COMBINED MACHINE FOR PREPARING SOIL FOR SOWING POTATOES ON THE RIDGE

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Abstract. The aim of the research is to substantiate the main parameters of the machine working elements for preparing the soil for sowing on the ridges and their mutual location. The authors have developed a machine that performs all technological operations to prepare the soil for sowing potatoes on the ridges in one pass in the field. The machine performs surface loosening of the soil, strip deep loosening of the soil, formation of ridges, loosening of the surface layer of the ridge top, compaction and giving them a trapezoidal shape in one pass. The design of the developed machine for realization of technology of preparation of soil for potatoes sowing is resulted. The basic principles and methods of classical mechanics, mathematical analysis and statistics were used in this study.

Key words: potato, machine, comb, body, soil loosening, deep loosening.

Introduction

In the agricultural production of the Republic of Uzbekistan large-scale measures are being taken to reduce labor and energy costs, save resources, cultivate crops on the basis of advanced technologies and develop high-performance agricultural machinery. Currently, agronomical measures to prepare the soil for potatoes sowing on ridges, consisting of ploughing, cheeseling, mallowing are carried out by separate units, which in turn leads to moisture loss, delaying sowing time and increasing operating costs. The analysis of studies has shown that to reduce fuel consumption and other costs, as well as the harmful impact of agricultural machinery on the soil in the preparation of fields for potatoes sowing can be achieved by applying a machine that performs all technological operations to prepare the soil

for potatoes sowing on ridges in one pass on the field.

Problems of cultivation and preparation of soils for potatoes sowing are considered in many published scientific works [1, 2, 6, 7]. Studies on the creation and application of machines for tillage and preparation of soil for sowing on ridges, the study of their performance and justification of parameters, as well as the study of processes of interaction of working bodies with soil were engaged F.Mamatov, B.Mirzaev [3], I.Ergashev [4], D.Chuyanov [5], V.Kurdyumov and E.S.Zykin [6], B.C.Lakhmakov [7] and others. Machines and implements created as a result of these studies are used in agricultural production with certain positive results. However, in these studies the issues of soil cultivation for potatoes sowing with simultaneous formation of ridges ensuring high quality of work at minimum energy consumption are insufficiently studied.

The aim of the study is to justify the main parameters of the machine's working elements for preparing the soil for sowing on the ridges and their mutual location. The developed machine to implement the proposed technology consists of frame 1, lancet tines 5, deep looseners 4, left and right winging bodies 6 and 7, rollers 9 (Fig.1). Lance paws, deep leavers, left and right-tripping bodies of the developed machine are rigidly mounted on the frame, and the rollers - hinged.

The machine works like this. During the technological process the deep loosening machine 4 performs deep loosening of the soil along the line of the formed ridge. Lancet tines 6 and 7 located at the front of the hulls 5 loosen the top layer of soil to a depth of 8-10 cm, then plough hulls 6 and 7 with guide knives 8 perform undercutting, lifting and laying of soil layers with loosened top parts in the middle of the formed ridge and form ridges. Profile rollers 9 loosen the surface layer of the top of the ridge, compacting and giving it a trapezoidal shape.

A machine based on the potato ridge soil preparation technology should cultivate and prepare a field with a width of 2,8 m in one pass.

Basic parameters of the body (Fig. 2) are determined on the basis of the crest formation of the required shape and height. On the basis of previously conducted studies, the form of the cross-section of the pre-formed ridge is taken by a sinusoid. To form a crest of such shape it is necessary to cut, lift and turn towards

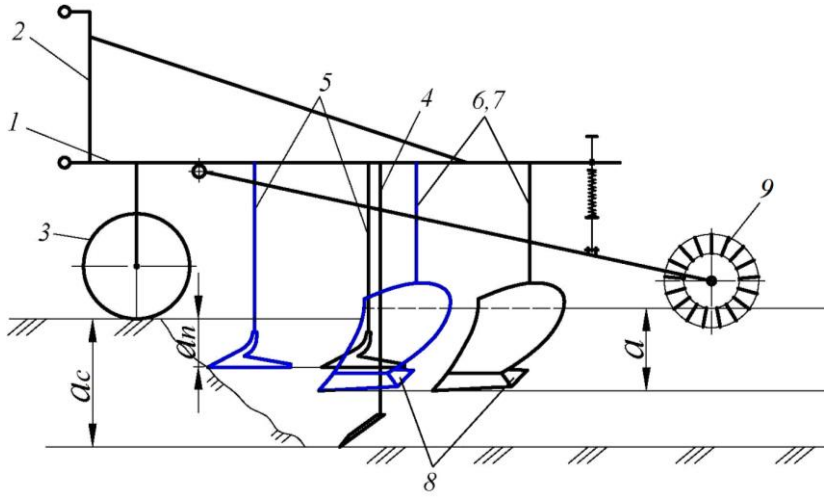


Fig.1. Structural diagram of the machine for preparing the soil for sowing potatoes: 1 – frame; 2 – mounting device; 3 – support wheel; 4 – deep loosener; 5 – lancet paw; 6 and 7 – right and left turning bodies; 8 – guide knife; 9 – profile roller

each other soil layers of the right and left outermost part of the formed ridge with a width of Bm. We determine the working width of the body.

$$b_k = \frac{B_M}{4} + \Delta, \tag{1}$$

where Δ – is the value of the teachable relief roughness, Δ=2,5 cm.

In expression (1) b_k=20 cm.

Maximum depth of soil cultivation by the body is determined based on the condition of stability of the laid layer

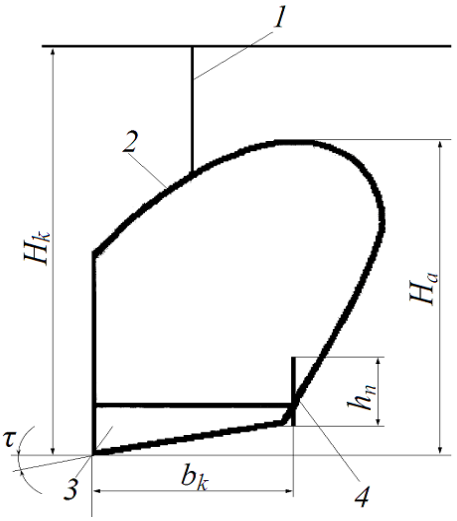
$$a = a_{\max} - \frac{1}{2} b_k tg\tau. \tag{2}$$

By expression (2) at a_{max}=15,75 cm, $b_к$=20 cm and τ=6° the hull processing depth is a=14,7 cm. We accept a=15 cm.

Hull height was determined on the basis of conditions of free turn of formation under the frame and exclusion of clogging by vegetative remains of the machine by the following dependence

$$H_k = 2{,}25a + 1{,}25\sqrt{a^2 + (b_n - \Delta_n^2)}. \tag{3}$$

Calculations made by expression (3) at a=15 cm and $b_к$=20 cm showed that the minimum height of the body should be H_k=56,25 cm.



1 - rack; 2 - blade; 3 - ploughshare; 4 - guide knife

Fig.2. Basic parameters of the housing with a guide knife

The guide knife 4 is fixed to the heel of the ploughshare (Fig.3). Its main parameters are the following: distance from the blade to the blade, length and height of the guide knife h_n, angle of setting the guide knife blade to the horizon.

The height of the guide knife is determined from the condition of minimizing the collection of the layer and the furrow wall from the side of the formed ridge by the following formula

$$h_n \geq a - b_k tg\tau - \Delta_n. \qquad (4)$$

At values b_k=0,2 m, $\Delta_п$=0,05 m and τ=6° in expression (4) the minimum height of the guide knife should be at least 79 mm. We accept 80 mm.

The analysis of design features of existing machines, implements and working bodies, used for preparing the soil for potatoes sowing, made it possible to develop the design of the tool, which allows to prepare the soil for potatoes sowing on the ridges.

CONCLUSIONS

1. The analysis of the design features of existing machines, implements and working bodies used to prepare the soil for sowing potatoes, provided the opportunity to develop the design

of the tool, allowing to prepare the soil for sowing potatoes on ridges.

2. According to the results of theoretical and experimental studies it was established that with the width of the left and right turning semiscrew bodies with guide knives 200 mm, length of the blade wing 515-545 mm and the angle of slope of the blade left to its base 6^0, the formation of ridges of the required degree with minimal energy costs is achieved.

3. The use of a guide knife with a length of 150 mm and a height of 80 mm as an additional element on the left and right-hull housings ensures the formation of ridges of the required degree with minimal energy consumption.

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