ISSN: 2350-0328

International Journal of Advanced Research in Science, Engineering and Technology

Vol. 6, Issue 7 , July 2019

Determination of the Number of Groups of Holes on the Seeding Disk at the Peripheral-Single District

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ABSTRACT: The results of experimental studies of the sowing of row crops by the nesting method with a pneumatic sowing unit are specified in the article.

KEYWORDS: SEEDING, PNEUMATIC SEEDER, SEEDING DISCS, NUMBER OF HOLE GROUPS, SEEDING ACCURACY, SEEDER VELOCITY, PERIPHERAL VELOCITY, DISK ROTATION FREQUENCY

I.INTRODUCTION

Soy (or soybean) is a high-quality feed for animals and birds, is used in the form of meal, cake, pellets, green mass, hay and straw. In addition, soybean crops have a beneficial effect on the condition of the soil: nodule bacteria are formed on soybean roots, which enrich the soil with nitrogen. Therefore, soy is a good precursor for subsequent crops [1,2].

Such a culture as soybean, which is one of the most valuable food, technical and fodder crops. It has no equal in versatility of use. More than 300 types of food and industrial goods are made from soybean grain. Soy is especially rich in protein and butter. Soybean contains up to 55% of high-quality protein and up to 20-27% of oil, which is one of the best vegetable oils. Soy is full of all kinds of vitamins and minerals that are necessary in our daily life [3].

Implemented agro technical studies show that soil and climatic conditions of our country allow us to grow and obtain high yields of soybean - up to 3.0-3.5 t / ha. In effort to achieve this amount and reduce the cost of its cultivation, it is necessary, along with other requirements, to apply advanced agro technical techniques in all operations of the technological process. In particular, soybeans need to be sown in the exact nesting way. At the same time, a certain number of seeds will be sown in each nest, which will ensure optimal seeding density. This in turn eliminates the need for thinning. In addition, it is preferable to apply the breeding method of sowing soybeans, because soybeans, like cotton, take their seedbed leaves to the soil surface. Therefore, the group of plants is easier to overcome the soil layer. Nesting sowing is especially necessary in rainy spring conditions, when some single germinating seeds cannot overcome the formed soil crust and die, which leads to thinning of sowing (crops).

The most suitable method of implementation the accurate sowing is a pneumatic sowing unit. The main feature of the pneumatic sowing unit is that the selection of seeds from the mass and their transfer to the bottom of the furrow is carried out by means of air (pneumatics). At the same time, the seeds do not enter the cells (holes), but stick to them, and therefore their damage is excluded. The pneumatic unit can be used on sowing seeds of both tilled and vegetable crops with different distances between the seeds.

When sowing seeds of soybean, the number of groups of holes on the sowing disk of the unit is the main factor influencing the quality of sowing seeds of tilled crops. Smaller the holes on disk, then with a constant sowing interval, it is necessary to inform the disk of a greater rotational velocity. And as you know, with increasing velocity, the suction capacity of holes in the disk decreases [4].

Currently, the seed units work as usual (5-7 km / h), and at elevated (7-9 km / h) velocities. Therefore, it is necessary that the pneumatic seed drill also works at these velocities, and its sowing unit at the same time ensures quality seed sowing.

ISSN: 2350-0328

International Journal of Advanced Research in Science, Engineering and Technology

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According to the recommendations of [5], soybeans should be sown both in dotted and nested exact ways. When nesting method in the nest should be sown in two or three seeds. Consequently, there must be an appropriate number of holes in the seed disc in groups.

II. RESULTS AND THEIR ANALYSIS

In order to select the optimal number of hole groups on the disk, three different disks were made with the number of groups 32, 36 and 40, with three holes per group. The middle concentric row of all disc holes is placed, like the disk for dotted seeding, on a diameter of 195 mm, i.e. outer diameter of 209 mm, internal - 181 mm. The peripheral velocity of the disks with such hole placement was determined by the average diameter of the holes (195 mm). For sowing two seeds per nest, the internal concentric row of holes was closed, and only two holes from each group worked [6,7].

This is due to the fact that different disks have different peripheral velocities at the same translational velocity of the seeder. However, the limiting value of seeding accuracy is obtained for all disks at almost the same peripheral velocity (see table).

Thus, in a sowing unit with 32 holes on the disk, the limiting value of seeding accuracy (86.7%) was obtained at a peripheral velocity of 0.187 m / s. For the sowing unit with 36 holes on the disk, the limiting value (90%) was obtained with a disk peripheral velocity of 0.198 m / s [8,9].

Finally, with a unit with 40 holes on the disk, 86.5% of the seeding accuracy was obtained with a disk peripheral velocity of 0.206 m / s. Thus, the difference in velocities is only 3%.

The following values of the standard deviation of ± 0.35 fall on the above circumferential velocities according to the disks; ± 0.30 and ± 0.31%, as well as coefficients of variation 12.1; 10.3 and 10.8%. As he sees, the values of these indicators are close to each other, so they can be decisive in assessing the quality of seeding. Judging by the magnitude of the circumferential velocity of the disk, it should be noted that it remains still small, at which the limiting value of seeding could be shifted [10].

Table

The quality of seeding soybean units with a different number of groups of holes on the disk

Number of holes, n, pieces	Seeder velocity, V_v, m/s	Peripheral velocity of disk, m/s	Seeding accuracy, T_s,%	Nests with 2 seeds, %	Deviation per average quarter, $\pm\sigma$, %	Variation coefficient, V, %
z_e=32	1,19	0,152	89,5	7,9	0,31	10,7
	1,47	0,187	86,7	9,7	0,35	12,1
	1,75	0,223	82,5	15,4	0,36	12,7
	2,03	0,258	80,7	16,7	0,45	16,0
	2,31	0,294	73,1	21,9	0,48	17,5
	2,58	0,329	66,7	30,5	0,65	25,1
z_e=36	1,19	0,135	94,9	5,1	0,22	7,5
	1,47	0,167	91,7	6,7	0,25	8,6
	1,75	0,198	90,0	8,0	0,30	10,3
	2,03	0,230	85,7	12,5	0,34	11,8
	2,31	0,261	80,4	19,0	0,45	15,7
	2,58	0,293	69,0	28,8	0,55	19,6
$z_г$=40	1,19	0,122	96,3	2,8	0,19	6,4
	1,47	0,150	93,8	4,0	0,22	7,4
	1,75	0,178	91,7	8,2	0,29	9,9
	2,03	0,206	86,5	10,4	0,31	10,8
	2,31	0,235	81,7	18,6	0,44	15,6
	2,58	0,263	75,6	19,1	0,46	16,2

ISSN: 2350-0328
International Journal of Advanced Research in Science, Engineering and Technology
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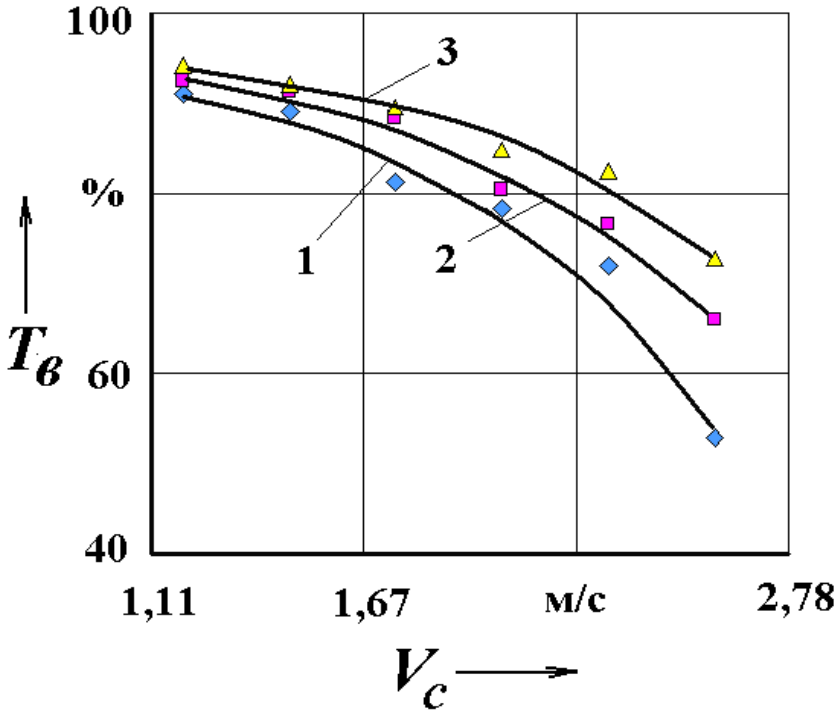
Decrease in seeding accuracy, as established, occurs due to reduction of seeds in nests with increasing velocity above the limiting values of seeding accuracy. Thus, in a sowing unit with 32 groups of holes, with an increase in the peripheral velocity of the disk from 1.75 to 2.58 m / s, the percentage of nests with two seeds increases from 15.4 to 30.5%. Accordingly, for disks with 36 and 40 groups, these values increase from 8.0 to 28.8 and from 8.2 to 19.1. When sowing seeds according to the 10x2 scheme, the accuracy of sowing by the unit with different discs is similar to the previous one. The smallest values of seeding accuracy were shown by a sowing machine with 32 holes on the disk, the average values of a unit with 36 holes and the highest values - a unit with 40 holes (Fig. 1).



1, 2,3 – number of cell groups on the disk accordingly 32, 36, 40

Fig.1. Accuracy dependency of seeds sowing T_s from seeder velocity V_v

Moreover, this difference is not the same at all velocities of the seeder. Approximately, up to a seeder velocity of 2.03 m/ s, the difference between the seeding accuracy of different discs does not exceed 4.4%. And with a further increase reaches 13.2%. A characteristic feature when seeding with an unit with different disks is that with increasing disk velocity, accuracy of seeding decreases. And this is a decrease in sowing unit with 40 holes, where accuracy of sowing is 94.2-72.7%. The limit value here (84.8%) falls on the seeder velocity of 2.03 m/ s. For other discs as 36 and 32 holes, respectively, they fall at a velocity of 1.75 and 1.47 m/ s.

Another major factor affecting seeding accuracy is the height of the fall of the seeds. Finding the optimal height of the installation from the bottom of the sowing groove was experimentally determined. In effort to study its efficiency, sowing unit was installed at a height of 50, 75, 100 and 150 mm from the bottom of seed groove. Experiments were performed at normal and elevated velocities of movement of seeder 1.47; 2.03 and 2.58 m / s.

Accuracy of sowing, as the main indicator of the quality of work of the seeder, decreases with increasing height of the unit. So, if at sowing velocity of 1.47 m/ s and an installation height of 50 mm, the accuracy of sowing is 98.4%, while increasing the height to 100 mm, the accuracy of sowing decreases by 6.8% and is 91.6% (Fig. 2).

With a further increase in height up to 150 mm, the accuracy of seeding decreases by 3.6% and amounts to 88.0%. With an increased seedling velocity of 2.03 m / s, the accuracy of seeding decreases, respectively, by 4.4 and 9.0%. And finally, at a seedling velocity of 2.58 m/ s, satisfactory seeding accuracy (89%) is obtained only at an installation height of 50 mm. When the unit is installed at a height of 75 mm, it is below the maximum allowable

ISSN: 2350-0328
International Journal of Advanced Research in Science, Engineering and Technology
Vol. 6, Issue 7 , July 2019

and is 82.2%. With a further increase in the installation height of the unit to 150 mm, the seeding accuracy decreases to 73.6%.

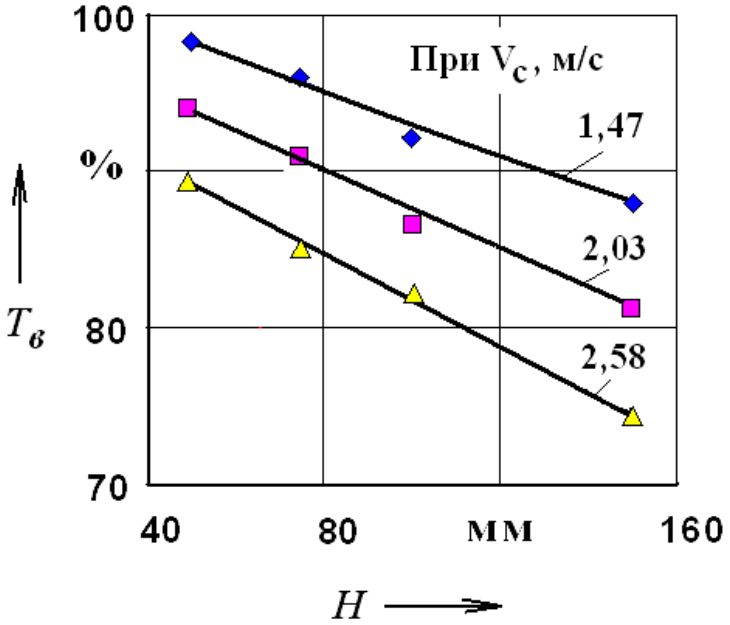


Fig.2. Seeding accuracy T_s of seeds depending on the height H of units installation at various velocities V_v of the seeder

CONCLUSIONS

Thus, it is established that at the velocities of the seeder

V_c = 1.75-2.03 m / s to ensure the required accuracy of seeding soybean seeds with the required nest length, the number of groups of cells should be 40 pcs. Installation height of the metering unit (from the center of suction hole in lower position to bottom of the groove) should be equal to 50-60 mm. At the same time, maximum seeding accuracy and optimum nesting length are ensured.

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