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Solutions for Decreasing Damage Soybean Seeds in Sowing Mechanic Seeder Apparatus

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Abstract: In this article results of research in the field and laboratory are shown for sowing soybean seeds using SCHX-4 sowing machine and its mechanical sowing apparatus. During the experiment, the damage level of seed caused by seeder SCHX-4 was 5.2 % and this apparatus did not reach agro-technical requirement. Thus a restrictor was installed was made from rubber and formed a semi molded formation on the hole where the seed enters the sowing apparatus which decreased the seed damage to 0.8 %.

Keywords: soybean, seeder device, damaging of seed, adaptation, restrictor.

Introduction

Soybean is one of the most important crops. Approximately 300 varieties of foodstuffs, raw materials and valuable goods are produced from soybean crops and grains, as well as valuable poultry and fish forage. Soybean plants also absorb nitrogen from the atmosphere through symbiotic bacteria; the nitrogen is transformed into biological nitrogen and equates to an available nitrogen content of 80-100 kg/day in a hectare during the growing period. This also helps to increase soil fertility and decreasing erosion soil [1]. Therefore soybean production is increasing every year and the current area is approximately over 110 million hectares [2]. Currently, in Uzbekistan knowledge of soybean development is important. At the same time, research is underway to cultivate soybean as a rotation crop after wheat. While efforts are being made to establish large scale soybean production in Uzbekistan, there are currently a number of difficulties in cultivating this crop.

The density of the seedlings should be 200-300 thousands per hectare, 300-400 thousands seeds and 400-500 thousands early varieties. According to the sowing rate, the soil moisture content and the weight of 1000 grains should be 40-60 kg per hectare, and the depth should be 4-5 cm. Early observations have shown that not enough seedlings obtained from sowing in grain-free areas mainly because of damage caused by mechanical sowing machines [3-5].

However, in the above studies, authors did not investigate, evaluate and improve the work of planting machines used for mechanical sowing. SChX-4 is a mechanical type, it is one of the most widely used machine for seeding plants in Uzbekistan. That is why it is important to research and improve it in sowing the soybean.

Methods

The work-quality indexes of the sowing used in State Standards 31345-2007 and field testing and soil conditions were determined according to State Standards 20915-2011. Mechanical type SCHX-4 seeder was sealed for shrub planting. Because it is the most commonly used in Uzbekistan.

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To prepare the serial SCHX-4, the soybean seeds were put into a number of bunkers, and in the case of the wheel, the rotors were put into operation. The number of soybeans per kilometer was calculated by calculating the path to the rotation of the cellar wheel.

Planting machines were set up from 35 to 40 seed shrubs per hectare. The depth was equal to 4 cm by lifting and lowering the support of the plowshare on the surface of the earth. The plowshare and soil-reel pulse pressure on the soil was 30-35 kilograms. In the experiments, the number of measurements at the sowing depth was 100 and the number of lines was 10. The sowing capacity was 35-40 kg, the sowing depth was 4 cm and the width of the line was 90 cm. Continuous fall and burial of the seed was monitored by the operator.

Results and Discussion

Based on the established methods, experimental work on sowing seeds with the SChX-4 seeder with mechanical planting equipment was carried out.

Based on the results of experiments, the sowing norms and depths of seeds for the SChX-4 ranged widely across of agro-technical requirements (ATR) (Table 1).

Table 1. Results of sowing seeds with the SChX-4 seeder

Indicators	According to agro technical demand	Defined	Actual
Sowing measure (kg/ha)	At least 10 %	35-40	37.8
Depth of sowing (cm): Mean M_{av} Standard deviation $\pm\sigma$	 3-6 1	 4 –	 3.8 0.31
Width between rows (cm): actual side	 90±1 90±5	 90 –	 89.5 92.5
Damage rate of seeds (%)	1.0	-	5.2

At the same time, the difference between the defined sowing norm and the actual sowing norm was 6.75 percent (10 percent maximum by ATP), mean sowing depth and its standard deviation were 3.8 cm and 0.31 cm (4.0 ± 1.0 in ATT) and the width of the adjacent line spacing was 89.5 cm and 92.5 cm respectively (90.0 ± 1.0 cm and 90.0 ± 5.0 cm respectively). However, the damage rate of seeds was 5.2%, which does not correspond with ATT. It was found that the seeding machine caused mechanical damage to the seeds between the sowing slurry and the sowing rod.

The SChX-4 seeder has been tested on a universal stand under laboratory conditions to eliminate the deficiencies identified as a result of a field-test investigation of mechanical sowing (Fig. 1). Seeds were damaged as a criterion for evaluation.

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Fig. 1. Universal stand designed for testing machines for planting

The SChX-4 seed sowing device has a semi molded cutter that ensures that the sowing unit is fitted to the shrub layer without damaging the shrub slices by the shingle rolling hole, which was prepared from metal list, plastic and rubber, was tested (Fig. 2 and Fig. 3).

1-metal barrier

2-plastic barrier

3-rubber barrier

Fig. 2. View of the barrier that should be installed on the seed hole

1-without barrier

2-metal barrier

3-plastic barrier

4-rubber barrier

Fig. 3. View of the barrier on the seed hole of the mechanic sowing apparatus

Experiments consisted of the number of turns of the mechanical planting apparatus, i.e., 75, 100, 125 and 150 rpm/min. and 5 repeats. The number of cycles of the mechanical planting apparatus

was 75 rpm/min. and 150 rpm/min., and the damage rate of the seeds was higher than that of a metal cutting machine from 2.5% to 5.4%, and from plastics, which restricted cultivation by 1.8% to 3.6% (Table 2).

Table 2. Damage caused to seeds by mechanical sowing apparatus with a protector barrier constructed different materials

Type of barrier installed on the mechanical sowing apparatus	Rotation number of the sowing apparatus (rpm)			
	75	100	125	150
	Rate of damage seed (%)			
Metal	2.5	2.9	4.1	5.4
Plastic	1.8	2.1	3.0	3.6
Rubber	0.3	0.4	0.6	0.8

Although the damage caused by the rubber increased by 0.3% to 0.8% but was less than that caused by the metal and plastic containment limitations, it was determined that the specified requirements did not exceed 1%. Based on this experiment, it is recommended that a rubber sack be placed at the bottom of the mechanical planting apparatus when sowing soybean.

Conclusions

Based on the results of the experiments, it is desirable to place a semi molded cut-out of rubber material into the sowing slots under the planting apparatus to reduce sowing damage when using mechanical planting devices. Based on the results of the experiments, it is advisable to install a semi-crescendo scope of rubber material on the seeding holes at the bottom of the seeding machine to minimize the damage to the seeds when sowing with mechanical seeding machines. Seed damage in the seeding machine with a rubber restraint was between 0.3 and 0.8 per cent, which was 4-6 times less than metal and plastic barriers and did not exceed 1 per cent.

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