METHOD AND ANALYTICAL RESULTS OF EXPERIMENTAL STUDIES IN LABORATORY CONDITIONS

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Annotation. *This article presents the methodology and results of laboratory experiments on a mechanical seeder that sows onion seeds in rows. As a result of experimental studies, the distribution of onion seeds in the sowing zone, the number of revolutions of the seeding disc and the roller of the seeder, the number of cells in the cell disc and the graph of the optimal values of the parameters of the seeding apparatus are shown.*

Keywords. *Sowing unit, conveyor, variator, cell, disc, roller, seed, parameter, leveling, distribution, sprocket, ratio, chain lengthening.*

In the world, scientific-research works are being carried out aimed at developing new scientific and technical solutions of resource-saving technologies and technical tools for sorting onion seeds and planting them without damaging them. In this regard, based on the technological characteristics of onion seeds, special attention is paid to the optimization of planting processes, the improvement of constructions of mechanical planting devices, the development of an energy-resource-saving machine that reduces labor costs in agrotechnical activities, and the justification of its technological process, parameters, and work modes [1].

Taking into account the above, a one-row experimental copy of the mechanical seeding device with a cellular disc, which sows onion seeds individually in rows, was developed and experimental studies were conducted in laboratory conditions.

In order to evaluate the quality of planting in the experimental studies, the equal distribution of onion seeds in the planting zone and the falling of seeds were determined.

GOST 31345-2017 "Technical agriculture. Seyalki tractor. Methody ispytaniy» according to the international standard [2], the distribution of seeds by rows (sowing step) is studied on precision and point sowing machines. It is emphasized that equal distribution of seeds will be carried out according to special standards. In this case, the distances between the planted seeds are determined by recording (measuring).

According to agrotechnical requirements, it is recommended that the longitudinal distance between the planted seeds is 8-10 cm, the number of seeds planted in one nest is up to 3 pieces, and the uneven distribution of seeds should not exceed 10 percent. In this case, the error of the measuring range should not exceed ±0.5 cm. The longitudinal distance between the seeds planted in a row, the mean square deviation, the coefficient of variation and the number of seeds in a cell should not exceed or decrease the values specified in the initial requirements developed [3].

When determining the even distribution of seeds, the longitudinal distance between the centers of two adjacent seeds is measured. Seeding is also carried out simultaneously with the help of counting. The accuracy level of the planting device is determined by the following expression

$$T_a = \frac{Ч_{ур}}{Ч_{ум}} \cdot 100, \quad (1)$$

in this $Ч_{ур}$– the number of cells in which the seed fell according to the specified planting rate; $Ч_{ум}$- total number of cells.

In conducting these experiments, the number of revolutions of the cellular disk was varied from 80 rpm to 140 rpm in 20 rpm intervals. In this case, the number of slots is from 6 to 12 with 2

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intervals, the ratio of the number of rotations of the disc with slots and the rollers holding back the excess seeds is 1, and the speed of the conveyor is in the range of 1-1.6 m/s.

In the experiments, the number of seeds planted and the longitudinal distance between them were studied as the main indicators. In this case, changing the number of revolutions of the slotted disk was done by changing the stars (Fig. 1).

1. Frame, 2. Seed box, 3. Planter, 4. Set of sprockets for driving the slotted disc, 5. Set of sprockets on the cylindrical return roller shaft, 6. Chain drive for driving the cylindrical return roller, 7. Slotted disc and drive the return roller drive chain drive

Figure 1. A view of the recommended planting apparatus on the stand

The graphs obtained from the experiments are presented in Figures 2-3. From the graphs presented in Figure 2, it can be seen that when the number of revolutions of the slotted disc is increased from 80 rpm to 140 rpm, the distance between the onion seeds falls from 12.7 cm to 6.5 cm, and its mean square deviation is from 0.57 cm to 2 increased to .49 cm. This can be explained by the fact that as the number of revolutions of the honeycomb disk increases, the honeycombs drop seeds into the seed transfer slot faster.

From the graph presented in Figure 3, it can be seen that with the increase in the number of rotations, the number of onion seed drops first decreased and then increased. For example, when the number of revolutions increased from 80 rpm to 120 rpm, the fall of onion seeds decreased from 1.45 to 1.22 grains, and when it increased from 120 rpm to 140 rpm, it was observed that it increased by 1.36 grains.

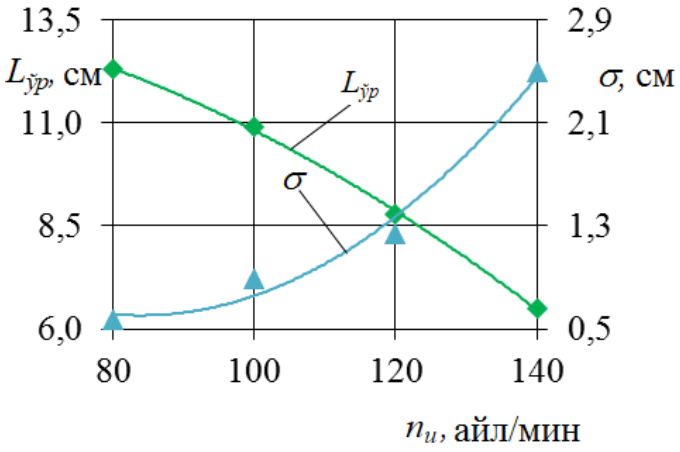

Figure 2. Longitudinal distance between seeds ($L_{ўр}$) and its mean squared deviations (σ) is the number of revolutions of the cellular disk (n_u) graph of change depending on

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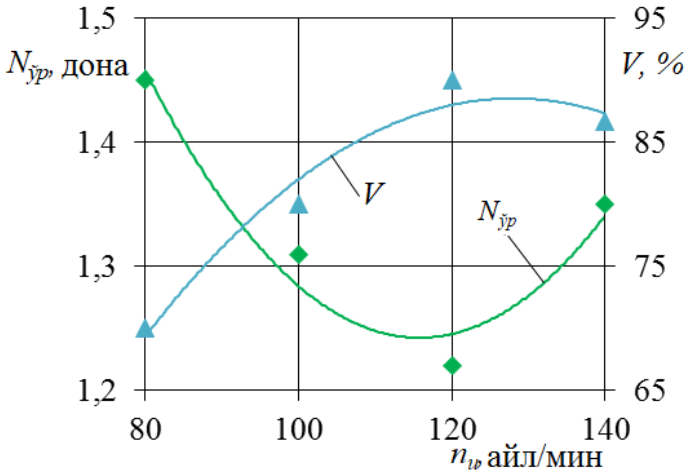
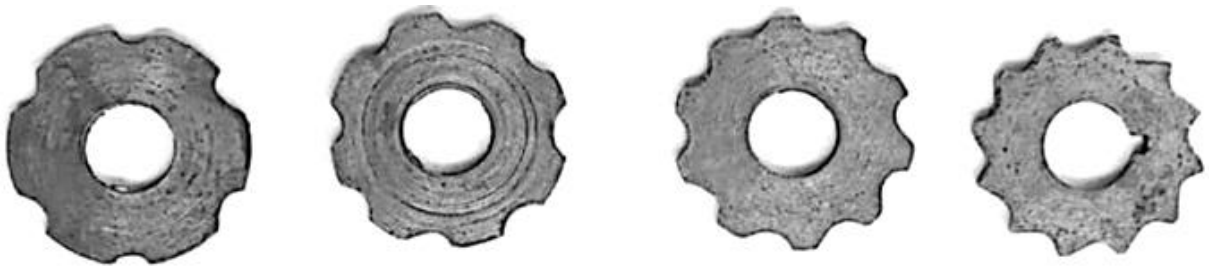


Figure 3. Number of seeds planted ($N_{ўр}$) and their variation (±V) is the number of revolutions of the cellular disk (n_u) graph of dependence on

According to the above analysis, in order for the onion sowing machine to meet the specified agrotechnical requirements, the number of revolutions of its slotted disc should be 140 rev/min.

In the study of the effect of the number of cells in the cell disk on the number of planted seeds and the longitudinal distance between them. The number of slots on the seed drill disc has been changed from 6 to 12 slots at 2 intervals. In this case, the number of revolutions of the cellular discs is 140 rev/min, the ratio of the number of revolutions of the cellular disc and rollers holding back excess seeds is 1, and the speed of the conveyor is in the range of 1-1.6 m/s. In the experiments, the cellular discs of the seeding apparatus (Fig. 4) were replaced and experiments were carried out.



а *б* *в* *г*

а – 6 slots; *б* – 8 slots, *в* – 10 slots, *г* – 12 slots

4- fig. Display of cellular disks

The graphs obtained from the experiments are presented in Figures 5-6. From the curves presented in Figure 5, it can be seen that with the increase in the number of cells in the **($L_{ўр}$)** cell disk, the distance between the sown seeds decreased, and its mean square deviation increased. For example, when the number of cells in the disc with cells increased from 6 to 10 cells, the distance between onion seeds fell from 11 cm to 8.5 cm, and when it increased from 10 cells to 12 cells, it decreased to 4.8 cm, and its average square deviation was from 0.9 cm to 1, increased to 6 cm. This can be explained by the fact that the time of seeding decreases with the increase in the number of nests.

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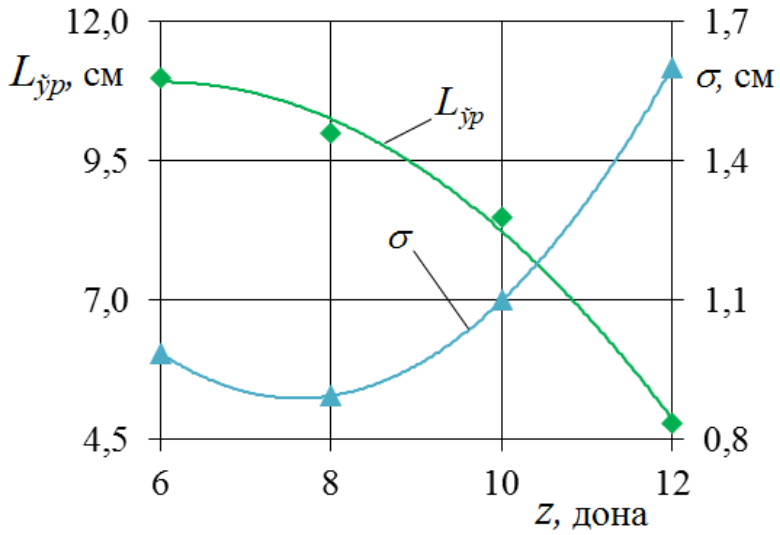

Figure 5. Longitudinal distance between seeds ($L_{ўp}$) and its mean squared deviations ($\pm\sigma$) is the number of cells in a cell disk (z) graph of dependence on

From the graph presented in Figure 6, it can be seen that with the increase in the number of cells in the disc disc from 6 to 12 cells, the drop of onion seeds decreased from 1.72 cells to 1.12 cells. This can be explained by the increase in the even distribution of seeds with the increase in the number of cells.

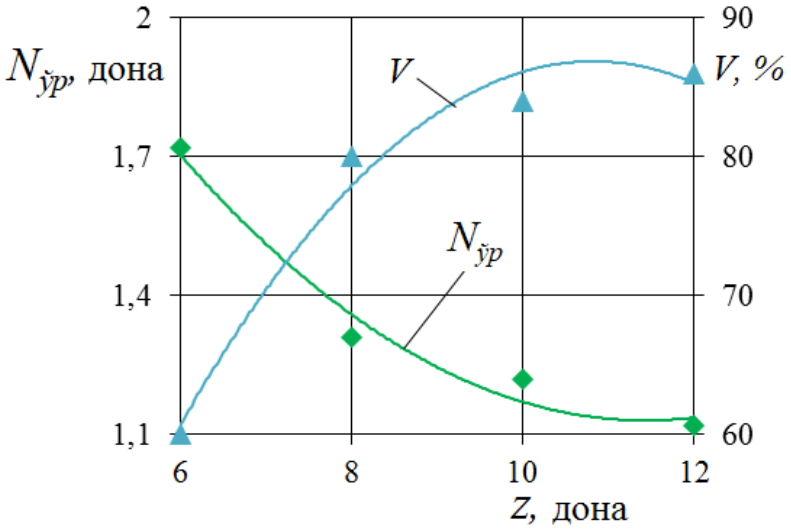

Figure 6. Dropping of seeds ($N_{ўp}$) and variation (±V) is the number of disk slots with slots (z) graph of dependence on

Therefore, it can be concluded from the results of the conducted research that the number of cells of the cell disk of the planting device should be 8 in order for the onion planter to fully meet the agrotechnical requirements and for the seeds to be evenly distributed.

And in determining the influence of the ratio of the number of rotations of the cellular disc and the cylindrical seed return roller on the number of fallen seeds. the ratio of the number of revolutions of the hollow disc and the cylindrical seed return roller was taken in the range of 1-1.6.

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From the graph presented in Figure 7, it can be seen that when the ratio of the number of rotations is 1, the number of seeds dropped is 1.72, when the ratio of the number of rotations is 1.2, and when the ratio of the number of rotations is changed to the ratio of 1.4-1.6, it is 1.22-1. A decrease to 12 units was observed.

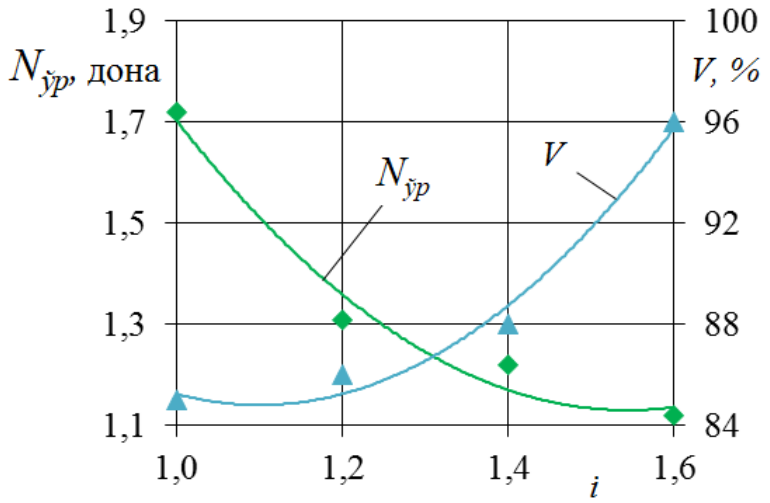

Figure 7. Onion seeds fall into pieces ($N_{ўp}$) and variation (±V) is a graph of dependence on the ratio of the number of revolutions of the slotted disc and the return roller

From the results of the research, it can be concluded that the ratio of the number of revolutions of the slotted disk of the planting device and the cylindrical seed return roller should be in the ratio of 1.2 in order to prevent excess seeds from falling into the planting area and to distribute the seeds evenly.

In determining the impact of the speed of the unit (conveyor) on its performance, the speed of the conveyor V_a=1 м/с from V_a=1,6 м/ amended to s. From the graph presented in Figure 8, it can be seen that as the speed of the conveyor increased, the longitudinal distance between the seeds also increased. For example, conveyor speed V_a=1 м/с from V_a=1,6 м/с it was observed that the longitudinal distance between the fallen seeds increased to 7-15 cm. This is explained by the fact that after dropping one seed, the conveyor increases the speed of the conveyor and travels a longer distance during the next seed drop.

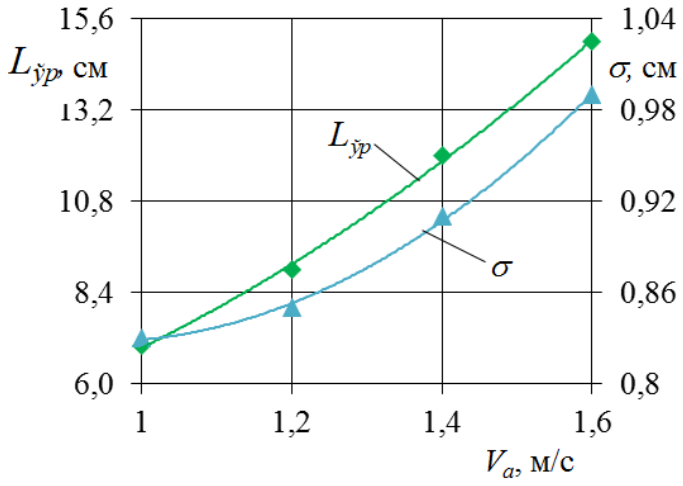

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Figure 8. Longitudinal distance between seeds ($L_{ўр}$) and its mean squared deviations ($\pm\sigma$) graph of dependence on conveyor speed

From the graph presented in Figure 9, it can be seen that with the increase in the speed of the conveyor, the number of falling onion seeds decreased. For example, conveyor speed V_a=1 м/с from V_a=1,6 It was observed that the number of fallen seeds decreased from 1.72 to 1.12 with an increase to m/s [5].

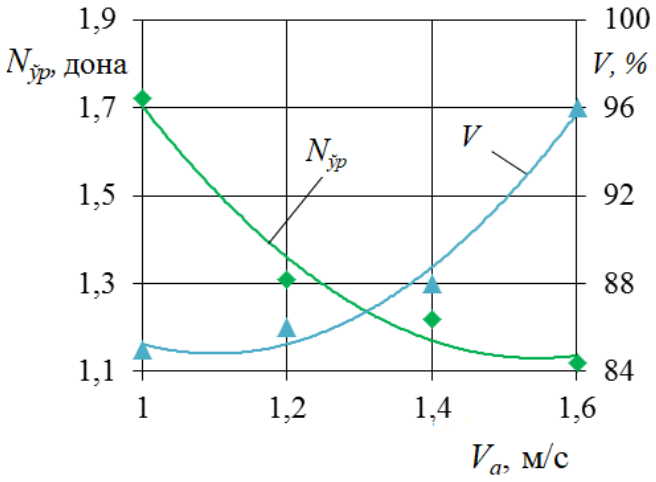

Figure 9. Dropping the seeds ($N_{ўр}$) and variation (±V) graph of dependence on conveyor speed

Summary. 1. The values obtained as a result of experimental studies were compared with the values determined in theoretical studies. According to the results of the comparison, in theoretical studies, it was determined that the distance between the planted seeds is in the range of 7.5-10.5 cm when the speed of the sowing machine is in the range of 1-1.4 m/s, the number of revolutions of the slotted disc is 140 rev/min, and the number of slots in the slotted disc is 8 pcs. in experimental studies, it was determined that this indicator is in the range of 8.0-10.0 cm.

2. Based on the research results, it can be noted that if onion seeds are sown in rows (40+10+10+10)×10/4 cm, it will be possible to save up to 40-45% of seeds compared to sowing in the open.

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