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Research on the Energy Performance of the Ridge Former

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ABSTRACT: The article reveals the urgency of the problem and the need for the introduction of a support-lump-breaking coil for the cultivation of cotton in the garden.

The substantiation of the effectiveness of the use of elastic rods of the ridge former for pre-sowing processing of cotton beds is also given. The substantiation of the dependence is given that with an increase in the speed of movement, the width of the coverage and the vertical load, the traction resistance increases in direct proportion. The substantiated results of theoretical calculations of traction resistance from speed, vertical load and sweep width are also given.

KEY WORDS: lumps, ridge former, hiller, discs, elastic rods, diameter.

I.INTRODUCTION

From the moment man created a tool of labor for influencing the soil and until now there is a problem of cultivating any culture the fruits of which a person uses. Over time, as a result of the evolution of the human mind, these tools have been improved to be more effective. From primitive wood to metal. Over the centuries, this industry has been transformed into agricultural production. And an integral part of the cultivation of crops is pre-sowing soil cultivation. After all, the yield of any crop largely depends on this. With the development of science and technology, scientists have developed many technological methods for the cultivation of agricultural crops. In the regions of our republic, mainly sown areas are occupied by cotton cultivation.

II. LITERATURE REVIEW

Also, research was carried out on the processing of the soil layer of the ridge, on the basis of which many variants of machines were developed. The proposed design developed by the authors Vinogradov V.I. [20] ,, and others is intended for processing row spacings. This design consists of a battery of discs 5 mounted on one axis 1 at the edges mounted on the hinges a tapered rotor coil 7 with an adjusting screw 8 of the angle of inclination for processing the side surface of the bed. The disks on both sides of the equalizer coil 3 are interconnected by rods 2, installed along the surface of the disks at equal distances between themselves.

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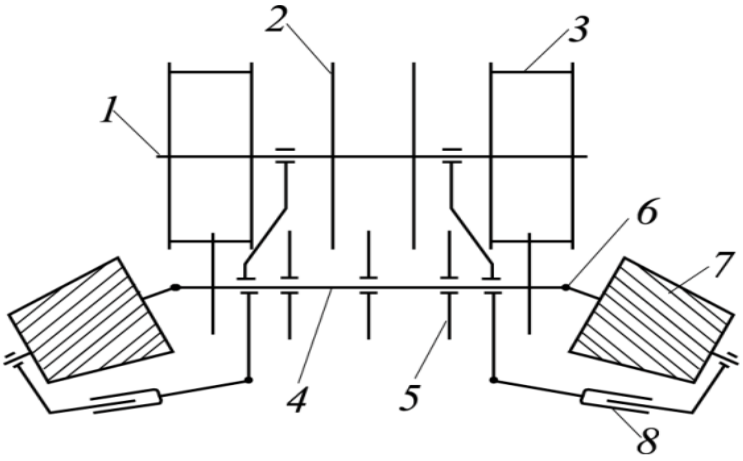

Fig. 1. Garden bed processing device

1-axis; 2-disk; 3-metal rod; 4-axis; 5-needle discs; 6-spherical joint; 7-cone leveler coil; 8-adjustment screw
Designed and created by KA Pshechenkov [21], and others, the design of a device with rotary working bodies for processing potato beds and row spacing.

III. SIGNIFICANCE OF THE SYSTEM

Usually, cotton is shown on flat prepared surfaces, but in some regions of the republic, cotton seeds are shown on the upper part of the bed. Of course, for this it is necessary to prepare this bed in accordance with agrotechnical requirements. When thinning the beds with hillers, beds with different sizes of lumps are formed. As a result, large lumps are formed that do not meet agrotechnical requirements. These lumps adversely affect germination of seedlings, moisture retention and uniformity of sowing. To solve this problem, the authors have developed many design options, the works of which have been published in many Scopus journals [1-10]. Having studied the cause of the appearance of large solid soil lumps and having analyzed the designs of the working bodies of machines for pre-sowing treatment, created earlier by the authors, we developed a herb-former whose main working bodies are elastic rods (a cable with a diameter of 3 mm).

IV. METHODOLOGY

In the process of researching the structure, special attention was paid to the dependence of the traction resistance on the speed of movement, vertical load and width of coverage. These dependences seriously affect the result of obtaining a high energy effect.

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Figure: 1. View and photo of the ridge former during testing

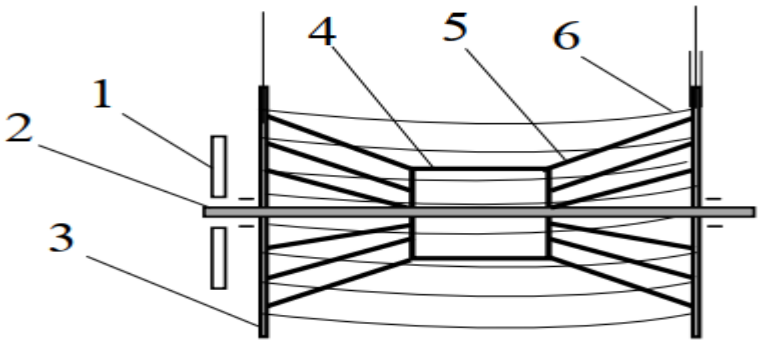

Figure: 2 - Scheme of the ridge former

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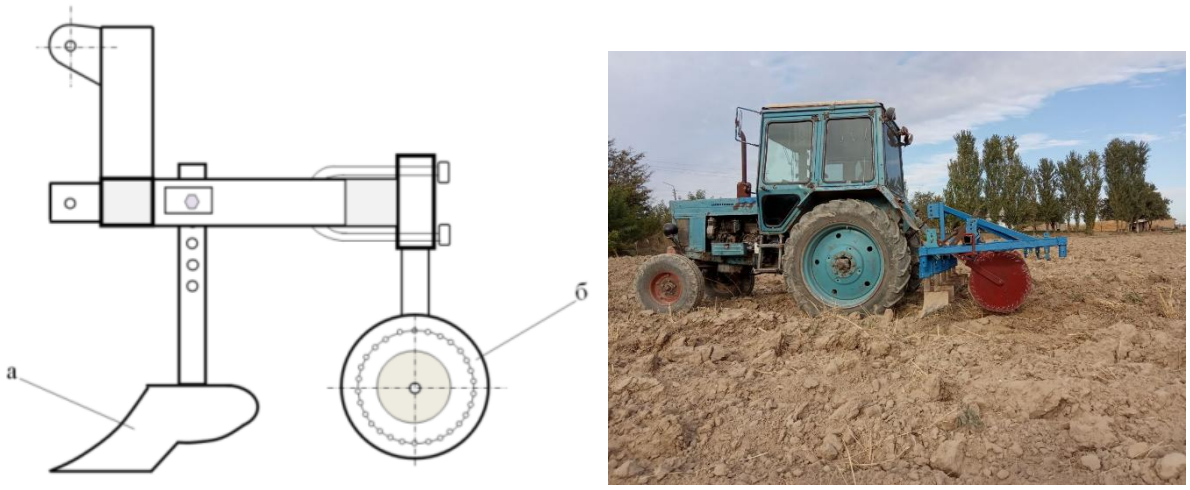
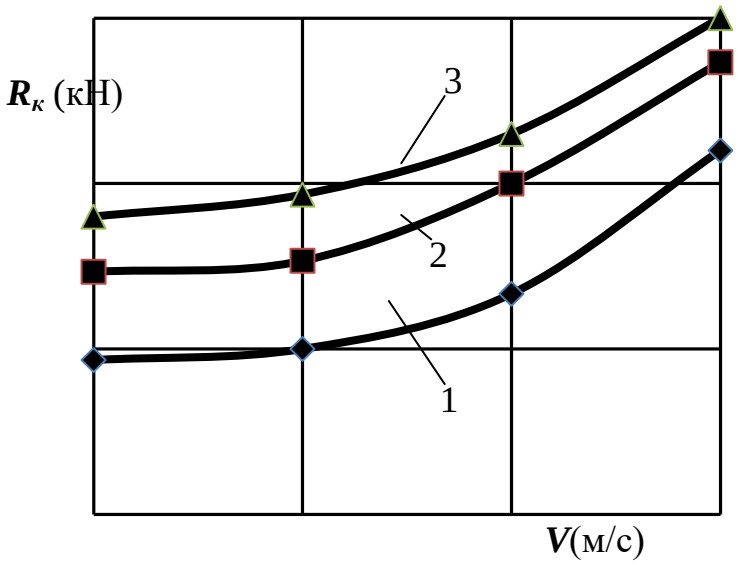
The ridge-former consists of a frame 1, an axis 2, disks 3, which are mounted on an axis 2 between the disks 3; a roller 4 with rods 5. The roller 4 consists of rods and is generally made as a combination of the connection of two truncated cones at the edges and in the middle in the form cylinder. Elastic rods 6 are located along the perimeter of disks 3 [11-13].



a - hiller; b - roller bed former

Figure 3 - Scheme and photo of the ridge former

For the energy assessment of the developed ridge former, strain gauging was carried out according to the method. The data obtained are presented in Fig. 4. The dependence of the traction resistance of the ridge former on the speed of the device was studied at a vertical load $Q_в$=2,0 кН and the width of the roller of the ridge former B = 0.50; 0.60; and 0.7 m. The speed of the ridge former was varied in the range of 0.4-1.6 m / s.



1,2,3 - *B*= 0,50; 0,60; and 0,70 m.

Fig. 4. Dependence of the traction resistance of the ridge former roller on the speed of movement and its width of capture

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As can be seen from the graphs, with an increase in the speed of movement and the width of capture, the traction resistance of the ridge former with its entire width of capture increases according to the parabolic law. So, at a speed of movement of the installation of 0.4 m / s and a width of capture of the roller of the ridge former 0.50; 0.60; and 0.70 m, the traction resistance of the ridge former was 0.44, respectively; 0.52; and 0.57 kN, and at a speed of movement of the installation of 1.6 m / s, respectively - 0.63; 0.71 and 0.75 kN.

The increase in the traction resistance of the ridge former roller with an increase in the speed of movement and the working width occurs mainly due to an increase in the resistance force arising from the inertia force and the volume of the cultivated soil.

The influence of the speed of movement and the width of its capture on the traction resistance of the ridge former roller can be expressed by the following empirical formulas [14-19],

with a working width, B = 0.50 m

$$R_т=0,1875V^2 -0,22V+0,5R^2=0,9965; \quad (1)$$

at working width, B=0,60 м

$$R_т=0,1562V^2-0,1525V+0,555\ R^2=0,9991; \quad (2)$$

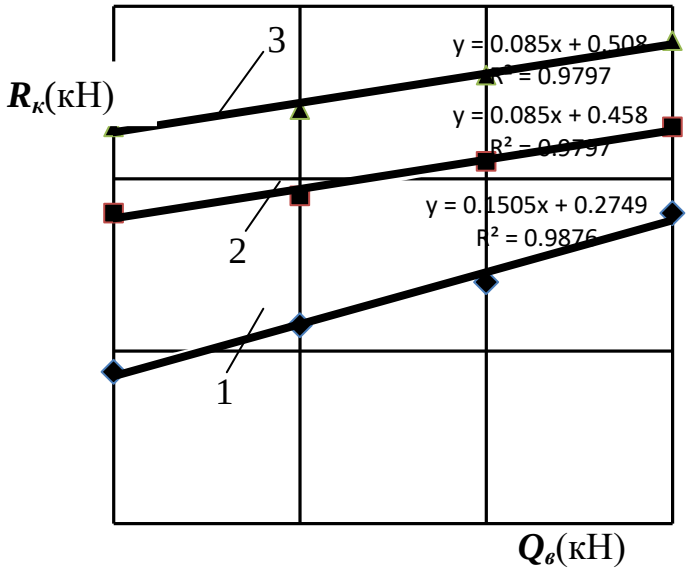
at working width, B=0,70 м

$$R_т=0,1328V^2-0,1169V+0,5962\ R^2=0,9994; \quad (3)$$

In the range of operating speeds of movement from 0.4 to 1.6 m / s, the traction resistance of the experimental ridge former was in the range of 0.44-0.75 kN.

Figure 5. the dependence of the traction resistance of the ridge former on the vertical load is presented.

In the experiments, the number of elastic rods was 64 pieces, the disc diameter was 0.6 m. The soil was heavy loamy with an absolute moisture content of 14.0-16.5%. The width of the ridge former is 0.6 m. The thickness of the discs is 5.0 mm. The diameter of the elastic bars is 3.0 mm.



1- at V = 0.8 m / s; 2- at V = 1.2 m / s; 3- at V = 1.6 m / s

Fig. 5. Dependence of the traction resistance of the ridge former on the vertical load on it

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V. EXPERIMENTAL RESULTS

The graphs show that with an increase in the vertical load on the working body, its traction resistance increases. At a speed of movement of the installation 0.8; 1.2 and 1.6 m / s and a vertical load of 1.40 kN, the traction resistance of the ridge former, respectively, was 0.488; 0.58 and 0.63 kN, and with a vertical load on the working body of 2.0 kN, its traction resistance is, respectively, about 0.58; 0.63 and 0.68 kN, i.e. in the range of operating speeds of 0.4-1.6 m / s, the traction resistance of the ridge former increases by 8.5-27.5%.

The influence of the load on the traction resistance of the support-lump-breaking device can be expressed by the following empirical formulas

at speed, V=0,8 m/s

$$R_т=0,1505Q+0,2749\ R^2=0,9876; \quad (6)$$

at speed, V=1,2 m/s

$$R_т=0,085Q+0,458R^2=0,9797; \quad (7)$$

at speed, V=1,6 m/s

$$R_т=0,085Q+0,508\ R^2=0,9797. \quad (8)$$

The above data indicate that the proposed ridge former does not lead to an excessive increase in the traction resistance of the unit.

VI.CONCLUSION AND FUTURE WORK

An increase in the traction resistance of the bed former with an increase in the speed of movement and the width of coverage occurs mainly due to an increase in the resistance force arising from the inertial force and the volume of the cultivated soil.

The increase in the working width of the device from 0.40 m to 0.70 also led to an increase in its traction resistance. So, with a speed range of 0.4 -1.6 m / s, the traction resistance increased from 0.44-0.75 kN.

The graphs show that with an increase in the vertical load on the working body, its traction resistance increases. When the speed of the ridge former is from 0.4; up to 1.6 m / s and vertical load from 1.4 to 2 kN, the traction resistance of the ridge former, respectively, was from 0.48 kN to 0.68 kN, i.e. in the range of operating speeds of 0.4-1.6 m / s, the traction resistance of the ridge former increases by 8.5-27.5%, forming an effective mulch layer.

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