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Analysis Of Damage To Cotton Seeds

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Abstract *— The article provides data on the degree of mechanical damage to seeds, on how this indicator has a significant impact on the energy of germination and germination. The diagram of the dynamics of damage to cotton seeds by the transitions of the technological process is presented. In the case of an increase in seed damage (cracks) in the pipelines of pneumatic conveying installations, it was suggested that the air flow rate should be reduced, which is achieved by turning the throttle valve on the fan exhaust outlet. In order to prevent a significant increase in seed damage during the transportation of raw cotton in pneumatic transport systems, it is recommended that seed bundles be completed at sites located 80 ± 100 m from the main building.*

Keywords — Pneumatic conveying device, seed damage, impact force, separator, separation chamber,

Introduction

The degree of mechanical damage to seeds is an important indicator of the quality of sowing crops; high damage to seeds has a significant effect on germination energy and germination. It is known that damaged seeds often do not germinate at all, and if a sprout does appear, then in its development it usually lags far behind plants obtained from normal (whole) seeds. [1]

With damage to cotton seeds, the quality of the products - cotton fiber and linters - deteriorates due to an increase in the content of skin with fiber and soft defects. Increased residual fibrillation leads to a decrease in the yield of fiber and linters, and an increased complete descent of cotton seeds after linting leads to a drop in the productivity of machines and the yield of cottonseed oil at oil and fat plants. In this regard, the need arose for a comprehensive study of changes in the degree of damage and omission of cotton seeds according to the main transitions of the technological process of a cotton ginning plant [2].

According to the current GOST-5895-64, seeds are allowed for sowing, the damage of which does not exceed 5.0%.

In the process of processing, raw cotton is consistently subjected to a large number of operations: the effect of the air flow of pneumatic conveying installations and working bodies, grate-saw and auger cleaners, screw conveyors, gins and linters.

It is known that seed damage increases with the number of operations. The technological process of processing seed cotton, provides for the required number of transitions and operating modes of the cotton plant equipment, ensuring the release of standard sowing seeds [3].

However, in practice, there are often cases when, due to a malfunction of any machine or group of machines, the damage to the seeds at the exit from the linter shop increases sharply.

Due to the flow nature of production and the presence of a large number of transitions, it is not always possible to timely and accurately determine a machine or a group of machines in which intensive damage to seeds occurs. To solve this problem, the nature of damage arising in seeds from the impact of pneumatic conveying installations, grate-saw-bar cleaners, gins and linters was studied. The work was carried out at the cotton ginning enterprises of Sangzor Textile LLC, as well as at the local experimental laboratory of cotton products in the Jizzakh region.

At ginneries, during the preparation of sowing seeds of grade 108-F of the third reproduction, at the main transitions of the technological process, samples of raw cotton and seeds were taken three times. Sampling time - 30 minutes.

The samples were analyzed for damage to seeds, the latter were classified by the type (nature) of damage (cracks, severely destroyed seeds, cuts, punctures).

Material and methods

In addition to the total damage to the seeds, the percentage of seeds of a certain type of damage was determined for each sample. So, as the raw cotton moves along the technological process, the total damage to the seeds increases.

In the seeds taken from the storage site, about 5.0% of damaged seeds were found, including 3.5 with cracks and cuts, 0.9 strongly destroyed (in the original raw cotton - 0.3) and 0.6 with punctures. In damaged seeds, the largest specific gravity is made up of cracks that appear at almost all transitions of the technological process, which include pneumatic conveying installations (Fig. 1, transitions a, b, c). It has been established that cracks appear, as a rule, at high air flow rates in pneumatic pipelines (25 ± 30 m / s).

Severely destroyed seeds appear in the process of cleaning and ginning raw cotton (Fig. 1, transitions d, e, f). Punctures are found after exposure of the seed to the saw organs of gins and linters (Fig. 1, transitions f, g, h, i).

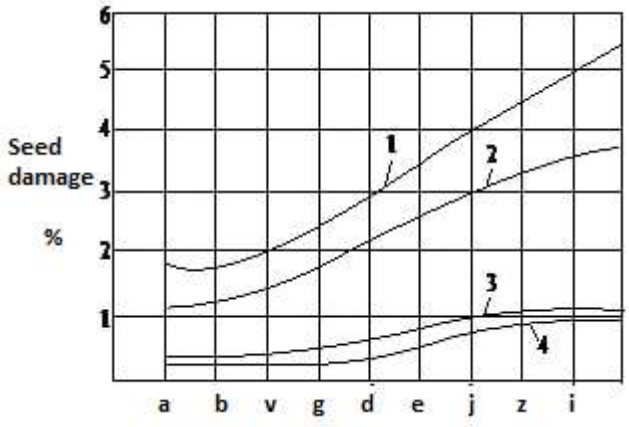

Fig. 1. Dynamics of damage to cotton seeds by transitions of the technological process: a) seeds from a riot; b) after the first transshipment; c) after the second transshipment; d) after cleaners CHH-3M; e) after cleaners 6A-12M; f) after the gins; g) after transporting devices; d) after the linters of the first removal; i) after linters of the second removal; I) the total number of damaged seeds; Ii) seeds with cracks and cuts; III) badly destroyed; IV) with punctures.

In the practice of individual ginneries, sometimes raw cotton is supplied from the storage location to the cleaning group of machines with the help of powerful fans, and sometimes it is even paired (daisy chain) fans with a fully open throttle valve. Under these conditions, in the pipeline near the separator, the air flow rate exceeds 40 m / s, which leads to an increase in the number of cracked seeds. To reduce damage to seeds in the process of processing seed cotton, it must be transported at an air flow rate in the pipeline no more than 20 m / s. Since the flow rate and speed of air in the pipelines depend on the transportation route, when picking up lots of seed cotton at ginneries, they must be placed on sites close to the main building of the plant. It is possible to reduce the amount of severely destroyed seeds by strictly observing the recommendations for blockages, distribution and speeds of the working bodies of cleaning machines, as well as using high-quality genie and linter saws, which help to reduce the number of seeds with punctures.

When transporting raw cotton in a suspended position in straight pipe sections, seeds and fibers are not damaged and the process of surface wear slows down. However, during transportation at such a speed, the forces of inertia in the pipe shells increase sharply. The raw cotton hits the inner surface of the shell harder. As a result, speed is lost and the stress at the point of impact increases. This leads to increased damage to seeds and accelerated destruction of the shell [4].

Discussion

If during the processing of seed cotton a large damage to the seeds is found, then it is advisable to disassemble all damaged seeds into separate fractions according to the type of damage (cracks, punctures, cuts, severely destroyed), then determine their specific content in the total number of damaged seeds and according to the results obtained identify the groups of machines with the greatest damage.

In the event of an increase in seed damage (cracks) in the pipelines of pneumatic conveying installations, it is necessary to reduce the air flow rate, which is achieved by turning the throttle valve on the exhaust outlet of the fan. In order to prevent a significant increase in seed damage during the transportation of raw cotton in pneumatic transport systems, it is recommended that seed bundles be completed on sites 80 ± 100 m from the main building [5].

During processing at a cotton ginning plant, raw cotton, interacting with the working surfaces of technological equipment, is subjected to mechanical stress, which negatively affects the quality of the products. In this regard, it is of great interest to study the damage of cotton seeds along the chain of the technological process, since this is one of the important factors affecting the quality of the cotton fiber produced. The research was carried out at the Sangzor Textile LLC cotton ginnery.

In the areas of pneumatic transport, the speed of raw cotton was 24 ... 26 m / s. Damage to seeds was determined during processing of raw cotton of selection 108-F, grade I, manual collection with an initial moisture content of 9.2% and weediness of 1.2%. For analysis, samples of raw cotton were taken at eight points of the technological scheme, indicated in Fig. 3 in Roman numerals. Sampling and analyzes were performed according to the standard method. The research results are presented in the form of a diagram in Fig. 3.

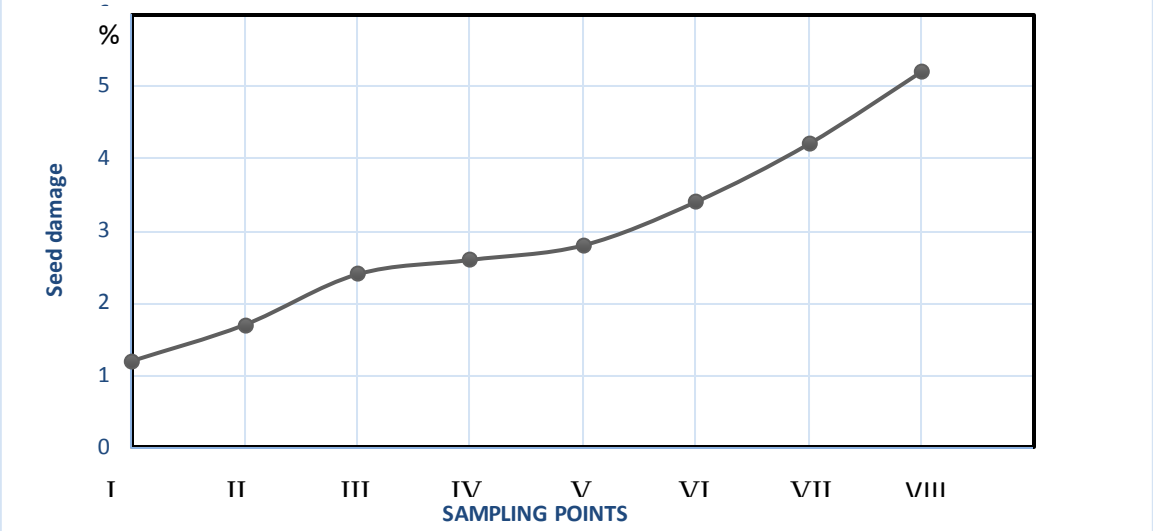

Fig. 3 Diagram of changes in damageability of seed cotton seeds in the process of processing at ginneries.

The diagram shows that the greatest damage to cotton seeds is observed on gin and linters (section V-VIII), where it increases by 2.5-3.0%. When moving raw cotton from a warehouse to gin (section I-V), damage to seeds increases by 1.5%, of which most, approximately 1.0-1.2%, falls on the pneumatic conveying sections.

Conclusion

The use of the above recommendations in the practical activities of ginneries will allow timely elimination of malfunctions in individual machines and exclude the possibility of releasing non-standard sowing seeds from production. The diagram shows that the study of the processes taking place in the pneumatic transport system will allow finding opportunities to reduce the damage to the seeds of pneumatically transported raw cotton and improve the quality of the cotton fiber produced.

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