# SUBSTANTIATION OF SEEDER ROLLER PARAMETERSFOR SEEDING ONION SEEDS

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***Abstract.*** *The results of a theoretical study on the justification of the parameters of the rolling of a seeder for sowing onion seeds with a tape method in three rows in each tape are presented.*

***Key words:*** *Onions, seeder, packer roller, immersion depth, embedment depth, soil, density.*

Enter. In recent years, large-scale reforms have been carried out in the Republic of Uzbekistan aimed at increasing the level of cultivation of fruit and vegetable crops. Among these crops, onion occupies a special position, being an important and valuable food product. Bulb and onion leaves contain many different nutrients and vitamins. Onion stimulates the secretion of digestive juices, has a diuretic and some sedative effect.

Problem statement and research method. Currently, there is no special seeder in the Republic of Uzbekistan designed for sowing seeds of small-seeded vegetable crops, while many different pneumatic seeders are produced abroad for this purpose. They provide accurate sowing of seeds at a given depth in an ordinary way. However, foreign seeders are not adapted to the soil and climatic conditions of Uzbekistan, they cannot ensure uniform placement of seeds on the ridges. The cost of the seeders themselves and maintenance is very high, the seeders have a complex design. Therefore, farmer farms are forced to use technical means that are not adapted to their conditions.

In addition, the operations for preparing the soil for sowing and directly sowing the seeds are carried out separately, which each time is accompanied by the arrival of units on the field, excessive consumption of fuels and lubricants, time and labor costs. All this, ultimately, leads to an increase in the cost of production.

Research results and their discussion. Based on the foregoing, at the Research Institute Mechanization of Agriculture (RIMA) developed a seeder for sowing seeds of onions and other small-seeded vegetable crops. In one pass, it cuts irrigation furrows with the formation of trapezoidal sowing ridges and sows onion seeds or other small-seeded crops in a tape method in several rows in a tape.

It is known that small seeds are planted at a shallow depth, and therefore, when sowing vegetable crops, special attention should be paid to the issues of planting. Based on this, this article is devoted to the substantiation of the main parameters of the double cone-shaped rolling of the above-mentioned seeder, taking into account the requirements for sowing small seeds of vegetable crops, in particular, onions.

The double cone-shaped rolling during rotation due to the vertical load applied to it, deepens to a certain depth into the soil, presses and shifts it to the middle of the sowing furrow, thereby closing the seeds to a given depth and compacting the soil above the seeds.

The depth of immersion of the rolling into the soil. The depth $h_0$ of immersion of the rolling into the soil is determined from the condition of ensuring the required density of the soil of the sowing row according to the expression.

$$h_0 = h_1\left(1 - \frac{\rho}{\rho_T}\right), \quad (1)$$

where $h_1$ is the thickness of the compacted soil layer, which is equal to the depth of its pre-sowing treatment (6-8 cm); $\rho_T$ is the required density of the sowing row of soil; $\rho$ is the density of the soil before the passage of the sowing unit.

Taking $h_1$= 8 sm, ρ = 1.10 g/sm$^3$ and taking into account that in order to ensure full-fledged seedlings, the soil density of the sowing row should be within 1.20 g/sm$^3$, according to expression (1) we obtain that the average depth of immersion of the rolling in soil should be equal to 0.7 sm. Since the rolling has a conical surface, the resulting value $h_0$ will be attributed to its middle part.

Determining the rolling diameter. The rolling diameter is determined from the condition that there is no loading of the soil in front of it. To do this, as it is known from the literature, the angle $\alpha_0$ (Fig. 1) of immersion of the rolling into the soil should be no more than $20^0$.

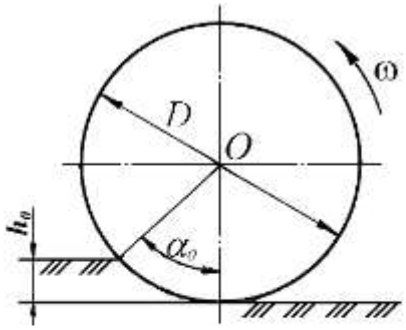


Figure 1. Scheme for determining the rolling diameter

From the diagram in Fig. 1 we have

$$D \geq \frac{2h_0}{1-\cos\alpha_0} \qquad (2)$$

or taking into account (1), we have

$$D \geq \frac{2h_1\left(1-\frac{\rho}{\rho_T}\right)}{1-\cos\alpha_0}. \qquad (3)$$

Taking $\alpha_0 = 20^0$, $_{h}1$ = 8 sm, $\rho$ = 1.1 g/sm$^3$, $\rho_T$ = 1.2 g/sm$^3$, according to expression (3) we obtain that the average rolling diameter should be at least 232 mm.

Determining the planting width. To ensure the placement of seeds to the required depth, the volume of soil moved by the rollers (Fig. 2) per unit of time must be equal to the volume of the sowing furrow formed by the furrow-forming part of the coulter at the same time, i.e.

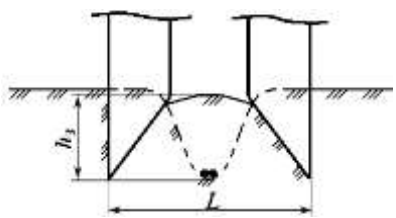


Figure 2. Scheme of seed placement with rolling

$$S_1 V_n = S_2 V_n \qquad (4)$$

or

$$S_1 = S_2, \qquad (4a)$$

where $S_1$ is the cross-sectional area of the soil moved by the rollers; $S_2$ is the cross-sectional area of the seed furrow, formed by the coulter; $V_n$ is the speed of movement of the sowing unit. According to the scheme in Fig. 3, the cross-sectional area of the soil moved by the rollers, taking into account its compaction, can be determined by the expression where bb is the width of the seed furrow.

$$S_1 = 2b_б h_0 \frac{\rho_T}{\rho}. \qquad (5)$$

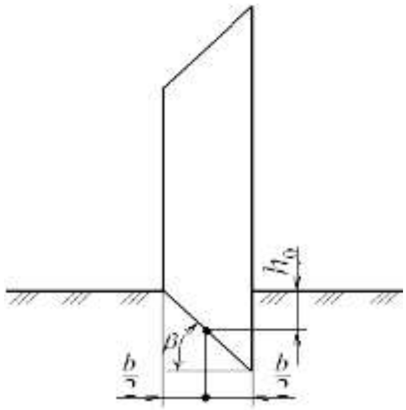


Figure 3. Scheme for determining the width of the rolling

The coulter forms a parabolic seed furrow with a depth $h_б$ and a width $b_б$ (Fig.4). It can be represented by the following equation

$$Y = \frac{4h_б}{b_б^2} X^2, \qquad (6)$$

where X and Y are coordinate axes.

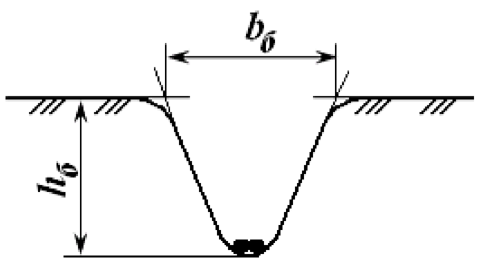


Figure 4. Seeding furrow formed by the coulter

Determine the cross-sectional area of the seed furrow

$$S_2 = b_б h_б \int_{-\frac{b_б}{2}}^{\frac{b_б}{2}} YdX = b_б h_б - \frac{4h_б}{b_б^2} \int_{-\frac{b_б}{2}}^{\frac{b_б}{2}} X^2 dX = \frac{2}{3} b_б h_б . \quad (7)$$

Substituting the values of $S_1$ and $S_2$ by (5) and (7) into (4a) and solving the resulting equality with respect to *b*, we have

$$b = \frac{\rho b_б h_б}{3\rho_T h_0}. \quad (8)$$

Assuming the width of the seed furrow is equal to the width (along the top) of the furrow-forming part of the seed drill coulter compactor, i.e. 3 cm, and the depth of the groove is equal to the maximum depth of onion seed placement (2 cm) and taking into account the above values of ρ, $\rho_T$ and $h_0$, according to expression (8), we get *b* = 2,62 sm.

Therefore, to ensure a given depth of seed placement, the width of the bedding must be at least 2,62 sm. Based on this, we take *b* = 3 sm.

Knowing the values of *D*, *b* and taking $\beta = 30^0$, we can determine the diameters of the small and large rolling bases

$$D_м = D - btg\beta \quad (9)$$

and

$$D_б = D + btg\beta. \quad (10)$$

Substituting in (9) and (10) the above values of *D*, *b* and *β*, we get that the diameters of the small and large bases of the laps should be 206 and 257 mm, respectively.

Vertical load on rolling. The vertical load required to plunge the inflow to the required depth $h_0$ is determined by the formula.

$$Q = 2q_0\left(KV_n^2 + d\right)bR\left[\sqrt{2Rh_0 - h_0^2} - (R - h_0)\arcsin\frac{\sqrt{2Rh_0 - h_0^2}}{R}\right], \quad (11)$$

where $q_0$ is the coefficient of soil volumetric collapse; $K$ - coefficient of proportionality; $d$ is the dimensionless coefficient.

In conclusion: Taking $q_0$ = 2,4·10$^6$ N/m$^3$, $K$ = 0,08 s$^2$/m$^2$, d = 0,9 and substituting in (11) the above values of $h_0$ and $R$, we obtain depth within the speed range of 1,5-2,0 m/s, they must be subjected to a vertical load within Q = 44,8-50,6 N.

Thus, for high-quality embedding of onion seeds to the required depth, the diameters of the small and large bases of the tread should be, respectively, 206 and 257 mm, the width of the tread should be 3 cm, and the vertical load on it at a speed of 1,5-2,0 m / s should be within Q = 44,8- 50,6 N.

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