

Comparison of pneumatic sowing machines by the number of seeds in the slots of the discs and the distance between the slots

Mukhayyokhon Saidova^{1*}, *Sarvar Tursunbaev*¹, *Mohichekhra Boltaeva*² and *Nilufar Isakulova*³

¹Tashkent State Technical University, Tashkent, 100095, Uzbekistan

²Jizzakh branch of the National University of Uzbekistan, Jizzakh, Uzbekistan

³Uzbekistan State University of World Languages, Tashkent, 100138, Uzbekistan

Abstract. This article compares the pneumatic seeders currently in use. The comparison results provide the following indicators specifying the number of seedlings in the clusters, the distance between the clusters, the width of the clusters and the length of the clusters. Based on the results obtained from 3 sowing machines selected for clustering sowing of seeds, it was determined that it is advisable to improve the sowing disc in order to improve it so that the indicators of the sowing machine in 3 variants exceed the indicators of other devices.

1 Introduction

The world is leading in the development of energy-resource technologies and modern technical means for growing cotton. One of the important tasks is scientific improvement and the development of new ones that are energy-saving, the quality of work and efficiency are high. In this regard, some progress has been made in developed foreign countries, including the United States, Turkey, India, China and other countries, with great attention being paid to the development and application of pneumatic sieves that accurately sow seeds. Purposeful scientific research is underway in the world aimed at creating new samples of resource-saving technologies for precise sowing of seeds and technical means for their implementation, developing scientific and technical foundations for improving existing machines in order to ensure resource saving during operation [1-2]. In this direction, there are pneumatic devices for precise sowing of seeds in a cellular manner for various soil and climatic conditions and the development of a seed drill design with 3 seeds per cluster, conducting targeted scientific research to substantiate its parameters, ensuring functioning at the level of agrotechnical requirements [3-6].

2 Materials and experiments

The experiments compared the seeders of pneumatic seeders currently in use:

* Corresponding author: anvarovichsarvar908@gmail.com

- Option 1-Case-1200 pneumatic seeder;
- Option 2-pneumatic seeder module CMX-4-04;
- Option 3 is a PS-4 pneumatic seeder.

The planting apparatus of the case-1200 seeder in option 1 works as follows.

The body of the device consists of two parts, one of which is the feed chamber (Figure 1), and the other is the thinning chamber. The landing disc, located between these chambers and separating them from each other, is mounted at the end of a horizontal shaft using three levers. The shaft rotates on a sliding bearing in the feed chamber housing. The plastic landing disc (thickness 1 mm, outer diameter 300 mm, Number of holes 20, holes arranged in groups) is clamped in the thinning chamber using a special gasket. The supply chamber is connected to the atmosphere. Its inner lower and side parts are curved and have straight bristles.



Fig. 1. Case-an overview of a laboratory stand equipped with a pneumatic seed drill 1200.

These brushes are used to clean the grooves (holes) of the disc from clogged seeds. The thinning chamber is made of plastic and consists of a dead-end groove made in a circle. The thinning chamber is connected to the fan (extractor) by means of a nozzle and a hose.

The extractor sucked air from the supply chamber through the holes of the landing disc (consisting of 3 holes), the thinning chamber, the nozzle and the hose.

The seeds in the supply chamber, under the influence of the airflow, stick to the holes of the planting disc and block the path of air intake from the atmosphere. The seeds stuck to the holes, together with the disc, exit the rotation chamber into the guide area and cluster in the glued conveyor belt of the stand. The rectifier rotates clockwise with the disc using a hardware shaft. It fixes the seeds in the supply chamber [7].

For normal operation of the device (for sowing exactly one seed in each hole), it is necessary to adjust the position of the coils of the singulator in accordance with the scale. With the help of the separation barrier lever, you can adjust by determining the rationing of the device. Due to the fact that the holes in the disc are arranged in groups of 3 pieces, the seeds are planted in clusters [8].

The planting apparatus of the modular seeder CMX-4-04 in option 2 (Figure 2) works as follows.

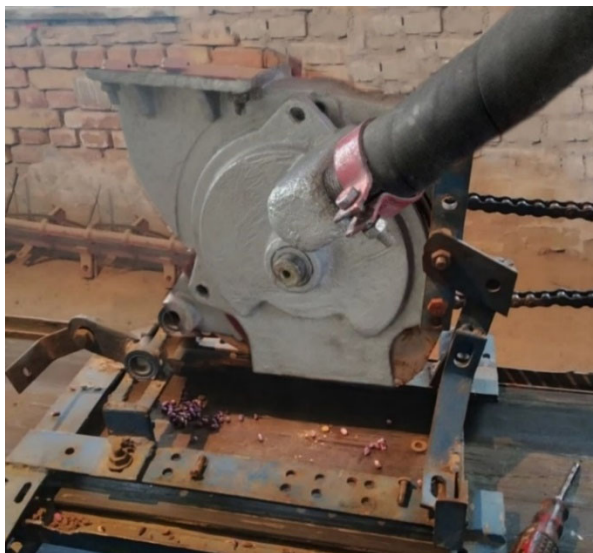


Fig. 2. General view of the CMX-4-04 laboratory stand equipped with a seeding-machine pneumatic landing device.

The equipment body consists of two parts: feed chambers and dilution chambers. It is located between the chambers, and the landing disc separating them is mounted on the rectangular end of the horizontal shaft using a special nut. The shaft rotates on a sliding bearing in the feed chamber housing. Landing disc (suction holes with a diameter of 3.5 mm, round diameters of 180 and 200 mm, where the holes are located, the number of holes is 32x2 (32 groups, 2 holes in each group) it is attached to the thinning chamber with a rubber parrot. The parapet is also mounted at the square end of the shaft. The grinding chamber is connected to the atmosphere. A cleaner is installed on its inner upper part. The cleaner keeps excess seeds stuck in the holes of the disc. The grinding chamber consists of a dead-end ditch made in a circle. The dilution chamber is connected to the fan (extractor) by means of a nozzle and a hose.



Fig. 3. Laboratory stand with pneumatic planting machine PS-4 seeder.

The exhauster sucked the air in the supply chamber through the holes of the planting disc (the groups consist of 2 holes), the thinning chamber, the patrubok and the hose. The seeds

in the supply chamber adhere to the holes of the disk under the influence of air flow and seal the path of absorption of air from the atmosphere. Seeds that stick to the holes roll along with the disc out of the supply chamber, then go into the zone where there is no thinness. At the very bottom of the body, the seed is exposed to the weight of the seed due to the lack of force that pulls the seed into the disc hole or hits the rubber Parrack, clustering on the glued transporter tape of the stand. The puller rotates counterclockwise along with the disc using a hardware Valve and keeps the seeds in the supply chamber spinning. Clustering planting is carried out due to the fact that the holes in the disc are grouped and located from 2 holes.

The PS-4 seeding-machine in option 3 (Figure 3) works as follows: the shaft in which the seeds in the sowing chamber rotate clockwise transmits movement to the sowing disc.

When a vacuum is created, air passes through the pipe through the seed chamber, the clusters of the planting disc and the vacuum chamber into the fan of the seeder. The landing disc is pressed tightly against the vacuum chamber with a gasket so as not to lose the vacuum force. The running gear acts on the shafts and sliding bearings. The rotating shaft, in turn, moves the landing disc mounted on its hexagonal tail. In it, the seeds, in turn, also move due to the friction force on the surface of the disk, are carried away by the air flow and, regardless of their weight and shape, are grouped (3 pieces each) into barrier clusters on the disk, closing the suction path.

As a result, a constant vacuum is maintained in the vacuum chamber. Due to this vacuum, a group of seeds settles firmly in the clusters. The shape of the clusters is related to the location of the 3 seeds, that is, to the rational shape of the triangle in a group order. The ends of the triangle are made by placing round and Y-shaped barriers between them in order to more tightly absorb a group of seeds, eliminate loss of pressing force and improve the absorbency of the clusters. The Y-shaped barrier ensures reliable fastening of the seed group in the clusters, eliminates damage to the seeds and clogging of the vacuum chamber. The centers of the clusters of the landing disc are arranged in a circle. A rotating disk takes groups of seeds outside the vacuum. In the lower part of the case, due to the lack of vacuum, groups of seeds fall out of the clusters of the planting disc into a cesspool, which opens with a coulter of exactly 3 pieces under the influence of gravity.

3 Results and discussion

The results of the comparison are shown in Table 1.

Table 1. Comparative test results.

Specification	Initial requirements	Hardware type					
		Option 1		Option 2		Option 3	
		Disc number of rotations, r/min					
		29	35	29	35	29	35
Number of seeds in clusters							
M_{medium} , piece	2±1	2.77	2.26	1.9	1.6	2.9	2.7
$\pm\sigma$, piece	3±1	0.87	0.69	0.38	0.33	0.37	0.54
V , %		31.41	30.53	20.0	20.6	12.7	20.0
The distance between the slots							
M_{medium} , cm	-	25.94	26.06	13.0	13.1	12.0	12.1
$\pm\sigma$, cm		4.37	6.37	1.29	1.37	1.49	1.72
V , %		16.85	24.44	10.0	10.4	12.4	14.2

Slots width							
M_{medium} , cm		1.04	0.93	0.99	0.85	0.80	0.77
$\pm\sigma$, cm	-	0.36	0.29	0.27	0.24	0.22	0.20
V , %		34.62	31.18	27.27	28.24	27.50	25.97
Slots stretched							
M_{medium} , cm		5.79	5.43	2.01	1.92	1.47	1.32
$\pm\sigma$, cm		1.76	1.56	0.56	0.42	0.31	0.27
V , %	-	30.40	28.73	27.86	24.48	21.09	20.45

As can be seen from the data in Table 1, the number of seeds in the hives sown in the planter of the pneumatic planter of option 1 practically did not differ from the sowing apparatus of option 3, but its standard deviation and coefficient of variation were higher.

The distance between the hubs and its standard deviation, variation, at 29 rpm the number of revolutions of the discs was 25.94 cm, $\pm$ 4.37 cm and 16.85%, respectively, at 35 rpm this indicator was 26.06 cm, $\pm$ 6.37 cm and 24.44%, with option 2 these indicators are 26.06 cm, $\pm$ 6.37 cm and 24.44%, respectively. at 29 rpm, these indicators were 13.0 cm, $\pm$ 1.29 cm and 10 percent, at 35 rpm-13.1 cm, $\pm$ 1.37 cm and 10.4 percent, and in option 3 these indicators were 12.0 cm, $\pm$ 1.49 cm and 12.4 percent at 29 rpm-the number of revolutions of the discs. if the percentage was, At 35 rpm, these indicators

4 Conclusion

The Case-1200 seed drill is located in the coulter relatively high above the field surface, so a seed channel is installed between the seeder and the coulter. Two other indicators, namely the width and elongation of the grooves, received the best values in the 2nd and 3rd options.This can also be explained by the fact that the landing device is located above the coulter, as noted above.

As can be seen from the results of the experiments, the agrotechnical requirements for cluster sowing of seeds in all variants were not fully met. Since the pneumatic PS4 seeder copes relatively well with the performance of the seeder, it is advisable to improve its planting disc in order to improve performance.

References

1. F.A. Alimova, M.T. Saidova, B.Sh. Primkulov, IOP Conference Series: Earth and Environmental Science **1231(1)** (2023).
<https://doi.org/10.1088/1755-1315/1231/1/012012>

2. M. Saidova, F. Alimova, S. Tursunbaev, D. Kulmuradov, M. Boltaeva, IOP Conference Series: Earth and Environmental Science **1284(1)**, 012014 (2023).
<https://doi.org/10.1088/1755-1315/1284/1/012014>

3. J. DeJong-Hughes, J. Vetsch, Extension Publication BU-08483 On-farm comparison of conservation tillage systems for corn following soybeans (University of Minnesota) (2007)

4. B. Kalimbetov, A. Tukhtakuziyev, EurAsian Journal of BioSciences **13**, 1 (2019)

5. R. Awale, Chatterjee A and Franzen D Soil Tillage Res. 134, (2013)

6. O. Schneider, J. Roger-Estrade, J. Aubertot, T. Dore, Soil Tillage Res **85**, 115 (2006)

7. S. Tursunbaev, N. Turakhodjaev, S. Turakhujaeva, S. Ozodova, S. Hudoykulov, A. Turakhujaeva, IOP Conference Series: Earth and Environmental Science **1076**, 1 (2022). <https://doi.org/10.1088/1755-1315/1076/1/012076>
8. F.A. Alimova, B.S. Primkulov, IOP Conference Series: Earth and Environmental Science **1076**, 1 (2022). <https://doi.org/10.1088/1755-1315/1076/1/012001>