Results Of The Research On The Basis Of The Parameters Of The Working Body Forming The Irrigation Equipment Of The Combined Aggregate

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Annotation.*Special attention is paid to the planting of ornamental trees and rare flower seedlings and medicinal plants in forestry plantations in the country. As no special aggregates have been developed to prepare the land for planting, the use of existing aggregates or their adapted variants leads to an increase in energy consumption and operating costs. Research methods and materials. The analysis and research developed a combined aggregate structure that performs the technological processes of preparing forest plantations for planting in one pass of the unit, and used theoretical mechanics, higher mathematics and mathematical statistics to theoretically substantiate the size of its working body. Research results. When comparing the existing and proposed technologies, the proposed technology significantly reduces the consumption of labor, energy and fuels due to the lack of tillage, mulching and plowing, a sharp reduction in the number of field trips (5-6 times to 3 times). was found not to condense. Theoretical studies have identified the main parameters for the working body, which forms the combined aggregate irrigation canals, to produce the required level of irrigation canals and piles with low energy consumption. Conclusion. Depth of soil to a pan, which impedes rooting, should be 7–8 cm. The height of the opening chest is at least 20.5 cm, the opening angle of the wings is in the range of 60–65,, the angle of entry into the soil is 35–40º, the angle of the side clipping is 35–38º, the width of the wings and the length of the body should be at least 41 cm and 78 cm, respectively.*

Keywords: *Forest plantations, soil density, technology, preparation for planting, energy consumption, combined aggregate, cultivator, soil crusher, irrigation ditch, soil depth, chest height, ridge width, wing side cutting angle, body length, ditch width.*

I. INTRODUCTION.

Currently, significant progress is being made in the development of forestry plantations in many regions of the country [1].

Since the cultivation of ornamental trees and rare flower seedlings as well as medicinal plants in forestry plantations is considered effective, attention is paid to their planting. Therefore, there are special requirements for land preparation for planting and planting of seedlings [2].

At present, forestry does not have special units for preparing plantations for planting, so it is necessary to use existing units or their adapted versions in the preparation of lands, which in turn leads to increased energy consumption and

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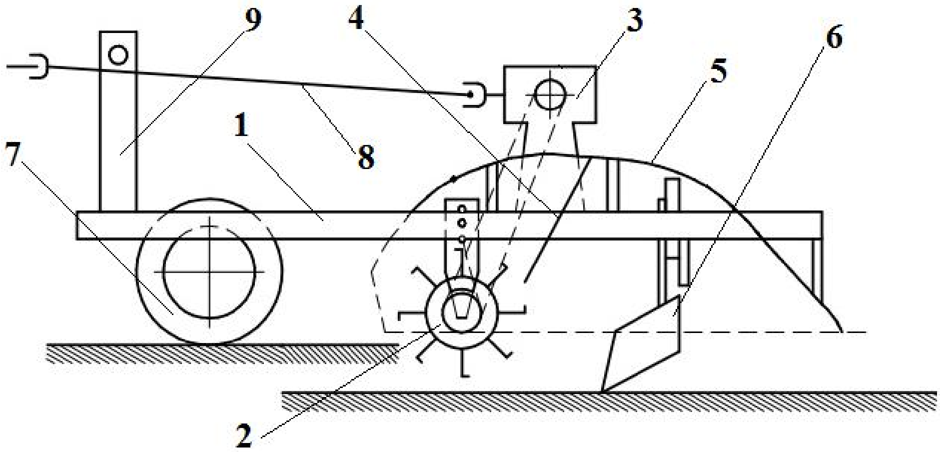
operating costs.

For forestry farms, the use of combined aggregates to prepare the soil for planting by processing the aggregate in one pass is of great importance. Because the number of transitions is small, the soil is less compacted and creates the basis for good development of the root system of crops. In addition, the need for agricultural machinery to cultivate different brands of soil and the direct operating costs will be reduced, productivity will increase.

Research methods and materials. As a result of the analysis and research, a new technology of preparation of forest plantations for planting and a combined aggregate design that performs the technological processes in one pass of the unit have been developed (Figure 1) [4,5].



1 frame, 2 earth crusher, 3 directional reducer, 4,5 protection device to prevent the crushed soil from spilling out, 6 pile picker; 7-wheel drive, 8-speed transmission, 9-unit connection to the tractor.

Figure 1. Preparation of forest plantations for planting aggregate for combined.

Combined unit (Fig. 1) Frame 1, which allows to adjust the working bodies and adjust them at different distances and depths, soil crusher 2 to grind the soil to the required level, reducer 3, which changes the direction of movement of the soil crusher to the working body, protection device 4 -5, opening of watering cans and bushing 6, support wheel 7, transmission 8, mounting device 9 for mounting the unit to the tractor, ag. the furrows of a transition loosened soil at the required level, chopped and prepared for planting furrow pink, [4].

The proposed combined aggregate is plowed in autumn and crushed in spring by chiseled soils by an active soil crusher to a depth of 8-10 cm with a size of less than 10 mm, the crushed soil layer receives irrigation furrows with a depth of 10 ... 15 cm, width 40 ... 60 cm forms clumps.

Research results. Determining the depth of subsidence of the working body that forms the irrigation canals. We determine the depth of sinking (walking) of the working body forming the irrigation branches using the scheme shown in Figure 2. In this case, from previous studies, the width of the ridge a = 40-60 cm, the width of the ridge b = 20 cm, the angle of inclination of the ridge wall relative to the horizon φ. This angle is the angle of natural shedding of the soil $\varphi_т$ we assume that is equal to, i.e $\varphi = \varphi_т$ =38-41° [7,8,9].

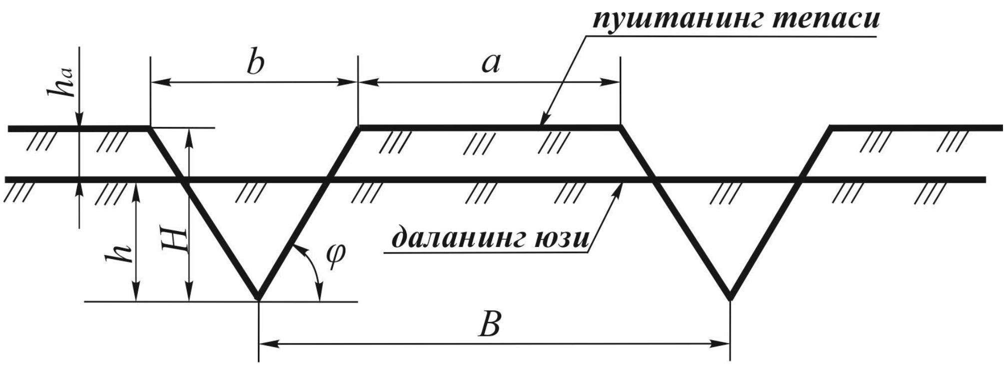


Figure 2. Scheme for determining the depth of subsidence of the working body forming the irrigation canals

From the diagram shown in Figure 2, we obtain the following expressions.

$$S_1 = h_б^2 ctg\,\varphi; \quad (1)$$

$$\frac{0{,}5b}{hctg\,\varphi} = \frac{h_б + h_a}{h_б}; \quad (2)$$

$$b = 2\left(h_б + h_a\right)\, ctg\,\varphi; \quad (3)$$

$$S_2 = ah_a + h_a^2 ctg\,\varphi, \quad (4)$$

here $h_б$ – the depth of immersion of the working body in the soil;

h_a – the height of the soil spread over the ridge.

S_1=S_2 (where S1 is the face of the soil cross-section cut by the working body and spread over the top of the pile) [10], we obtain the following equation;

$$h_б{}^2 ctg\,\varphi = ah_a + h_a^2 ctg\,\varphi. \quad (5)$$

We make this expression look like this below

$$\left(h_б - h_a\right)\left(h_б + h_a\right)ctg\,\varphi = ah_a. \quad (6)$$

Given expression (3), we give expression (6) as follows

$$\left(h_б - h_a\right)\cdot b = 2ah_a. \quad (7)$$

from

$$h_б = \frac{b + 2a}{b} h_a. \quad (8)$$

$h_б$ Substituting this value of (3) into the expression, we obtain the following

$$b = \frac{4\left(a + b\right)}{b} h_a ctg\,\varphi. \quad (9)$$

From this

$$h_a = \frac{b^2 tg\,\varphi}{4\left(b + a\right)_a} \quad (10)$$

It turns out that.

h_a Substituting (10) for (8), we obtain the following result

$$h_б = \frac{(b + 2a)b}{4(b + a)} tg\,\varphi. \quad (11)$$

This expression b, a and φ putting the above values of, we determine that the working body should be able to adjust the depth of immersion in the soil in the range of 7–8 cm.

If b and B given the indicators (11), the expression will have the following appearance;

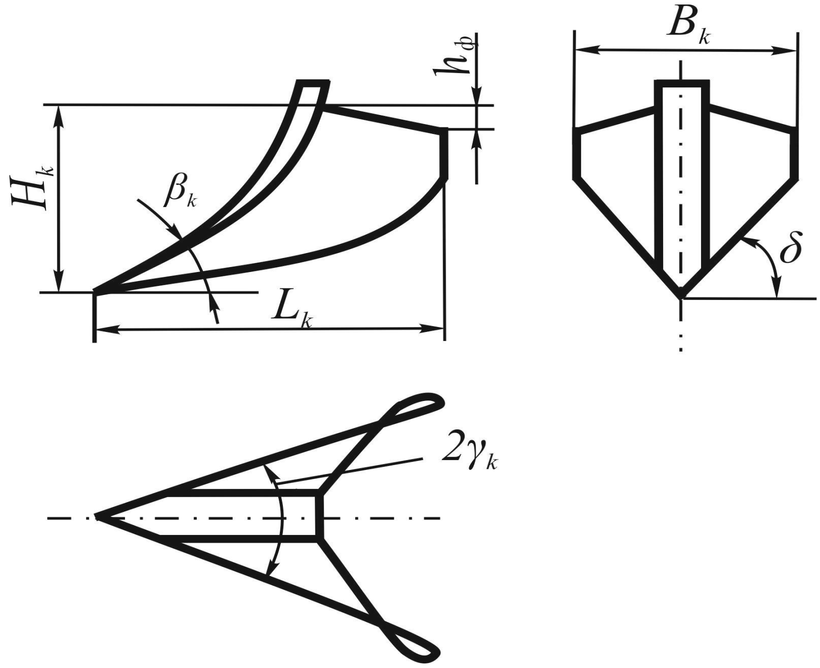
$$h_б = \frac{(2B - b)b}{4B}. \quad (12)$$

Calculations on this expression also give the same result as calculations performed on expression (11).

Hence, the depth of immersion of the working body forming the irrigation branches of the combined aggregate should be in the range of 7-8 cm.

Determining the parameters of the working body that forms the irrigation canals.

The following are the main parameters of the working body that form the irrigation canals (Figure 3):



$H_к$- egat chest height; $2\gamma_к$ - the opening angle of the wing wings; $\beta_к$- the angle of entry of the egat into the soil; $\delta_к$- the side shear angle of the wing wings; $B_к$- the width of the wings of the egat; $L_к$ – the length of the egat body.

Figure 3. The working body that forms the irrigation canals basic parameters.

We determine the height of the working body chest at a certain value of its depth of immersion in the ground using the following expression [10,11]

$$H_k \geq (1 + K)\frac{h_б}{\sqrt{2}}(1 + \sqrt{2}). \quad (13)$$

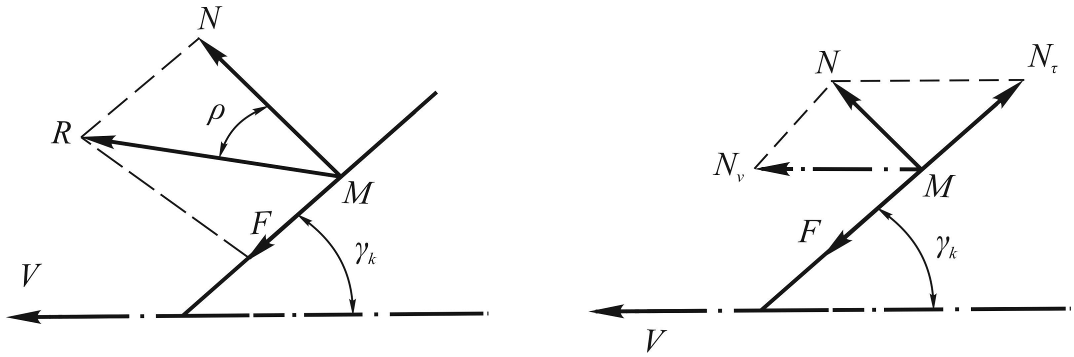
where K is the coefficient taking into account the erosion of the soil in front of the working body.

$h_б$ Given the value of (11) in terms of expression, expression (13) has the following form

$$H_k \geq (1+K)\frac{(1+\sqrt{2})(b+2a)b}{4\sqrt{2}(b+a)} tg\varphi. \tag{14}$$

K=assuming 0.5 and expressing the above values of b, a, and pH (14), we determine that the height of the working body chest should be at least 20.5 cm.

To determine the opening angle of the working body wings, we consider the movement of the soil pieces in the horizontal plane under the influence of its right wing (Fig. 4). Normal friction and friction by the wing of the working body on the soil fragments in the horizontal plane $F=Ntg\rho$ (where r is the angle of friction of the soil particles on the wing of the working body) (Fig. 4, a). N power N_V and N_τ in this case N_V – in the direction of movement, N_τ the force is directed parallel to the wing surface of the working body (Fig. 4, a).



а) б)

Figure 4. Schematic of the forces acting on the soil fragments in the horizontal plane by the wing of the working body

4- from the diagram shown in the figure

$$N_V = N/\sin\gamma_k \tag{15}$$

and

$$N_V = Nctg\,\gamma_k \tag{16}$$

Is consided.

N_V in the direction of movement of soil fragments under the influence of force, N_τ under the influence of force it moves along the surface of the working body. However, $N_\tau < F$, as $\gamma_K > \frac{\pi}{2} - \rho$ when the pieces of soil cannot slide along the wing of the working body, they can only move forward. This leads to a large accumulation of soil in front of the working body and as a result its resistance increases. In addition, in this case it is observed that pieces of soil stick to the surface of the working body. This leads to poor opening of the irrigation holder and further increase the resistance of the working body.

If the pieces of soil can move along the wings of the working body, the above-mentioned defects will not be observed. For this $N_\tau > F$ if $\gamma_K < \frac{\pi}{2} - \rho$ should be. In this case, the soil fragments move in the direction of the force R, which is an equal effect of the forces N and F under the influence of the working body (Fig. 4, b).

For this case, the absolute velocity of the soil particles in the horizontal plane V_a can be found in the following formula (Figure 5)

$$V_a > V\ \frac{\sin\gamma_k}{\cos\rho}, \tag{17}$$

here V – the advancing speed of the aggregate.

V_a the advancing speed of the aggregate

$$V_K > V\ \frac{\sin\gamma_k}{\cos\varphi}\cos\left(\gamma_к + \rho\right). \tag{18}$$

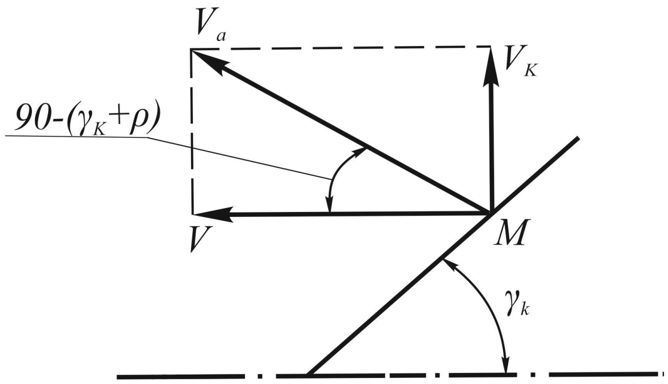
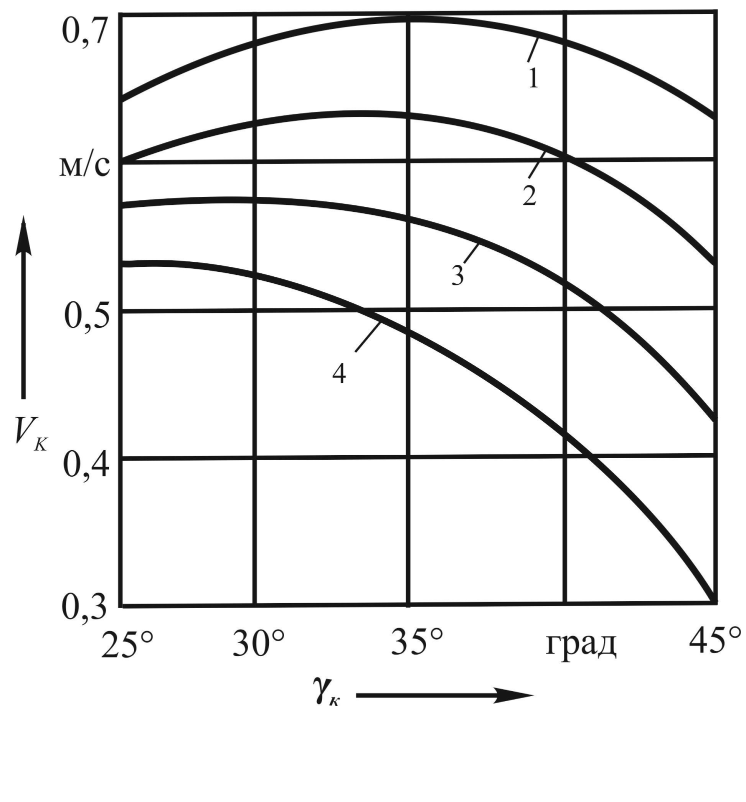


Figure 5, Schematic for determining the velocity of soil fragments

V_K the higher the speed, the less the soil pile in front of the working body and the pieces of soil do not stick to the wings of the working body.

6-picture V =2 м/ when s and at different values of the friction angle V_K speed $\gamma_к$ graphs of change depending on the angle are given. As can be seen from the graphs given $\gamma_к$ at certain values of the angle V_K the speed is reaching its maximum value. Hence $\gamma_к$ at these values of, it can be said that the soil pile in front of the working body and its resistance to gravity will be minimal, and a quality cut of the irrigation owner will be achieved.



1,2,3,4-φ=20,25,30,35º if

6-picture, V_K speed γ_κ angle dependence graphs

γ_κ corner V_K we determine the values that ensure the maximum speed. To do this, we examine the expression (18) to the extremum, i.e., to its right we take the product at an angle and set the result to zero

$$\frac{dV_t}{d\gamma_k} = V\left[\cos\gamma_k \cos(\gamma_k + \rho) - \sin\gamma_k \sin(\gamma_k + \rho)\right] / \cos\rho = 0. \qquad (19)$$

This measurement γ_κ decomposing with respect to, we obtain the following

$$\gamma_\kappa = \frac{\pi}{2} - \frac{\rho}{2}. \qquad (20)$$

This is the expression obtained ρ The opening angle of the working body, setting certain values of (25º – 30º) we determine that it is in the range.

We determine the angle of penetration of the working body into the soil from the following condition [12] $\beta_k + \rho < 90^\circ$. (21)

When this condition is met, the soil particles slide upwards along the working surface of the working body and the soil pile in front of it is prevented.

(3.21) measuremet β_κ decomposed and obtained in relation to ρ setting the maximum value of (35º [12]), we determine that the angle of entry of the working body into the soil can be no more than 55º. As a result β_κ =35–40º we accept. **The** angle of lateral shear of the wings of the working body is equal to the angle of natural shedding of the soil or less than 2-3º [11]. This reduces the likelihood that the excavated soil will be re-buried in the open field. Based on the above δ_κ =35-38º accepted

We determine the width of the wings of the working body according to the diagrams shown in Figure 3 by the following expression

$$B_\kappa \geq 2H_\kappa ctg\,\delta \qquad (22)$$

or considering (14)

$$B_\kappa \geq 2\left[(1+\kappa)\frac{(1+\sqrt{2})(b+2a)b}{2\sqrt{2}(b+a)}tg\,\varphi - h_\phi\right]ctg\,\delta, \qquad (23)$$

here h_ϕ – the difference between the heights of the anterior and organ parts of the wings, m.

κ, b, a, φ and δ by putting the above and defined values of h_ϕ =5 sm The calculations carried out on expression (23) showed that the width of the wings of the working body should be at least 41 cm.

The length of the body of the working body can be determined by the following expression [11].

$$L \geq \frac{H_k\left(1+\sqrt{1+f}\right)}{\sin\delta}, \qquad (24)$$

here f – rubbing pieces of soil on the wings of the working body coefficients.

f=0,7 [11] and H_κ and δ If we express the above values of (24), it follows that the length of the body of the working body should be at least 78 cm.

Conclusion. 1. As a result of the analysis and research, a new technology of preparation of forest plantations for planting and a combined unit design that implements the technological processes in one pass of the unit have been developed.

2. Failure to carry out plowing, mulching and plowing of the land on the proposed technology significantly reduces the consumption of labor, energy and fuels, sharply reduces the number of passages of aggregates in the field, leads to excessive compaction of the soil.

3. The depth of immersion of the working body opening the irrigation branches should be in the range of 7-8 cm to ensure the specified widths of the irrigation trough and the ridge to be formed.

4. The working body forming the combined aggregate irrigation canals should have a chest height of at least 20.5 cm, the opening angle of the wings should be in the range of 60–65º, the angle of entry into the soil should be 35–40º, and the angle of the side clipping should be 35–35 °. 38º, the width of the wings and the length of the body should be at least 41 cm and 78 cm, respectively.

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