



ANALYSIS OF COTTON SEED PROCESSES

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Abstract: The article presents an analysis of the physical, mechanical, biological, and other properties of cotton seeds, as well as the technological processes of preparing cotton seeds for sowing.

Key words: cotton seeds, cotton, fiber, force, sensor.

Decree of the President of the Republic of Uzbekistan No. UP-60 dated January 28, 2022, "On the Development Strategy of New Uzbekistan for 2022-2026," defines a number of tasks for the development of the country's textile industry [1]. At the videoconference meeting chaired by President Shavkat Mirziyoyev on June 28, 2022, on measures to develop and implement a program to increase the production and export volumes of textile industry products in 2022-2026, as well as to increase cotton production volumes through science-based seed production and agrotechnologies, and to increase the export of textile products based on deep cotton processing:

increase the yield and volume of cotton by at least 30% due to science-based seed production and agrotechnologies;

deep processing of cotton and increasing the industry's exports by at least 2 times;

It was noted that this is a huge opportunity and reserve for our economy, and textiles are considered a sector that brings us more income than gold at a lower cost, which is why a full cluster system has been implemented in the sector. It was noted that today 100 percent of cotton fiber is processed in our country (five years ago, 40 percent of the fiber was processed).

Cotton seeds germinate under favorable conditions. During the initial period of the plant's development, the seeds contain a sufficient amount of nutrients. The seeds are regular, slightly crushed, oval in shape, and sometimes may be crushed on the sides. The length of the seeds is 7-12 mm, the width is 4-7 mm, the thickness is 3-6 mm, and the mass of one seed is 0.08–1.8 g. The upper thick part of the seeds is called the khalase, and the lower conical narrowed part is called the micropil. The seed coat is hard and dark brown, with a nucleus located inside it. The oil-bearing, pale yellow, rounded nucleus inside the seed coat consists of clustered leaves—seed-leaves. Between these cotyledons, on one side, is a young rhizome protected by the cotyledon arm (a bow-shaped, curved stem of the sprouting grass) and the root sheath, and on the other side is the upper growth point. Later, a root germinates from the



seedling's root sheath, and a cotton stalk is formed from the growth point. Regardless of the location of the seed in the soil, the initial root always grows downward. The seeds contain vegetable oils and proteins, as well as toxic substances such as gossypol and others. The shell of a ripe seed, even if it is 0.25 mm thick, is so hard that it is difficult to cut with a sharp knife, and when pressed between the teeth, a crackling sound is heard. Unripe seeds (raw seeds) are whitish in color and crumble without cracking when bitten [2].

The seeds germinate from the cell of the outer shell and are covered with two layers of fibers. Long fibers account for 30-40% of the mass of the fibrous seeds, short fibers—wool—for 5-10%, and the seeds themselves for 56-62%. The seeds are separated in gin machines, and the lint in linters. After the fiber and lint are separated, the hairs remain.

Such seeds are called hairy seeds, while seeds cleaned of hair using any method are called hairless (delinted) seeds. The cotton seeds of the Peruvian variety are covered only with long fibers and become hairless after ginning. After sowing seeds, heat, air, water, and nutrients—nitrogen, phosphorus, potassium, calcium, magnesium, and others—are necessary for normal germination and plant growth and development. The mechanical parameters of seed seeds are characterized by their absolute mass, density, size, friction coefficient, impact reflection coefficient, shape, dimensions, and moisture content.

The absolute mass of seeds is understood as the mass of 1000 dry seeds. The absolute weight of the seeds of medium-staple cotton varieties is 80–100 g, with 105–125 g seeds being the most common. Fine-staple ones weigh 120–150 g. The relative density of individual seeds is determined by immersing them in solutions, and it is within ^{the range of} 0.85–1.12 g/cm, with seeds with a density greater than 1 g/cm accounting for 82–95%. The density of free-flowing dry, hairy seeds is 290–310 kg/m³, while the density of dehaired seeds is 580–620 kg/m³; to avoid damaging the seeds, the force acting on the individual seed must not exceed 5 N. The friction coefficient of the fuzzy seeds is 0.6 for steel and 0.5 for polyethylene alcohol, respectively 0.42 and 0.25 for dehaired seeds.

In Uzbekistan, fuzzy and defoliated seeds are primarily produced. In recent years, the technology of preparing low-haired cotton seeds has also been introduced.

Seed procurement is carried out according to the "Technological Regulations for the processing of seed cotton raw materials and seed procurement." The regulation establishes the main requirements for the technology of preparing fuzzy, mechanically dehaired, and low-haired seeds, including the treatment and coating process.



Dehaired and low-haired seeds are prepared using the mechanical dehairing method. Mechanical depilation, in turn, can be carried out using single or double depilation technology. Seed treatment is primarily carried out with a medicinal suspension according to PDKI 43-2002 "Recommendations for Seed Treatment."

The quality of the seeds must comply with the requirements of the O'zDSt 663:1996 standard.

Preparation of fuzzy seed cotton

The preparation of fuzzy seeds consists of the following main processes: cleaning the seeds from impurities and external impurities, sorting them, treating them, packaging, and placing them in bags.

During the seed preparation process, fuzzy treated seeds are obtained as the primary product. Technical seeds, sorting waste, and cleaning and sorting waste containing short fluff are also collected.

Cleaning of seed seeds from impurities and foreign impurities is carried out in the CHSA seed cleaning and sorting unit, reducing the fuzziness of seeds to 6-8% using 5LP linters, and cleaning and sorting of seeds passed through linters is carried out in special sorting and cleaning machines. The cleaned and sorted seeds are treated in a seed dressing machine, packed in a weighing and packaging apparatus, and the sacks are sealed and sent to the finished product warehouse [2].

To ensure that the workshop's productivity remains at a certain recommended level, a UPS seed reception hopper was introduced into the technological process.

In order to ensure the uninterrupted operation of the fur seed preparation workshop, BDOS bunker-dosers are installed in the workshop for the temporary collection of cleaned and sorted seeds and their delivery to treatment according to standards.

Productivity of the workshop for treated fuzzy seeds - up to 3000 kgf.

Diagram of the sequence for installing the technological equipment system in the fur seed preparation workshop

1-UPS receiving hopper; 2-CHSA unit; 3-MCHT mechanical seed cleaner (included in the CHSA unit complex); 4 - cyclone; 5-distribution screw conveyor; 6- 5LP linters; 7-assembly screw conveyor; 8 - elevator; 9 - seed sorting and cleaning machine; 10-BDOS bunker dispenser; 11-seed dressing machine; 12-seed packing apparatus; 13-aspiration device for air purification; 14 – belt conveyor; 15-bag sewing machine.

Schematic layout of technological equipment in the fur seed preparation workshop



1- UPS receiving hopper; 2-CHSA seed cleaning and sorting unit; 3-VS-8 fan; 4 - SP-3 cyclone; 5-SP-6 cyclone; 6 - VS-10 fan; 7- 5LP linter; 8 - seed sorting and cleaning machine; 9-BDOS bunker dispenser; 10.16 - elevator; 11-seed dressing machine; 12-seed packing apparatus; 13 - belt conveyor; 14-bag sewing machine; 15.17 - screw; 18 - pipes.

Preparation of dehaired and low-haired seeds

According to O'zDSt 663:1996, the fuzziness of dehaired seeds should not exceed 0.5%, and the fuzziness of low-haired seeds should not exceed 2.5% [3-4].

The preparation of dehaired and low-haired seeds can be carried out in existing mechanical seed dehairing workshops and includes the processes of cleaning primary seeds from impurities, sorting, mechanical dehairing, calibration by size, treatment, packaging, and packaging.

In this case, the existing two-stage depilation method or a single-stage mechanical depilation method can be used, using the UCHDM (seed delinting machine) machine adopted by the Intersectoral Testing Commission in 2006.

In the process of seed preparation using the mechanical depilation method, in addition to depilation or low-pilation treated seeds, technical seeds are obtained, as well as cleaning, sorting, and depilation waste containing short fuzz [6].

Pre-sown seeds are poured into the UPS seed reception hopper, transferred to the CHSA unit in a specified amount, and cleaned and sorted using it; then, the seeds are calibrated in a calibrator in 1LB linters and OS lint removal machines, delinted to the required degree of lintiness, sorted by length in a trier, treated in a spraying machine, packaged in a seed packing apparatus, and the mouths of the bags are sewn on a bag sewing machine. The design capacity and productivity of the workshop depend on the fuzziness of the initial seeds and the number of 1LB and OS depilation machines used [6]. For example, 4 1LB and 6 OS machines are installed in the workshop; for a case where the fuzziness of the initial seeds is 8.5%, the productivity of this workshop for the prepared product (treated seeds) averages:

- for defoliated seeds - 1800 kgf;
- for low-haired seeds, it is 2400 kgf.

Schematic of the installation sequence for the technological equipment system for preparing two-stage dehaired and low-haired cotton seeds

1 - UPS receiving hopper; 2-CHSA unit; 3 - mechanical seed cleaner MCHT (included in the complex of the CHSA unit); 4 - distribution screw conveyors; 5 - cyclone; 6 - elevator; 7-calibrator; 8 - trier; 9-elevator; 10 -



BNOS bunker for the collection and rationing of debarked cotton seeds; 11-seed dressing machine; 12-aspiration units for cleaning polluted air; 13-seed packing apparatus; 14-bag sewing machine; 15 – assembly conveyor; 16 – OS seed hair removal machine; 17-elevator; 18 - linter 1LB without a grate; 19 - assembly screw conveyor;

Analysis of the technological process of primary processing of cotton and its seeds shows that the preservation of the initial natural quality indicators of the product during the technological process of primary processing of cotton and its products depends on each technological machine. In particular, taking into account that the force acting on a single seed should not exceed 5 N to prevent damage to the seeds during the technological process of seed preparation, it can be achieved to obtain high-yielding seeds for the next year by separating the fiber from the seeds, sorting and cleaning the seeds, and preparing seeds.

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