Linear plow with disk angle

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Abstract. The study aims to substantiate the design scheme of a linear plow with a disk angle. The authors have developed a linear plow with a disk plow for smooth, furrowless plowing. The proposed plow has disc lugs, screw housings, and guide plates. The technological scheme turnover of polygonal layers formed by disk pre-plates, the scheme mutual arrangement housings and guide plates, and the general view laboratory-field installation for conducting experiments are given. During the experiments, the degree of sealing plant residues, height irregularities on the surface arable land, and the traction resistance device were used to evaluate the performance plow. To ensure the required quality work with minimal traction resistance, a linear plow must be equipped with disc pre-lugs installed in front housings along their field cut line. When installing a disk prep lug with a working surface facing towards the turn formation, the degree sealing plant residues and the height of irregularities is 92-95% and 4.3-5 cm, respectively, which fully complies with agro technical requirements.

1 Introduction

Scientific research on the development of linear plows and the justification parameters of their working bodies G Okunev [1], Y Syromyatnikov [2, 11, 13, 15, 18-20], F Maiviatov [3, 6], F Mamatov [4], C Beckett [5], M Smirnov [7], B Tulaganov [8] established the main technological, kinematic and dynamic factors affecting the process formation turnover in its own furrow, the rational shape cross-section formation and the conditions of its autonomous turnover in its own furrow are determined, and the layout schemes and parameters of mutual placement technological functional modules "hull-plowman" are determined A Babaeva [9], S Kornienko [10], V Pashchenko [12], I Mukhametshin [14], N Kholikova [17], O Hamroyev [19] justify the mutual arrangement hulls and the plowman of a linear-stepped plow in cotton growing conditions. However, in the studies cited, the issues of substantiating the parameters of a wedge-shaped plug in the form of a spherical disk that performs egalitarian flat plowing have not been sufficiently studied.

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2 Materials and methods

A laboratory-field device was prepared for experimental research (Fig.1). Experiments to determine the quality indicators and resistance to drag disc-shaped disk angle wedge plugs were carried out in farms Kashkadarya region in 2022. Tenzometric fingers and a G-shaped strain gauge beam were fitted to the structure to determine drag resistance. In experiments, the speed device aggrseedbeded with the TTZ-812 tractor was 6.4-8.5 km/h.
The soil experimental field is medium-heavy loam soil with a smooth mechanical composition. Soil moisture, hardness, and density before conducting experiments GOST 20915-11 Tests of agricultural machinery. Methods for determining test conditions. In this case, soil moisture content was determined using a thermostatic drying method of at least 6 h at a temperature of 105º, and hardness was determined using a hardness measuring instrument.

Fig. 1. Laboratory-field installation

The authors have developed an improved technology for the turnover layers within their own furrow and a design scheme for a linear plow with disk plows. In the proposed improved flat plowing technology, the plast is cut correctly, and the left edges of their upper part before being rolled to 180º on the border of their own Seedbede and brought to polygonal shape and then overturned on the border of their own seedbed (Fig.2). Beyond it, the width of the seedbed is greater than the width plast. This results in a semi-free space on the left CD side edge plast and a thin free space on the AB side of the right edge. The rotation plast around the base edge is carried out with the CD edge less deformed, and the plast is poorly compressed at the first hem. This reduces energy consumption to overthrow the plast. To ensure the formation of an open seedbed by the guide plate, the seedbed width for the bodies after the first body must be greater than the width plast, i.e.

$$B = b_n + b_e \tag{1}$$

where B is the garden bed width, cm; b_n is the plast width, cm; b_e is the open garden bed width, cm.
In this case, the guide plate bodies after the first body acts in an open ego.

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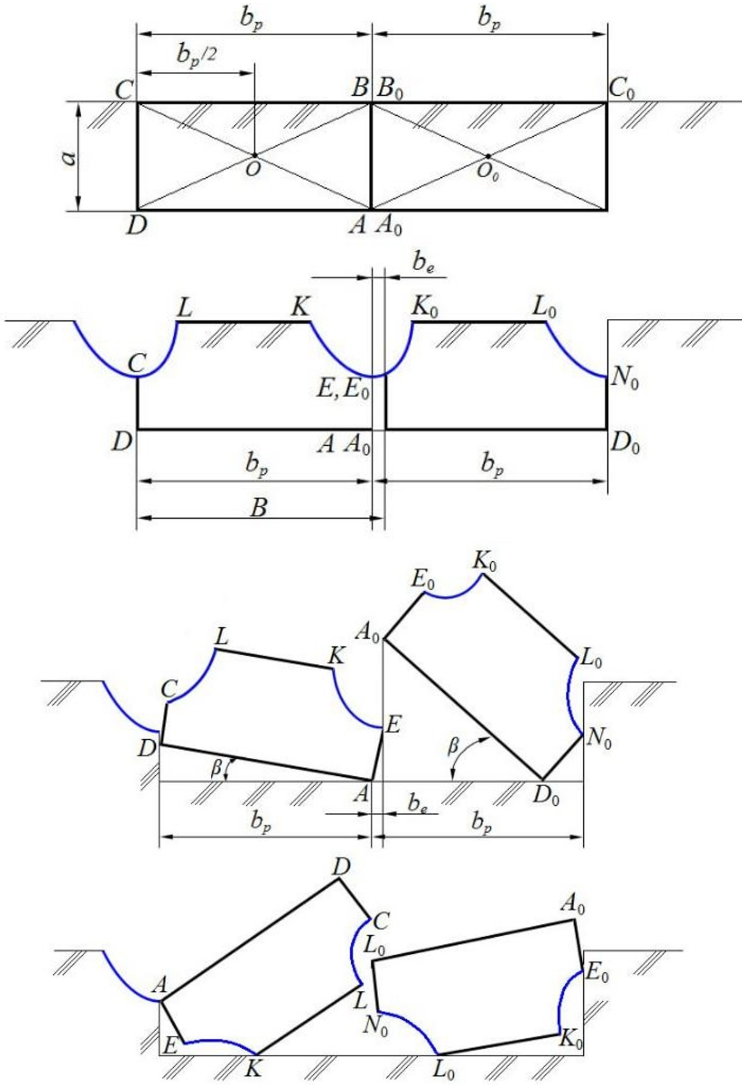


Fig. 2. System technology rolling earthen plast to 180º at border its own possession: *a* is the appearance a field transverse cross-section up to processing; *b* is appearance field transverse cross-section after correct, left edges plast are cut with spherical discs; *c* and *d* are schemes overturning the plast at border

The main working organs of ductless flat plowshare stump plow are in the form of a spherical disk with burrowers 1 and 4, screw bodies that roll to the correct side, which are placed by sliding in a longitudinal direction relative to each other 2 and 5, consisting guide plates 3 and 6, which are attached to their plowshare (Fig.3).

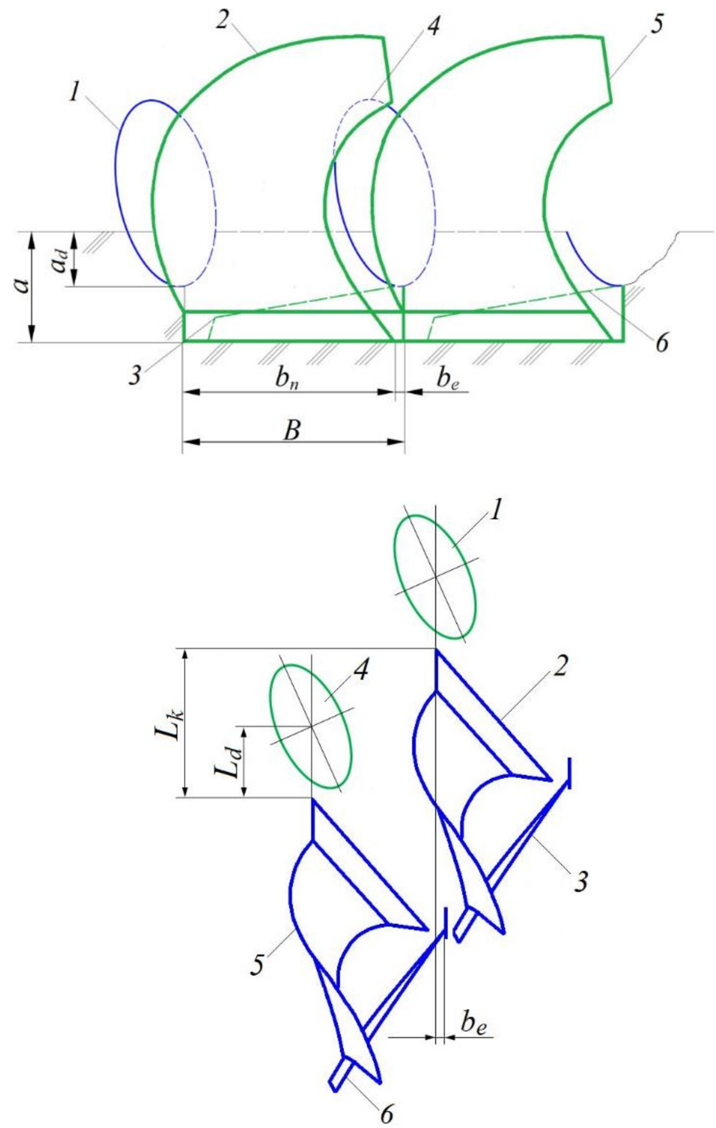


Fig. 3. Interposition and parameters spindle plug disc-shaped angle controller and housing

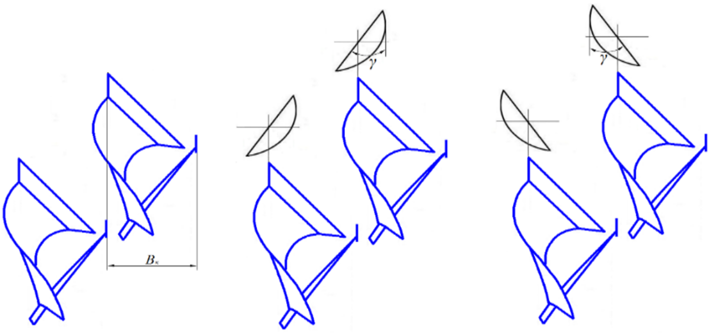
The working process step-by-step plug is carried follows. In the form of a spherical disk mounted in front first body 2 field edge, the angle finder 1 body cuts the left and correct edges in the upright plane field edge at the depth ad, respectively, and rolls it over the plast to the right, resulting in the formation polyhedral plasts (Fig.1,*b*). The steep section first guide plate 3 separates the limestone from the previous limestone. At the moment rotation first plast π/4 radians to a certain angle, and the second body 5 is launched. It also forms a polygonal plast with the help of a second crankcase 4, and rolls it to the side guide plate 6, acting on the open ego formed by the first body 2. The next rotation plast on the border, its own ego is carried out under the joint influence of corps. This improves the quality of plowing the plasts and reduces drag resistance.

3 Results and discussion

In field-experimental studies, the experience was conducted using the laboratory and field device (Fig. 4) to study the effect of disc-shaped on the performance indicators of a staggered plow.

Fig. 4. General type laboratory and field installation

In this case, the relative tests of the options for the plug on the handle were studied (Figure 5): *a* is disc-shaped angle, which is a stepless plow (Fig.4,*a*); *b* is a scheme in which the working surface disc-shaped angle is located opposite to the working surface housing (Fig.5,*b*); *c* is disc-shaped angle (Fig.5,*c*).



a *b* *c*

Fig. 5. Layout housings and disc pre-lugs: 1 and 2 are right-turning housings; 3 is guide plate; 4 is disc pre-lugs

In experiments, the coverage width of bodies was taken 50 cm, the total constructive coverage width device was 1.0 m, and the diameter of disc-shaped burners was 480 mm. In this case, the processing depth of their bodies was determined to be 26 cm, and that a disc-shaped angler-12 cm. As a criterion for assessing the performance of a staggered plug, the degree burial plant remains, the height of the irregularities (height of the grooves), and the resistance plug to pull were adopted. The results of the experimentation are shown in Fig.6.
The graph dependencies presented in Fig.6 can be represented by the following empirical formulas:

Option 1

by the degree burial of plant remains K_u =-8.1633V^2+115.55V – 317.48 (R^2 = 0.998);
the height irregularities U_n = 1.3265V^2 – 18.773 V + 71.642 (R^2 = 0.9526);
on drag resistance R = 0.6633 V^2 – 8.0153 V + 35.052 (R^2 = 0.9664);

Option 2

$$K_u = -6.4286\,V^2 + 91.014 - 229.72\ (R^2 = 0.9973);$$
$$U_n = 1.1735\,V^2 - 16.605\,V + 63.739\ 9\ (\mathrm{R}^2 = 0.901);$$
$$\mathrm{R} = 0.6122\,V^2 - 7.2735\,V + 31.42 (R^2 = 0.9947);$$

Option 3

$$K_u = -4.0816\,V^2 + 56.776\,V - 100.39\ (R^2 = 0.8476);$$
$$U_n = 0.5102\,V^2 - 7.1327\,V + 29.206\ (R^2 = 1);$$
$$R = 0.5612V^2 - 6.6745\,V + 29.267 (R^2 = 0.9914).$$

The results of studies carried out show that with an increase in the speed device, the burial plant remains in all three variants increased first under the law bubble parabola and then decreased. At the same time, the height irregularities decreased first under the law bottlenose parabola and then increased, resistance to drag increased under the law bottlenose parabola.

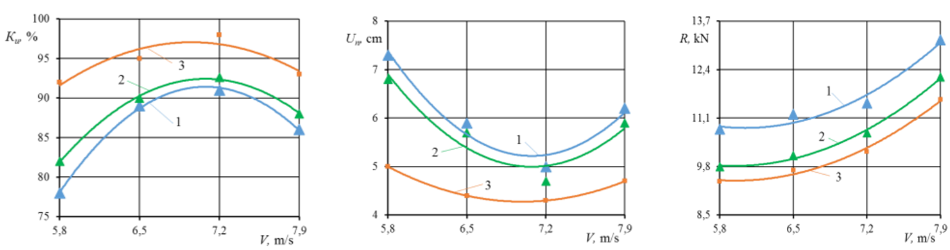


Fig. 6. Graphs dependence degree embedding plant residues (K_u), height of irregularities (U_n) and traction resistance device (R) depending on speed of movement frigate (V): 1 is option *a*; 2 is option *b*; 3 is option *c*.

In the process operation of a hollow plug without a disc-shaped burrow, only the burial of plant remains in the range of 6.66-7.5 m/s of speed is greater than 90%. In contrast, in the variant where the working surface disc-shaped burrow is located in reverse on the working surface body, this indicator at all speeds, the penetration rate of plant residues is higher than 90% in the variant with a disc-shaped angle working surface and the bodies working surface focused on the side plast toppling. At all working speeds, the first and second options in terms of heights of sickles on the field surface, that is, in the process of their work, the height of sickles is greater than 5 cm, the disc-shaped angle working surface and the corps working surface the option aimed at the side with the increase in speed in all variants, the drag resistance plow was increased in the case bottleneck parabola. Conforming to the data obtained in the experiments, it is necessary to bury the plant remains required level and to ensure the height sickles on the field surface are at the level of the requirements; the working surface disc-shaped burrower should be aimed at the side overturning plast with the bodies.

4 Conclusions

To ensure the required quality work with minimal traction resistance, the linear plow must be equipped with disc lugs installed in front housings along the line of their field cut. When installing a disk preplug with a working surface facing towards the turn formation, the degree of sealing of plant residues and the height of irregularities is 92-95% and 4.3-5 cm, respectively, which fully complies with agrotechnical requirements.

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