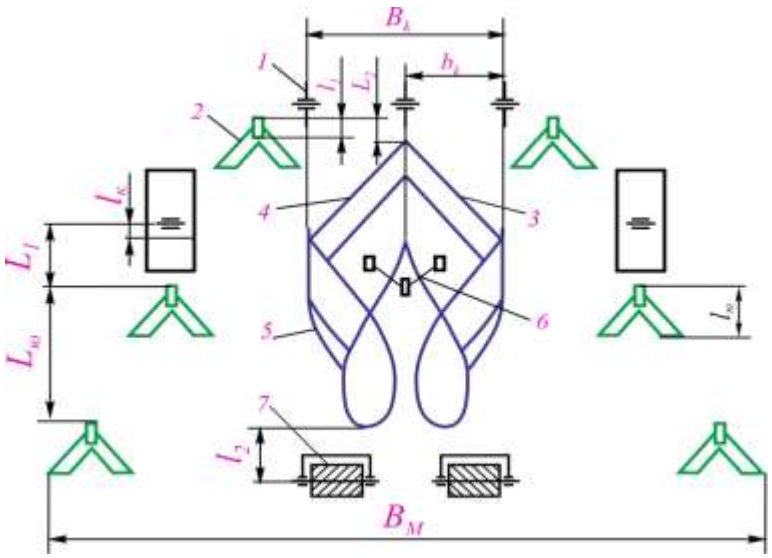

Figure 1. Scheme of mutual arrangement of working bodies in a combined machine

1 – disc-shaped blade; 2 – flat; 3 and 4 – right- and left-turning bodies; 5 – guide plate; 6 – deep softener; 7 – reel.

The main parameters of the slatted roller include the following (Figures 2 and 3): the radius of the roller $r_{кт}$, the angle of installation of the slat $\gamma_{пл}$, the number of slats $n_{пл}$, the covering width of the roller $B_к$, the number of sections n_c, the width of the section b_c, the distance between the sections b_0

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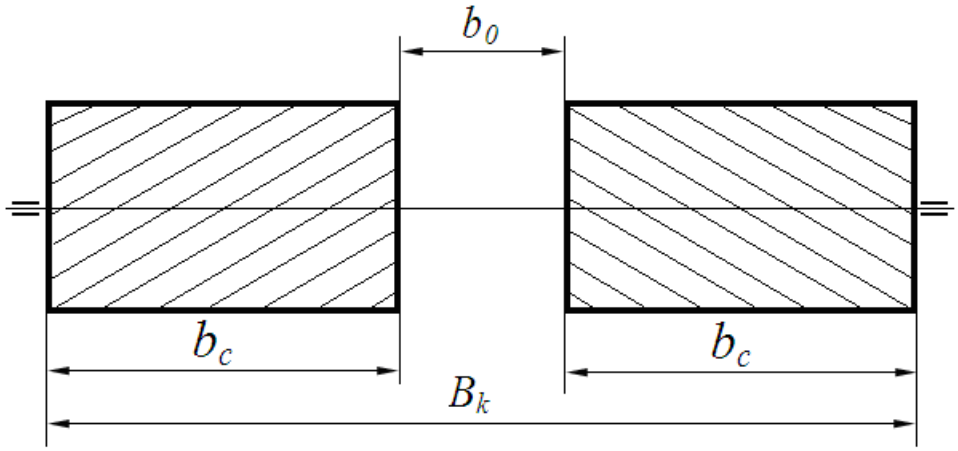

Figure 2. Parameters of the winding

Results and discussion. Based on the analysis of the patent and scientific research work, it was found necessary to use a planar roller attached to the frame with a hinge in the combined unit for the implementation of the proposed technology. The use of a roller flattens the surface of the field near the planting area, breaks up the lumps on the surface and compacts the soil. The roller works on the planting zone, i.e. on both sides of the formed watering edge. Therefore, the number of sections is two, and we determine the coverage width of each section by the following expression

$$b_c = (B_{эк} - b_a)/2, \quad (1)$$

where ba is the largest width of the irrigation ditch, m; Bek - the width of the planting area, m. According to expression (1), when Bek = 106 cm and ba = 45 cm, bs = 31 cm. We accept 35 cm.

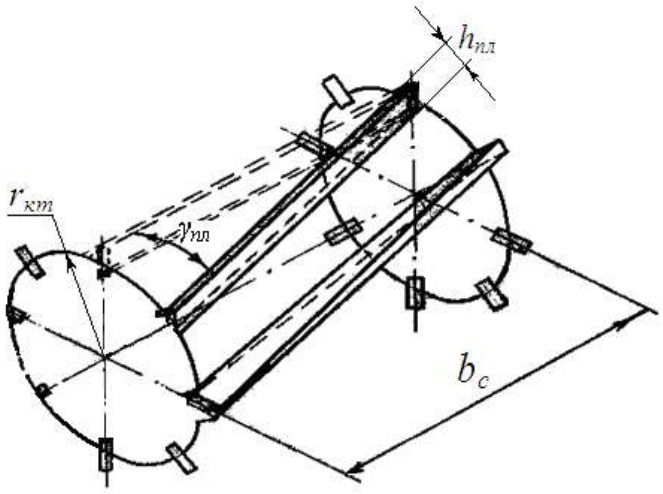

Figure 3. Parameters of the winding section

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We determine the radius of the roller (Fig. 4) according to the following formula [7, 8]

$$r_{кт} \geq r_{км} \cdot ctg^2 \frac{(\varphi+\varphi_1)}{2} + \frac{h_1 - h_2}{1-\cos(\varphi+\varphi_1)}, \quad (2)$$

where $r_{км}$ – is the average radius of the cut, m;

h_1– depth of immersion of the roller, m;

h_2 – the depth of the cut, m;

φ –angle of friction of the roller with the cut, degree;

φ_1 – is the angle of friction of the cut with the soil, grad.

According to expression (2), $r_к \geq 14{,}3$ cm when $r_{км}=5$ cm, $h_1=5$cm, $h_2=2$cm, $\varphi=25°$ and $\varphi_1=35°$. We accept $r_к = 15$ cm.

We determine the number of planks in the roller according to the following formula [7, 8]

$$n_{пл} = \frac{2\pi}{\pi - 2\arcsin\frac{r_{кт}-h_1}{r_{кт}} - 2cos\left(\arcsin\frac{r_{кт}-h_1}{r_{кт}}\right)}, \quad (3)$$

(3) according to the expression $n_{пл}=7.78$ units when $r_{км}=15$ cm and $h_1=50$ mm. We accept $n_{пл}=8$ pieces.

We determine the angle of installation of the plank from the condition of shifting the soil according to it. For this, the following condition must be fulfilled [9].

$$\gamma = \frac{\pi}{4} - \frac{\varphi}{2}. \quad (4)$$

From expression (4) $\gamma_{пл}=320$ when $\varphi= 25°$.

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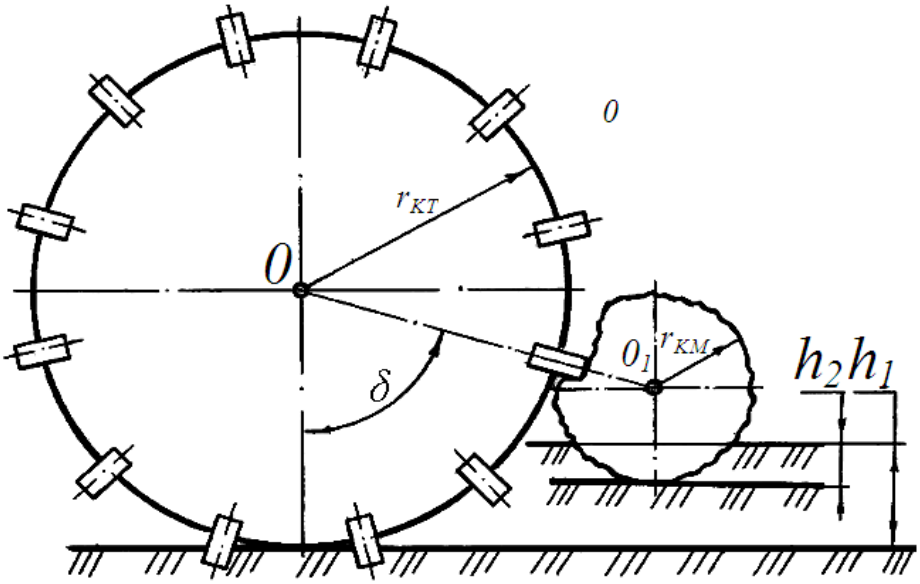

Figure 4. The scheme for determining the radius of the winding

During the movement of the roller of the combined unit, due to the unevenness of the field and the change of the physical and mechanical properties of the soil, it works with forced vibration in the longitudinal plane relative to the point (hinge) attached to the frame, that is, it has angular vibrations in this plane during its operation. This leads to uneven compaction of the soil. This leads to uneven compaction of the soil. Therefore, in theoretical studies, the smooth running of the roller on the depth of processing was investigated.

The following expression was obtained to determine the angle of deviation of the roller's tension from the equilibrium position.

$$\alpha(t) = \frac{\Delta R_z \sin(\omega t - \delta_1)}{m_e l \sqrt{\left[\left(\left(N_x + C_{me} B_k l + C_n \frac{l_n^2}{l}\right) l / \left(m_e l^2\right)\right) - \omega^2\right]^2 + \left(\frac{b_{me} B_k}{m_e}\right)^2 \omega^2}}, \quad (5)$$

where N_x –is the horizontal component of soil reaction force, N; m_e – mass of the roller, kg; l – the length of the roller bearing, m; l_n – is the distance from the point where the tensioner is attached to the coil to the point where the spring pressure is applied, m; C_{me} – is the compactness of the soil applied to a unit coverage width of the working body, N/m2; B_k – is the coverage width of the coil m; ΔR_z –is the amplitude of alternating force, N; δ_1 – deviation angle of the reaction force, degree; ω – is the rotation frequency of alternating power, c^{-1}; b_{me} – a unit of soil rolling coefficient of

resistance brought to the coverage width, H·c/м^2; C_n – is the stiffness coefficient of the pressure spring, N/m.

The analysis of the expression (5) shows that the uniformity of the depth of immersion of the roller into the soil and, therefore, the density of the soil depends on its mass, the length of the tie connecting it to the frame, the uniformity of the pressure spring, the amplitude of the variable force, and the physical and mechanical properties of the soil. improve the quality of work is achieved due to the correct selection of the mass and the stiffness of the compression spring.

Conclusion. 1. The use of some two-section slatted roller, the slats of which are installed obliquely in the opposite direction to the direction of movement in the combined unit, allows for high-quality preparation of the soil of the planting area for planting.
2. According to the results of the theoretical studies, the diameter of the roller is at least 30 cm, the width of each section is 35 cm, the angle of inclination of the plank is at least 17°, the number of planks is 8, which allows the soil to be compacted at the depth where the seeds of polys crops are thrown.

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