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PHYSICAL AND MECHANICAL PROPERTIES OF POTATO CULTURE

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Annotation

The article presents the results of the conducted experimental research on the study of the physical and mechanical properties of the potato culture, which is of great importance for the correct and reasonable design and calculation of working bodies and machines for the mechanization of their cultivation and harvesting, including potatoes.

The study of the physical and mechanical properties of agricultural crops is of great importance for the correct and reasonable design and calculation of working bodies and machines for the mechanization of their cultivation and harvesting, including potatoes.

Since this article discusses the issue of separating the tops from the tubers in potato harvesters, the given basic physical and mechanical properties apply only to the stems of the tops and potato tubers, such as the coefficient of friction, strength of stems and stolons, dimensional characteristics and others. All of these properties of the potato plant are not permanent. They can vary depending on the variety of potatoes and the soil and climatic conditions of its growth.

When pulling a potato bush, especially from a previously dug garden bed and when the tops are green, a significant number of tubers are extracted along with the stems, firmly held on the stolons. In the works of many researchers, the number of extracted tubers is about 50% or more [1].

The studies carried out by them show that the number of tubers harvested with tops depends on the degree of ripeness of the potatoes. When picking bushes with dried tops, a small amount of tubers is extracted, only about 6% by weight of the crop of the bush. With green bushes, 50 percent or more of tubers are extracted.

Our experiments show (Table 1) that when picking bushes with green and somewhat wilted tops, 60-70% of tubers are extracted from the dug-up beds along with the stems. Such a state of tops during the period of harvesting potatoes in the conditions of the Republic of Uzbekistan, the non-chernozem zone of the Russian Federation and other CIS countries is typical.

Potato tubers, as shown by the practice of mechanized harvesting of potatoes, as well as a number of studies carried out when passing through the separating body, do not completely break off from the tops; after the passage, up to 20-30% of tubers remain, for the separation of which additional devices are needed in the topping working bodies [1].

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Table 1 Results of pulling potato bushes before and after digging a layer

Variety	Humidity, %		Mass of tubers (kg) extracted from soil	Mass of tubers (kg) not removed from the soil	Percentage of tubers extracted from soil
	tops	soil			
Before the seam was undermined					
Lorch	88,5	18,5	0,737	0,660	52,7
Santa	70,3	16,1	0,480	1,073	30,9
After undermining the seam					
Lorch	83,7	15,4	0,687	0,270	71,2
Santa	52,4	17,2	0,580	0,340	63,0

Therefore, the study of the strength of the stolons, as well as the stems of the tops, is of great interest in substantiating the parameters of the haulm-removing working body. As can be seen from Table 2, the breaking forces of the stolon itself, as well as the force of separation of the stolon from the roots, is greater than the force for separation of the tuber from the stolon.

Since when removing the tops from the combine it is necessary to detach the tubers from the stolons, we are more interested in these data. The minimum value of the force of separation of tubers from the stolon was 0.8-1.0 N, and the maximum value was 18.0-23.2 N.

Table 2 The strength of stolons in relation to various parts of the plant

Variety	the date	Effort, N								
		separation of the tuber from the stolon			detachment of the stolon from the roots			stolon rupture		
		Wednesday	poppy	min.	Wednesday	poppy	min.	Wednesday	poppy	min.
Lorch	22.10.93	10,3	18,0	0,8	11,7	23,0	2,0	14,6	33,5	6,0
Santa	22.10.93	11,1	23,2	1,0	12,2	30,0	4,0	20,8	34,0	6,0

Table 3 shows the breaking forces of the leaf stem at the average diameter. However, this is not enough to substantiate the parameters of the haulm-removing working body. More complete data are needed, where it would be clarified the change in the breaking resistance of the stem stem depending on the height of the stem section, and, consequently, on the diameter.

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Table 3 Breaking forces of potato tops on average diameter

Variety	Average diameter, mm	Breaking forces, N		
		average	the maximum	minimal
Acrob	9,8	427	493	349
Lorch	8,4	417	433	349
Victoria	8,1	343	416	271
Cardinal	6,3	235	311	189
Santa	6,9	219	291	170

Work in this direction has been carried out by a number of researchers. We have repeated these works in order to supplement and clarify these indicators. In fig. 1 shows the curves of the change in the ultimate tensile strength of the leaf foliage depending on the change in the section height. From these data it can be seen that with an increase in the height of the section of the stem, the ultimate resistance decreases rapidly, especially within the range of 0-180 mm.

In fig. 2 shows the change in the amount of haulm entering the harvester at two meters of the path of the machine. It is highly variable and averages 2.43 kg / m.

Change in the ultimate tensile strength of the potato tops stem depending on the height of its section

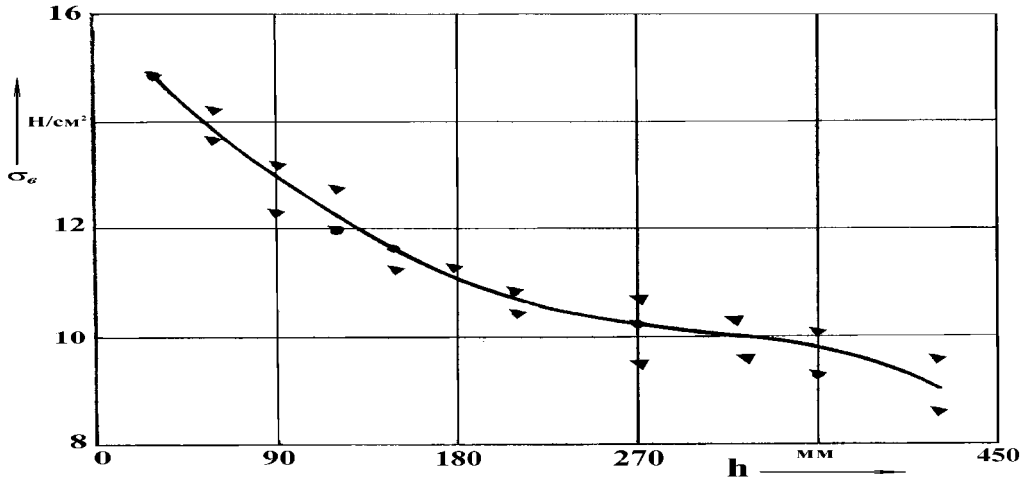

Fig. 1 Variation curve of distribution of haulm entering the harvester (m) on two meters of the path of the machine

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Fig. 2

Thus, when designing haulm-removing working bodies, working on the principle of pulling or on the principle of separation from the stems, it is necessary to strive to ensure that the capture of the stems occurs as close as possible to the base and root. In this case, there is a complete guarantee that the stems will not be torn off.

The density and coefficient of friction of tubers and tops are also necessary for the analysis and calculation of the parameters of the topping tool.

On the basis of numerous works [2], the density of tubers can be taken equal to 648 kg / m3, and tops - 133 kg / m3.

The results of experiments to determine the coefficients of friction of stems of tops and tubers of potatoes on various surfaces, carried out according to the existing methodology [2], are shown in table4.

Table 4 Coefficients of friction of tubers and tops on different surfaces (pressure - dead weight.)

The elements	Definition condition	Friction surface	Travel speed m / s	Coefficients of friction		
				minimum	maximum	Average
Tuber	Rest	Steel	-	0,71	0,80	0,76
		the soil		0,98	1,03	1,00
	Movement	Steel	1,6	0,53	0,59	0,54
			2,4	0,51	0,58	0,55
			3,2	0,45	0,57	0,54
		Rubber layer	3,2	0,42	0,51	0,46
		The soil	3,2	0,43	0,91	0,62
Tops	Rest	Steel	-	0,47	0,74	0,57
		Rubber layer	-	0,71	0,93	0,80
		The soil	-	0,67	0,96	0,80
	Movement	Steel	1,2	0,60	0,84	0,73
			2,4	0,63	0,76	0,71
			3,2	0,55	0,68	0,63
		Rubber layer	3,2	0,42	0,49	0,45

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From the data given in table. 4 it follows that the coefficient of friction of both tubers and tops over all studied friction surfaces at rest is 1.5 times higher than in motion. With an increase in the sliding speed, there was a noticeable decrease in the friction coefficients.

The largest coefficient of friction was obtained between the tuber and the soil, and the smallest - between the tuber and the rubber layer of the conveyor belt, as well as the tops and the rubber layer of the conveyor. To calculate the coefficient of friction of the tuber against steel, it can be taken in the range of 0.5-0.6, about the rubber layer of the conveyor - 0.4-0.5, and for tops - 0.6-0.7 and 0.4, respectively. 0.5.

The studies carried out to study the physical and mechanical properties of the tops and tubers of potatoes, such as the lodging and orientation of the stems of the tops on the field, the weight, the breaking forces of the tops and stolons, the coefficient of friction allows you to correctly select and justify the installation site, the shape and parameters of the topping working body in a potato harvester.

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