ISSN NO: 2770-4491
Date of Publication:21-10-2022

Basing the longitudinal distance between the bodies of the combined machine

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Abstract. The article presents the results of experimental studies of the influence of the longitudinal distance between the bodies of machines for preparing the soil for planting potatoes on its agrotechnical and energy indicators. Justified the longitudinal distance between the buildings.

Key words: machine, potato, soil, housing, agrotechnical indicator, energetic indicator, technology.

Introduction. In the world, the production of energy-resource-efficient and high-performance soil tillage and planting machines occupies a leading position [1-13]. In this direction, the development of the structural scheme of the device that prepares the fields for planting potatoes and the justification of the technological work process, the implementation of targeted scientific research on ensuring resource efficiency in the processes of interaction of the working parts with the soil are considered urgent issues. It is known that potato is a plant designed for soft soils. Compared to other crops, it needs deep softened soil, water, air and heat more. Therefore, it is necessary to ensure that the spatial composition and density of the soil is in an optimal state. In this, favorable conditions are created for the planting of nodules, their growth and the operation of machines with low energy consumption [1-5].

Soil preparation for planting potatoes in our republic consists of basic and pre-planting processing based on traditional technology. The main processing includes two agrotechnical methods - fertilizing and plowing, and pre-sowing processing includes four agrotechnical methods - leveling, chipping, grinding and threshing [2]. These operations are carried out as a result of several passes of individual machines through the field. As a result, along with the increase in energy and resource consumption, the structure of the soil is destroyed, and ultimately, productivity decreases.

Taking into account the above, a machine was developed that prepares the soil for planting potatoes in one pass of the aggregate through the field [14, 15]. Studies have been conducted on the justification of the mutual arrangement of the bodies, which are considered the main working body of the machine, in the frame in an optimal scheme.

The problems of tillage and preparation of soils for sowing potatoes are considered in many published scientific papers [1-13]. F. Mamatov, B. Mirzaev were engaged in research on the creation and use of machines for processing and preparing soil for sowing on ridges, studying their performance indicators and substantiating parameters, as well as studying the processes of interaction of working bodies with soil [2-7, 10-12] , N. Aldoshin [8, 9], D. Chuyanov [7], I. Ergashev [5, 12], H. Ravshanov [7], and others. The machines and tools created as a result of these studies are used in agricultural production with certain positive results. However, in these studies, the issues of tillage for sowing potatoes with the simultaneous formation of ridges, providing high quality work with minimal energy consumption, have not been sufficiently studied. The purpose of the study is to substantiate the longitudinal distance between the bodies of the machine for preparing the soil for sowing potatoes on the ridges.

Material and methods. Theoretical mechanics, agricultural mechanics, laws and rules of mathematical statistics, mathematical planning of experiments and tensometric methods were used in the research process. A laboratory-field device was prepared for conducting experimental studies. As the basis of the laboratory-field device, a special frame prepared at the Scientific-Research Institute of Agricultural Mechanization was used. Also, during experiments, special left and right cases were prepared in order to study the effect of the longitudinal distance between the device cases on the overturning process of the blade.

During the experiments, the laboratory-field device was aggregated with the MTZ-80 tractor and used at speeds of 6 and 9 km/h. The soil of the experimental fields is gray soil with medium-heavy mechanical

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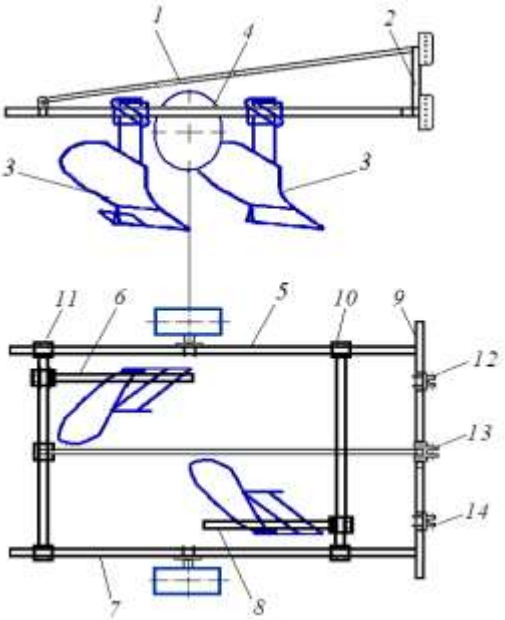
composition. Before conducting the experiments, soil moisture, density and hardness in 0-5, 5-10, 10-15, 15-20 and 20-25 cm layers were determined according to existing methods. The average moisture content of the soil in the 0-25 cm layer is 11.26%, the hardness is 3.27 MPa, and the density is 1.56 g/cm3. The soil compaction quality of the treated layer was determined by taking samples from the area of 0.25 m2 at the treatment depth in six repetitions.

Results. In the experiments, the influence of the longitudinal distance between the cases on the performance of the device was studied. Experimental studies were carried out by changing the longitudinal distance between the bodies of the device from 0 to 600 mm with an interval of 200 mm. In this case, the movement speed of the unit was 6 and 9 km/h, the coverage width of the casings was 200 mm, and the processing depth was 15 cm. During the experiments, the bending distance between the hulls was changed by moving them 10 and 11 transverse beams along 5 and 7 longitudinal beams (Fig. 1).

The results of the experiment are presented in Figures 2-4.



1 - picture. Construction scheme of the laboratory-field device:
1 – frame; 2 – suspension device; 3 – left and right bodies; 4 – support wheel; 5, 6, 7 and 8 – longitudinal brushes; 9, 10, 11 – transverse brushes; 12, 13 and 14 – brackets of the suspension device

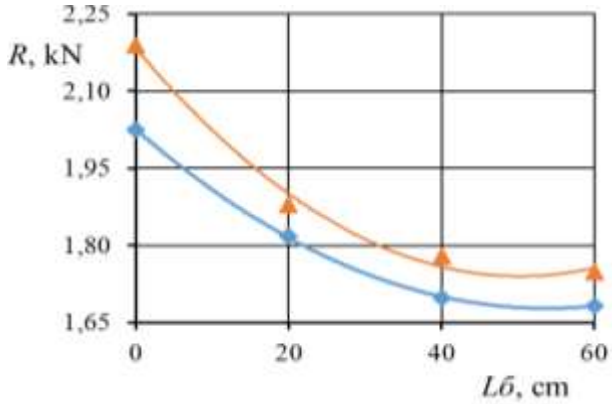


Figure 2. Tensile strength of casings Variation of (*R*) depending on the longitudinal distance (L_b) between them graph
1 and 2 operating speed is 6 and 9 km/h respectively

The given data show that at both speed of movement of the device, when the longitudinal distance between the bodies increases from 0 to 40 cm, the drag resistance decreases according to the law of concave parabola, and when it increases from 40 to 60 cm, this indicator almost does not change.

This is mainly due to the jamming of the processed pieces between the casings.

Increasing the longitudinal distance between the working bodies of the device from 0 to 60 cm at both speeds of the device's working bodies caused the height (H) of the formed brush profile to decrease according to the law of a concave parabola. This can be explained by the fact that with the increase of the longitudinal distance, the free overturning of soil slabs under the influence of the casings increases the distance of their pieces being thrown to the side.

At both speeds, it was observed that the height of the shaped profile of the pusher is less than 24 cm, that is, below the required level, at values of the longitudinal distance between the bodies of 35-60 cm.

In this case, the speed of the device (at values of 6 and 9 km/h) did not have a significant effect on the height of the brush profile.

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Increasing the longitudinal distance between the bodies from 0 to 60 cm at both movement speeds of the device led to a decrease in the level of soil compaction, that is, the amount of fractions smaller than 50 mm, according to the law of a concave parabola. Increasing the longitudinal distance from 40 to 60 cm had little effect on this indicator.

At values of this distance less than 40 cm, it was observed that the blades touch each other during the process of overturning with the hulls to the right and left. This improved soil compaction at small values of the longitudinal distance.

At all values of the longitudinal distance at both speeds, the degree of absorption was higher than 80 percent.

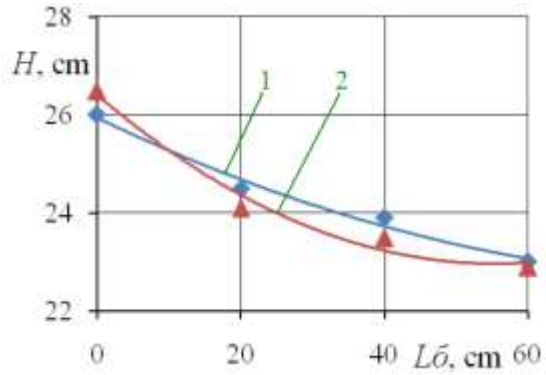

Figure 3. The graph of the change of the height of the pusher profile (*H*) depending on the longitudinal distance between the bodies (L_b)
1 and 2 operating speed is 6 and 9 km/h respectively

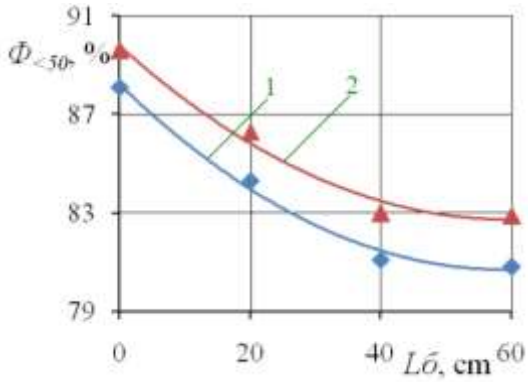

Figure 4. The graph of the variation of the degree of soil compaction ($F_{<50}$) depending on the longitudinal distance between the bodies (L_b)
1 and 2 operating speed is 6 and 9 km/h respectively

As it can be seen from the given data, as a result of ensuring the free passage of the soil slab between the housings when the longitudinal distance between the housings is greater than 350 mm at both movement speeds of the device, the height of the pusher profile and the level of soil compaction are at the required level, and there was no violation of the technological process of the machine. When this distance is greater than 400 mm, the above indicators have not changed much. When the housings are in one line, and the working surfaces are opposite, due to the jamming of the overturning soil plate, the level of soil compaction and the height of the pile profile were sharply reduced.

Conclusions

The agrotechnical and energetic performance of the combined machine that prepares the soil for planting potatoes depends on the longitudinal distance between the bodies, and in order to ensure the high quality of the technological process of potato production with low energy consumption, this distance should be in the range of 35-40 cm.

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