THE DEVICE THAT CREATES A LAYERED DRAINAGE HOLE, BASED ON THE PARAMETERS OF THE WORKING BODY WITH A COMPLEX SURFACE, INCREASES THE EFFICIENCY OF WORK

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Abstract: *In this article, a water-efficient, improved hole drainage device used to improve the melioration condition of poor and saline soils was developed based on the parameters of the working bodies and application technologies. Also, the resistance forces affecting the working bodies during the processing of the device that creates a hole drainage were determined and studied.*
Keywords: *Hole drainage device, saline soils, plowed layer, working bodies, resistance forces, steel rope, conical cylinder, complex surface working body, working columns.*

Softening the subsoil layer and creating hole drainage remains one of the most important agrotechnical activities and urgent problems in the agriculture of Uzbekistan today. For this reason, it is important to develop the theoretical and technological foundations of the creation of hole drainage in the subsoil layer, i.e., in the lands with a high level of salinity, to conduct scientific research work on the creation of some mathematical models of the absorption of underground seepage water [1,2]

According to the data obtained from the analysis and research, it is noted that the underground seepage water is located close to the surface of the earth, the level of salinity is high, and the formation of hole drainage in the subsoil layer of the saline land has a good effect. Therefore, it has been emphasized by many scientists and experts that it is possible to find a solution to the problem and eliminate it by applying the shape and dimensions of the working body of the device that creates a hole drainage in theoretical and experimental ways and applying it to production. can be seen in the conclusions of the conducted studies [3,4]

In order to reduce the tensile strength of the recommended device, ensure the steady movement of the working body during the work process, reduce the metal capacity, create a high-quality hole drainage, and ensure the effective long-term operation of the hole drainage during the salt washing process, which creates a hole drain an improved version of the device is designed, its dimensions are based on, working and structural, technological drawings are drawn, the issues of making experimental versions, applying it in production and obtaining results are waiting for their solution.

During the movement of the working body, the length of the steel rope, the diameter of the conical cylinder, and the physical and mechanical properties of the soil have an effect on the quality of the hole drainage.

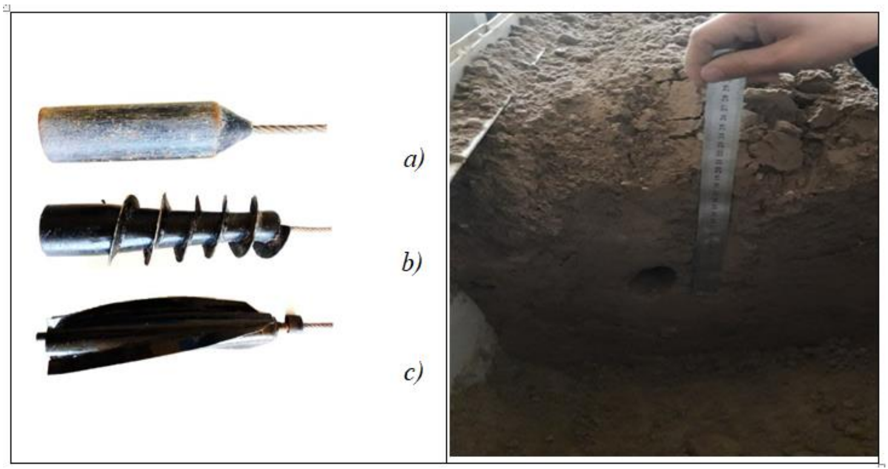

Figure 1. Hole openers prepared for conducting experiments and experimental works in laboratory conditions.

a - conical, flat, working surface; *b* - with a conical tip, a drill-shaped working surface, *c* - with a conical tip, screw-shaped working surface

Experimental and test results of scientific research showed that the salinity level of the soil increases in the places where underground seepage waters are located, and the salt particles reach the upper layer of the earth. As a result, different levels of soil salinity are formed.

It has been proven through theoretical and experimental studies that the diameter of the hole drainage is $d_m = 50 - 150$ mm for medium sandy soils, and $d_m = 100 - 300$ mm for fine and heavy sandy soils [5,6]

The pitch of the screw winding formed on the screw-shaped surface of the hole digger is 28 mm, the angle of curvature is 35 degrees, and the length of the winding equal to 900 mm allows to meet the agrotechnical requirements for the formation of the hole. The parameters of the digger include the following (Fig. 2):

d_t – hole opener diameter, m;

2γ – angle of sharpening the hole opener;

l_s – the length of the cylindrical part of the hole opener, m;

γ_o va l_z – rear cone length (m) and sharpening angle, respectively;

l_t – the length of the rope, m.

We determine the diameter of the hole opener as follows:

$$d_m = \frac{d_a}{k}, \quad (1)$$

here d_a – diameter of perforated pipe according to agrotechnical requirements, m;

k – soil softening coefficient, k = 1,06-1,1 coefficient [8].

d_a = taking 7.5 cm and k = 1.08, we determine that the diameter of the cylindrical part of the hole opener should be 6.94 cm, and we use the value d_t=7 cm.

It is suggested that the taper angle of the drill bit is between 45-52°, provided there is minimal resistance to pulling. As an optimal value, we get $2\gamma_k$ = 50°.

It is known from the literature that the length of the cylindrical part of the hole opener depends on its diameter, and it can be determined according to the following expression.

$$l_к = (1{,}5 - 2{,}0) d_к \quad (2)$$

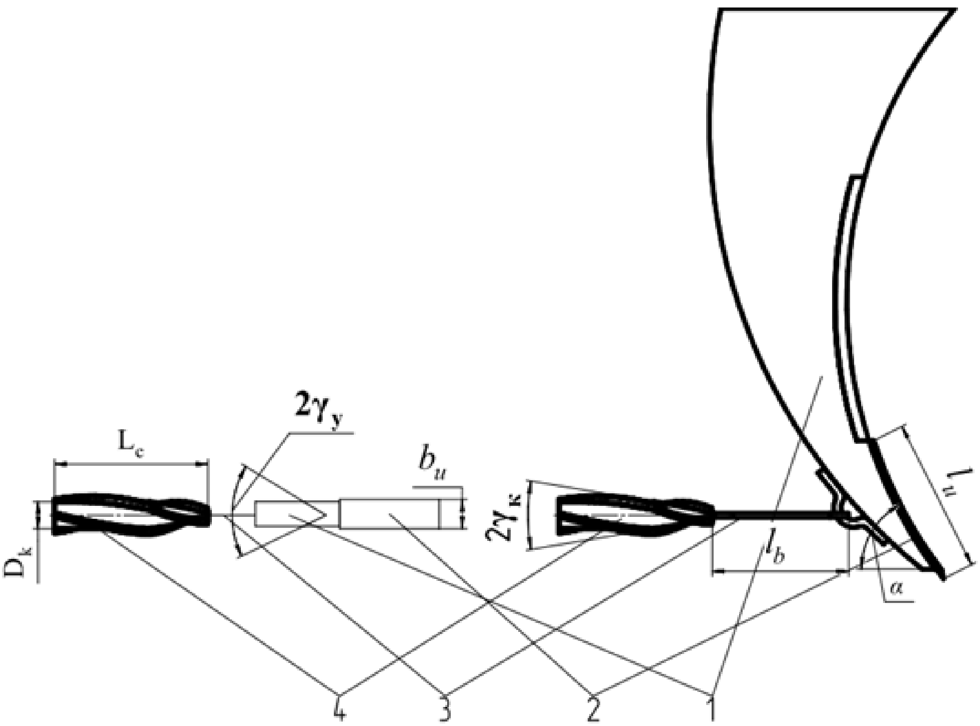

Figure 2. Parameters of the hole opener.

Putting the value of d_t determined above in this expression, we determine that the length of the cylindrical part of the hole opener is in the range of 105-240 mm. We accept

l_s=180 mm. The length of the steel rope is recommended in the range of 100-150 mm. We take the length of the rope as l_t = 120-130 mm.

The length of the back taper and the angle of sharpening do not affect the pull resistance of the hole opener. The length of the rear cone is between 25-50 mm, and the cone angle is between 20-25° [7]. It is better that the length of the rear cone is l_z = 30 mm and the sharpening angle γ_o = 25°.

We determine the tensile strength of the hole opener according to the following expression.

$$R_m = 10^3 k_д S_д + 10^3 \rho_л \pi d_m l_ц \qquad (4)$$

here k_d – the specific resistance of the soil to the movement of the hole opener, MPa;

S_d – cross-sectional surface of the hole, m^2;

ρ_l – relative resistance to soil adhesion, MPa;

k_d = 0,1 MPa, ρ_l = 0,008 MPa [7],

By putting l_s = 0,18 m, d_t = 0,07 m, we determine that the tensile strength of the drill should be 0.696 kN.

We determine the tensile strength of the steel rope according to the following expressions

$$F_a = 10^{-3} k_a l_a + k_б, \qquad (5)$$

here k_a – the specific resistance of the rope, N/m;

l_a – the length of the rope, m;

k_b – the initial resistance of the rope, N.

By putting k_a = 54 N/m, k_b = 15 N, l_a = 0,2 m, we determine that the resistance of the rope should be 15.1 N. Therefore, when the length of the rope is less than 1 m, its resistance to traction is not taken into account.

table 1

Recommended parameters of a device that creates a perforated drain.

T.r	Parameters	Unit of measure	Designation	Value
1	The diameter of the cylinder with a conical tip	Mm	D	100-110
2	The length of the steel rope connecting the column and the conical cylinder	Mm	l_a	300-350
3	Slope angle of edge work columns	Grad.	β	30-35^0
4	Installation angle of the working body	Grad.	α	27-30^0
5	The height of the column of the working body	Mm	N_c	1000-1200

Research shows that it is recommended to place the hole drainage device at the specified depths perpendicular to the direction of the ditches in the areas where the underground seepage water is located close to the surface and the salinity level is high. As a result of the application of this processing technology, it is possible to direct underground seepage water into ditches.

Table 2 shows the results of the experiment on the justification of the length of the steel rope.

table 2

Variation of the resistance of working bodies depending on the length of the steel rope

Steel rope length $l_{тўл}$, mm	The resistance force of the working body, F, kN.	Steady walking at the specified depth, h, mm.	The diameter of the perforated drain to be formed, mm	Coefficient of absorption of underground water into perforated drainage, m/sutka
200	5,2	± 30	90	0,42
300	5,1	± 60	100	0,45
400	5,7	± 80	101	0,43
500	6,8	± 100	98	0,43

From the results of the experiment, it can be seen that the 100 mm diameter cylinder with a conical tip has the lowest value (5.1 kN) when pulling with a 300 mm long steel rope, and the formed hole drainage is of good quality, and the underground seepage water absorption was 0.45 m/ days.

When the working body moves at the specified depth, the seepage water in the surface layer of the soil is absorbed through the hole drainage with a drill-like working surface formed underground, the salinity level of the soil is reduced, the water-air exchange is improved, and favorable conditions are created for the growth and development of plants.

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