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COTTONSEED SOWING TECHNOLOGY AND IMPROVEMENT OF ITS EXECUTIVE BODIES

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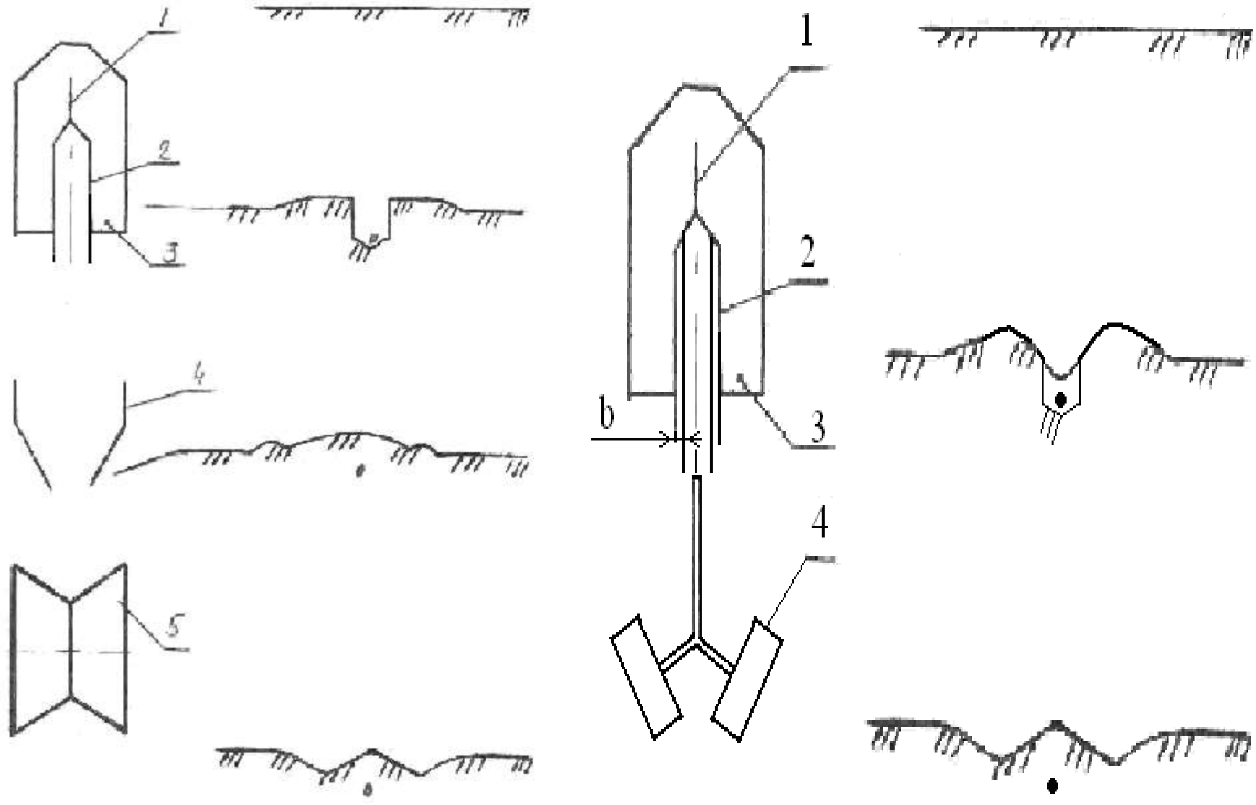
ABSTRACT

Sowing of seeds of technical crops is carried out on the basis of the following technology. Existing seed drills 2 open a ditch in the soil, compacting the bottom of the ditch with a compactor and preparing the seedbed directly for planting (Fig. 1, a). The ski in the sower seals the two ends of the 3 ditches. After the seeds had fallen into the ditch, they were buried to the required depth of 4 by loosening the shovel-compacted soil. After burial, the concave conical roller 5 presses the soil and compacts the surface by tilting it to both sides [1].



a) existing b) improved

Fig. 1 Schemes of planting technology.

a) existing, 1-Sowing blade; 2-sower; 3 base skis; 4- spade; 5-reel.
b) improved, 1-Sower blade; 2-sower; 3 base skis; 4-reel

In the improved experimental model we are proposing, since the ski 3 is placed at a distance of 2 b = (30-40mm) from the ski jaw 2, the soil pile formed by the ski 4 remains intact (without compaction at the bottom of the ski), creating a good opportunity to bury (Fig. 1, b). The sower

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moves the pile of soil into the ditch and bury the top of the seed. After burial, a slightly open (20-30 mm) cylindrical roller 4 presses the soil and compacts its surface by tilting it to both sides [1].

We will consider the technology of sowing the seeds of technical crops with an experimental (improved) sample sower and the determination of the size of the sower (Fig. 2).

Determination of the pressure of the roller on a sloping soil pile is carried out as follows: it begins with the determination of the coefficient of soil compaction for the background of sowing when the seed is buried in the soil using a roller [2].

$$q_0^{'} = \frac{q_0}{k_0^{'} \cdot k_p} = 0,85 q_0 \quad (1)$$

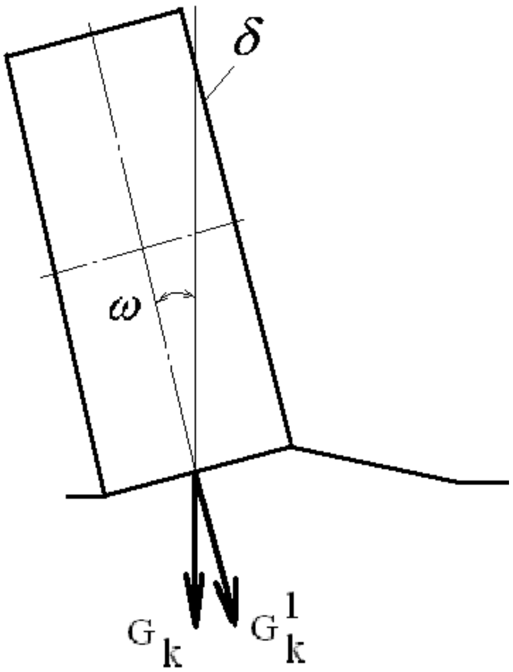

Fig. 2. Pressure of the roller into the soil pile.

Here:

k_0^I -coefficient of soil compaction by ski, equal to 0.9;

k_p -soil softening coefficient, equal to 1.3;

q_0 -coefficient of volumetric compaction of soil, kg / cm³. The pressure of the cylindrical roller on the soil pile is determined using the following formula.

$$G_k^{'} = v_{cm} \cdot q_0^{'} = S \cdot B_1 \cdot q_0^{'} \quad (2)$$

Here: v_{cm} - volume of soil rolled by the roller, cm³.

B_1 - half the width of the reel, $B_1 = 0,5 B_{np}$, cm.

S - level of soil accumulation on the front surface of the roller, cm².

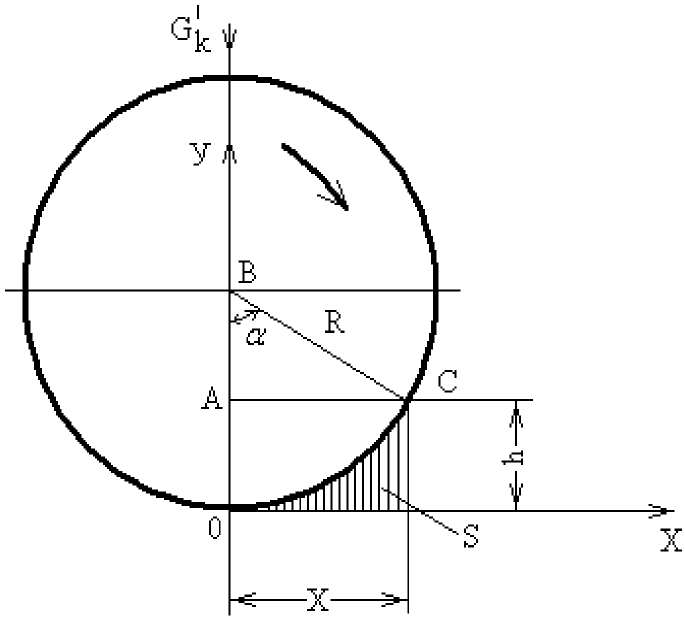

Fig. 3. Determining the area to be removed from the soil with a roller.

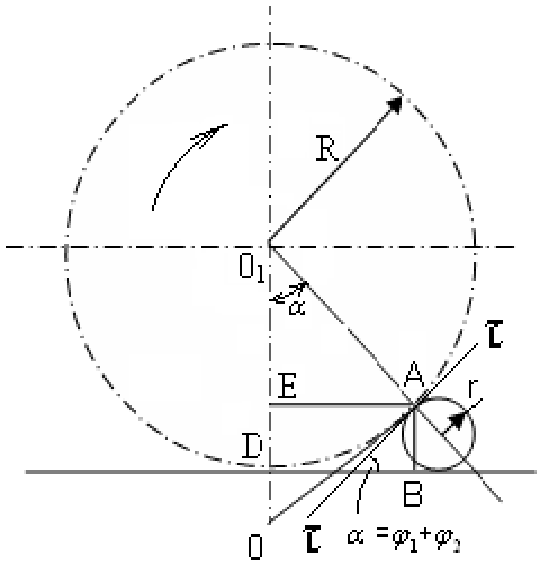

Fig. 4. Determining the diameter of the roller.

According to the Fig. 3:

$$S = 0,5\left[R^2 \arcsin\frac{\sqrt{2Rh-h^2}}{R} - h\sqrt{2Rh-h^2}\right] \qquad (3)$$

Here: R- roller radius, cm

h- roller flange depth

The pressure of the cylindrical roller in the vertical direction to the soil pile is determined as follows [2].

$G_k = \frac{2G_k^{'}}{cos\,\omega}$ or in the final view we have the following formula:

$$G_k = \frac{0,425B_{np}q_0\left[R^2 arc\sin\frac{\sqrt{h(2R-h)}}{R} - h\sqrt{h(2R-h)}\right]}{\cos\omega} \qquad (4)$$

By setting the values for the light soil h = 2 cm in the formula, and taking into account the coefficient of soil compaction $q_0 = 0,44\,\text{kg}/\text{cm}^3$, we determine the pressure values by assuming the dimensions of the working bodies of the cotton seeder $B_{np} = 14\,\text{cm}$ soil pressure direction deflection angle ω = 30⁰ and radius $R = 7\,\text{cm}$:

$$G_k = \frac{0,425\cdot 14\cdot 0,44\left[7^2 ar\tilde{n}\sin\frac{\sqrt{2(2\cdot 7-2)}}{7} - 2\sqrt{2(2\cdot 7-2)}\right]}{\cos 30^0} = 56,7\ \text{кГ}.$$

Hence, the pressure in the vertical direction of the roller on the soil pile is $G_k = 56,7\,\text{kg}$.

The diameter of the reel is determined from Figure 4 as follows:

$$AB = r[1+\cos(\varphi_1+\varphi_2)] = 2r\cos^2\left(\frac{\varphi_1+\varphi_2}{2}\right) \qquad (5)$$

$$AB = ED = R[1-\cos(\varphi_1+\varphi_2)] = 2R\sin^2\left(\frac{\varphi_1+\varphi_2}{2}\right) \quad (6)$$

From here we generate the following:

$$R \geq rctg^2\left(\frac{\varphi_1+\varphi_2}{2}\right) \quad (7)$$

According to the results of the experiment, we determine that the largest grain size in the planting background is r = 7 cm, the friction angles are $\varphi_1 = 31^0$ and $\varphi_2 = 58^0$, $R \geq 7{,}28$ cm (72.8 mm) or we assume the diameter of the roller is $D \geq 146$ mm.

This means that the smallest diameter of the reel should be 146 mm.

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