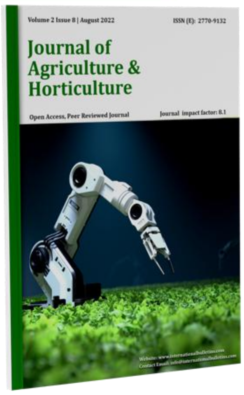

JUSTIFICATION OF THE DESIGN PARAMETERS OF THE SOIL-SLIDING AND SOIL-CLINGING BLADES OF THE ROTARY WORKING BODY USED FOR OPENING BURIED GRAPE BUSHES

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https://doi.org/10.5281/zenodo.17855895

Abstract.

In the article, based on theoretical studies, the structural parameters of the blades of the main parts of the experimental rotation working body used for opening buried grape bushes, which cling to the soil, were determined. Based on the relationship between the working surface of the soil-gripping blades of the rotary working body and the working surface of the soil-sliding blades, their design parameters are substantiated. The relationship between the working surface of the soil-gripping blades and the working surface of the soil-sliding blades of the rotary working body used for the stable implementation of the technological process is based on the following: $A_{sl} = A_s(1+\delta)$.

Key words: rotary working body, design parameter, buried current heap, soil-gripping blades, soil-sliding blades, working surface, agrotechnical measure.

Introduction. In recent years, rotary working bodies have been widely used in agricultural production worldwide for soil cultivation. The main reason for this is the effective fulfillment of agrotechnical requirements for rotary working bodies in the technological process. This is clearly manifested in the results of research and economic tests conducted by researchers.

The rotary working body, used for opening buried grape bushes, during operation moves the soil layer from the buried grape pile towards the center of the vine row. In this case, the design parameters of the soil-sliding and soil-clinging blades are of great importance. The rotary working body is characterized by the interdependent influence of changes in several design parameters during the implementation of the agrotechnical measure [1, 2, 3, 4, 5].

Object and methods of research. The main parts of the rotary working body used for opening buried grape bushes are soil-sliding and soil-clinging blades. For the rotary working body to steadily carry out the specified technological process and ensure the required kinematic operating mode, the number of soil-sliding blades must be equal to the number of blades clinging to the soil. The soil-sliding blades of the rotary working body used move the soil layer from the grain pile buried in the technological process towards the inter-rows. In this process, the soil-sliding and soil-clinging blades are brought to the surface by the soil mass along their working surface A_s, A_{sl}.

Asl Jafar Habibi and Singh Surendra conducted research on three types of rotary working bodies (i.e., C-type, L-type, and RC-type) in order to reduce energy consumption during soil cultivation by optimizing the design parameters of rotary working bodies. Based on the conducted research, the following relationship can be seen for the working surface of the soil-sliding and soil-clinging blades [7].

JAH | Volume 5, Issue 12, December

$$\frac{A_s \cdot V_s}{A_{sl} \cdot V_{sl}} \geq 1, \qquad (1)$$

where A_s- working surface of the soil-sliding blade, cm^2;

A_{sl} -working surface of the paddle-to-soil blade, cm^2;

V_s - working speed of the soil-sliding blade, m/s;

V_{sl} - working speed of the soil-clinging blade, m/s.

$$A_s = b_s \cdot h_s,$$

b_s-width of the soil-pushing blade, cm;

h_s-height of the soil-pushing blade, cm;

$$A_{sl} = b_{sl} \cdot h_{sl},$$

b_{sl}-width of the soil-clinging blade, cm;

h_{sl} height of the soil-gripping blade, cm;

$$V_s = \omega_s \cdot R, \qquad (2)$$

where ω_s - angular velocity of the soil-sliding shovel, rad/s;

R - radius of the rotary working element, cm.

$$V_{sl} = \omega_{sl} \cdot r, \qquad (3)$$

where ω_{sl} - angular velocity of the soil-clinging blade, rad/s;

r - radius of the blades attached to the soil, cm.

The rotation of the applied working body is carried out by the technological process in conjunction with the soil-sliding and soil-clinging blades. The clinging blade penetrates the soil, cuts it, and pushes the soil layer relative to the row spacing along its working surface. The most characteristic feature is that these blades sink deep into the soil and act as the instantaneous center of rotation of the working body. The spreading blade cuts the soil and separates it in a layered state, moving the soil layer along its working surface towards the inter-row spacing. If the soil-gripping blade does not have a sufficient working surface from a structural point of view, then the movement of the soil by the working body without fulfilling condition (1) will be ineffective. If the working surface is too large, excess energy is consumed. For the efficient execution of the technological process, the resistance force acting on the soil-sliding blade must be less than the resistance force acting on the soil-clinging blade.

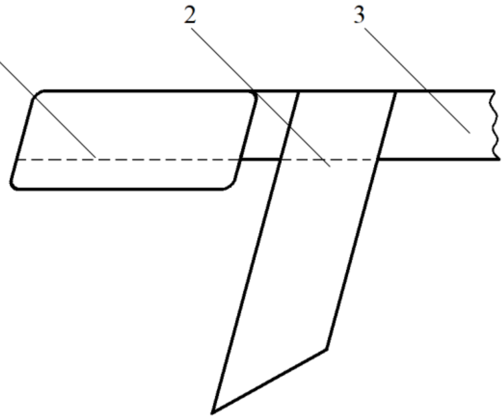
In the technological process, the soil-sweeping and soil-clinging blades must be structurally balanced, i.e., along the working surface acting on the soil. X. Bernatski and others conducted research on the mutual balancing of the working surfaces of rotary working body blades. According to the conducted scientific research, the following expression was used to determine the mutual equilibrium of the working surfaces of the rotary-type working body blades [8].

$$A_{sl} = A_s(1+\delta), \qquad (4)$$

where A_{sl} is the working surface of the soil-clinging blade, cm^2

A_s- working surface of the soil-sliding blade, cm^2

δ-relatively increased coefficient (10% - 30%).



1-soil sliding blade; 2-soil-clinging blade; 3 - handle for installing blades

Figure 1. Design of the soil-sliding and soil-clinging blades of the applied rotary working body

Based on the above data and the technological and design parameters of the applied rotary working body, as well as the parameters of the buried grain pile, it was established that the width of the soil-sliding blades of the rotary working body is b_s=8-12 cm and the height is h_s=6-10 cm, the width of the soil-clinging blades is b_{sl}=3-6 cm and the height is h_{sl}=18-22 cm.

Conclusion

It is possible to perform the technological process of uncovering buried grapevines with high quality using rotary-type working elements. In this case, the height and width of the soil-moving and soil-engaging blades of the rotary working element used to remove the required layer of soil from the buried grapevine mound should be h_s = 6-10 cm, b_s = 8-12 cm and b_{sl}= 3-6 cm, h_{sl} = 18-22 cm, respectively.

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