Improving the technology of post-harvest seed treatment

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Abstract. The article deals with the issues of grain injury by elements of production lines. The evaluation of the most typical operations that cause macro- and microtraumation of grain by air-sieve-Trier machines is given. The most rational design parameters of the machines and their operating modes that guarantee minimal injury to seeds are identified. Possible ways to improve the quality of the seed fractions extracted by passing through the sieve B2 and descending from the sieve G. Preferably, each of them should be passed separately through a puppet Trier. At the same time, the level of seed injury is lower and the laboratory germination rate is higher.

1. Introduction
The Central Chernozem region of the Russian Federation is one of the leading regions of grain production due to relatively favorable natural and environmental conditions. Grain production is traditionally the basis of the entire food complex and the largest branch of agriculture. Sowing qualities of seeds depends on climatic conditions, observance of technology of cultivation of culture, their level of injury during harvesting and post-harvest processing, quantitative and qualitative characteristics combine heap (humidity and relative content of components of organic and mineral origin), his defeat of microorganisms and the storage time.

Technological lines of modern grain cleaning units and grain-drying complexes have a large length from 100 to 150 m and more, technological lines for grain storage of 175 m and more including several burrows, augers, scraper conveyors. These complexes, when used in the agricultural sector of the Russian Federation, injure from 7.5 to 43% of seeds. Approximately 13.9-54.7% of the total injury occurs during harvesting and post-harvest processing, including 28.8–79.4% of all seeds during post-harvest processing by transport authorities [1-15].

The generalization of the research results shows that the given data on the injury of seeds by working and transporting elements of production lines can reach the following values:

- Receivers from 5.0 to 13.7%;
- In noria from 4.0 to 12.0%;
- Screws from 4.3 to 15.5%;
- Scraper conveyors from 10.5 to 16.0%;
- In gravity conveying devices from 0.06 to 0.09% on 1 m of transportation and from 0.08 to 0.13% on turns;
- In pneumatic transporters 17% or more;
- In grain cleaning and sorting machines from 2.0 to 8.4%.
In order to reduce the injury of grain during its post-harvest processing, it must pass through a minimum number of machines and transporting devices. Therefore, when developing new grain cleaning machines and grain cleaning units, it is necessary to reduce the number of operations and reduce the length of inter-operational links.

The level of injury to seeds and commercial grain during post-harvest processing depends on the complete set of technological lines of grain cleaning units and grain-drying complexes with machines for their processing, the design and technological parameters of their operation, the length of the line. Repeated collision of grain with working and technological transporting elements of these lines leads to an increase in the level of injury to seeds, a decrease in their sowing qualities [1-6].

Each subsequent collision or loading of grain with elements of a particular machine and working body leads to an increase in the size of the injury and a change in the nature of injuries. In order to improve the sowing qualities of seeds, when developing promising universal grain cleaning machines and technological lines, it is necessary to find ways to reduce the number of mechanical impacts on grain crops. It is desirable to achieve this by reducing the length of the technological line, the quality of the transporting bodies and machines.

2. Materials and methods

In our opinion, first of all, it is necessary to exclude the use of augers and scraper conveyors in technological lines of grain cleaning units, and the number of burrows should be minimal. From the whole variety of grain cleaning machines used in technological lines of grain cleaning units and grain cleaning complexes of Russian and foreign production, the maximum impact on the injury of seeds, in our opinion, is provided by those that in their design have scraper screw devices of all kinds of shastalki, etc. They have an increased length of the technological chain and an increased probability of contact of seeds with machine design elements.

These include air-sieve-Trier machines, which have in their design four sieves B1, B2, B and G. the grain mixture fed to the sieve B1 is divided, approximately, into two equal parts. Large grain and large impurities go with the course to the sieve B2, where cleaning of large impurities takes place. The purified grain passes through the sieve B2. Small impurities and fine grain Wake up in the sieve B1 a sieve In highlighting the small impurities and the remaining part is supplied to the sieve G, which stands feeble and crushed grain that is allocated to the grain impurity, which can be used for feed purposes and some minor impurities.

The cleaned grain goes with the course from the sieve G. the Clogging of the grain heap fed for post-harvest processing depends on the physical and mechanical properties of the harvested crop at the time of threshing, the design and operating parameters of the grain harvester. Depending on the clogging of the grain fraction and impurities passing through the sieve B2 and descending on the sieve D, their subsequent processing on Trier cylinders can be carried out in different ways.

In modern technological lines of grain cleaning units and grain-drying complexes, they are combined into a single stream and processed sequentially on oatmeal and doll triers. In our opinion, these fractions should not be combined to reduce the level of injury, but should be treated separately. Depending on the predominance of large or small impurities, they must be passed only through an oatmeal or doll Trier. Thus, transportation of grain or its part by the auger of the oat Trier is excluded, thus reducing the length of the technological line.

At the same time, the loading of each Trier will be reduced by 2 times and the overall productivity of the production line will increase.

To substantiate the rational technological line, the scheme of its layout, the quality of seeds for the level of injury and laboratory germination in various variants were studied. Samples for the analysis of quality indicators of winter wheat were selected in accordance with existing state Standards.

3. Results

The selection was made after air cleaning, before feeding the machine to the sieve mill from the fractions passing through the sieve B2 and coming off the sieve D, as well as after processing them
sequentially on the oat and doll triers or the fraction passing through the sieve B2 separately on the oat or doll Trier and the fraction coming off the sieve G on the doll Trier.

After sampling, the content of weeds with sizes from 5 to 8 mm and more, the mass of 1000 grains, the content of injured seeds (types of injuries led to one type of damage to the embryo), and laboratory germination were determined.

The results of studies on the determination of qualitative indicators are shown in Table 1.

**Table 1. Quality indicators of seeds during air-sieve-trier cleaning.**

| The location of the sample | Content of weeds, % | Weight of 1000 grains, g | Injury, percent | Laboratory germination, percent |
|----------------------------|---------------------|--------------------------|-----------------|-------------------------------|
|                            | in total | Including size, mm | before 5 | 5-8 | after 8 | | | | |
| After air cleaning | 9.6 | 8.2 | 0.9 | 0.5 | 44.6 | 16.2 | 96.5 |
| After passing through the sieve B2 | 5.8 | 4.6 | 0.9 | 0.3 | 45.4 | 18.1 | 94.2 |
| After the descent from the sieve G | 6.2 | 4.9 | 0.8 | 0.5 | 45.8 | 19.7 | 96.7 |
| After combining the fractions: passed through the sieve B2 and descended from the sieve G | 0.4 | 0 | 0.4 | 0 | 45.2 | 24.2 | 93.2 |
| After processing the fraction passed through the sieve B2 - on the puppet Trier: on oat Trier | 0.8 | 0 | 0.5 | 0.3 | 45.4 | 19.6 | 93.5 |
|                                              | 4.8 | 4.4 | 0.3 | 0.1 | 45.4 | 23.2 | 92.6 |
| After processing the fraction that descended from the sieve G, on the puppet trier. | 0.9 | 0.1 | 0.6 | 0.2 | 44.9 | 20.8 | 96.1 |

Analysis of the table data shows that after air cleaning with a grain cleaning machine, the heap contains 9.6% of weeds, including 8.2% with a size of less than 5 mm, 0.9% with a size of 5 to 8 mm and 0.5% with a size of more than 8 mm.

The content of weeds in the passage through the sieve B2 is in the range of 5.8%, including weeds less than 5 mm-4.6%, from 5 to 8 mm - 0.9% and more than 8 mm-0.3%. The bottom part of the sieve G contains 6.2% of weeds, including less than 5 mm in size - 4.6%, and from 5 to 8 mm - 0.8% and more than 8 mm - 0.5%.

It is known that seeds with a large mass of 1000 grains, fractions from 2.6 to 3.6 mm, with a low level of injury should be used for sowing purposes. From the table data, it can be seen that the mass of 1000 grains in the pile entering the sieve mill of the grain cleaning machine after air cleaning is 44.6 g, and in the passage part through the sieve B2 and the descent from the sieve G fractions, it was 45.4 and 45.8 g, respectively. A slightly smaller mass of 1000 grains in the pile arriving at the sieve mill of the machine is explained by the fact that a part of the puny seeds that should be used for commercial or feed purposes was sifted out on the sieve G. The content of injured grain in the pile entering the sieve mill is 16.2%, in the passage part of the sieve B2 and the exit part of the sieve G is 18.1% and 19.7%, respectively.
An increase in the degree of injury to seed shadowy parts with sieve G is a great stretching move them to the cleaning sieves, that is, the increase in the probability of contact of grains with the surface of resolved paintings.

The main indicator of the sowing qualities of seed material is their laboratory germination [10-12]. The data of the table indicate that the laboratory germination of seeds in the pile entering the sieve mill is 96.5%, and in the passage part through the sieve B2 and the descent from the sieve G is 94.2 and 96.7%, respectively. In the passage part of the grain heap through the sieve B2, seeds with a large mass of 1000 grains are contained than in the passage part from the sieve G and the degree of their injury is lower, the laboratory germination of seeds was less. This can be explained by the different susceptibility of large and small fractions of seeds to mechanical influences and the different depth of spread of various types of injuries, the transition in a certain period of time of some types of damage to others.

4. Conclusion

In modern technological lines of grain cleaning units and grain-drying complexes, the fractions released by passing through the sieve B2 and the descent part from the sieve G are combined together and passed sequentially through the oatmeal and doll triers. At the same time, the content of injured seeds increases to 24.2%, and their laboratory germination rate decreases to 93.2%. At the same time, after cleaning the grain heap, the content of weeds in the seeds is 0.4%.

In the case when the fraction released by passing through the sieve B2 of the grain cleaning machine is passed through a puppet Trier, the content of injured seeds increases to 19.6%, and the laboratory germination of seeds decreases to 93.5%. In the fractions obtained by descent from the sieve G, passed through the puppet Trier, the content of injured seeds increased to 20.8%, and their laboratory germination decreased to 96.1%. The content of weeds was 0.8 and 0.9%, respectively.

In the case when the fraction extracted from the grain heap by passing through the sieve B2 was passed through the oat Trier, the content of injured seeds reached 23.2%, and their laboratory germination decreased to 92.6%. The number of weeds after treatment was 4.8%.

The conducted studies show that to improve the quality of seeds, the fractions released by passing through the sieve B2 and descending from the sieve D should be treated separately. In our case, it is preferable to pass each of them separately through the puppet Trier. At the same time, the level of seed injury is lower and the laboratory germination rate is higher. If large impurities predominate in the initial pile, then the fraction released by passing through the sieve B2 must be passed through the oat trier.

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