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Study of the Effect of Changing the Speeds of the Potato Digging Machine on Work Quality

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Abstract: The study demonstrated a decrease in sieving efficiency due to uneven distribution of soil-tuber mass on the elevator surface in potato harvesting machines. To address this issue, a working element consisting of an elastic-fingered disk, installed perpendicular to the elevator plane, was employed. Field trial results showed that the proposed design increased soil screening efficiency by 12-17% compared to existing machines, maintained screening stability even at high speeds, and reduced tuber damage.

Keywords: elevator; elastic finger disc; screening efficiency; soil-tubers; traction resistance.

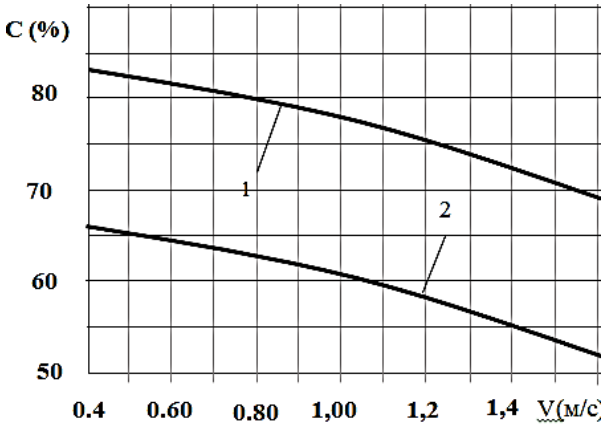
Introduction

To facilitate the loading of the potato harvesting machine with soil mass, improve working conditions and sieving, enhance work quality, and ensure uniform distribution of the mass along the width of the elevator surface, disk-shaped working components with elastic fingers have been installed perpendicular to the elevator.

Studies have shown that the quality performance of a potato harvesting machine depends on the amount of mass entering the sieving mechanism and its uniform distribution on the surface of the sieving working part. This is because the non-uniformity of the soil-tuber mass leads to uneven loading of the elevator and other working parts. When the load is insufficient, damage to the tubers increases due to the impact of the tuber-soil layer on the working components. Conversely, when the load is excessive, the working parts do not have sufficient time to separate potato tubers from the soil. Consequently, in these two extreme conditions, both the machine's

productivity and the quality of work decrease [1,2,3].

Figure 1 illustrates the relationship between soil sifting and the speed of the potato digger. As evident from the graph, as the speed of movement increases, the degree of soil sifting gradually decreases. Analysis of the graphs showed that the soil sifting capability of the experimental excavator is 12-17% greater than that of the existing excavator.



1-experimental digger, 2-existing digger.

Figure 1. Graph showing the relationship between soil sieving and the speed of the potato digger at soil moisture content w=10...12%.

In order to obtain high-quality results, comparative field tests were conducted with the proposed KTN-2V potato digger and the existing KTN-2V potato digger. Field tests of potato diggers are carried out at three different tractor speeds.

The test results showed that at three tractor speeds, the forward motion speed of the experimental potato digger was 0.5, 0.85, and 1.42 m/s, while the serial potato digger's speed was 0.5, 0.72, and 1.26 m/s. The difference in the speeds of the potato diggers can be explained by the fact that the traction resistance forces acting on the digging working parts varied, and consequently, the slippage of the tractor's drive wheels also differed. The reason for the increase in traction resistance forces on the working parts of both existing and experimental machines was observed to be the accumulation of soil clumps under operating conditions. The difference in the speed of the potato diggers can be explained by the fact that the forces of traction resistance acting on the digging working bodies are different, and therefore the rotation of the tractor's drive wheels in place is also not the same.

In the specified speed ranges, soil sifting in the experimental potato digger was 85.41-81% when soil moisture W_0=10...12%, while in the existing potato digger it was 70-66.9%. As shown in Figure 1, when the travel speed increased up to 1.42 m/s, the degree of soil sifting in the experimental potato digger decreased only marginally. However, in the existing potato digger, at a lower speed of 1.26 m/s, this indicator decreased more significantly to 56.9%.

From this, it can be concluded that installing the working component equipped with active discs with elastic fingers in the main soil mass zone creates the necessary conditions for separating the tuber layer, crushing large clods, and evenly distributing the mass along the width of the sifting mechanism. This setup provides the required conditions for sifting soils in the working component.

Conclusion

The research results indicate that elastic-fingered discs installed perpendicular to the elevator evenly distribute the soil-tuber mass across the elevator width, creating optimal conditions for the sieving process. The experimental potato digger, ensuring a sieving efficiency of 81-85% under soil moisture conditions of 10-12%, demonstrated a significant advantage over existing

machines. Furthermore, the reduction in tractive resistance forces on the working components and the decrease in tuber damage prove the practical effectiveness of the proposed design.

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