# DESIGN AND DEVELOPMENT OF AN IMPROVED SS-15A SEPARATOR

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***Abstract.*** *It is to preserve the natural properties of cotton based on the study of the existing separator construction in cotton gins and the development of a separator with a new guide device and an improved mesh surface.*

***Keywords:*** *cotton, air separation, separator, vacuum valve, seed, pneumatic transport, free fiber.*

**Introduction.** It is known that the SS-15A type separator is widely used in the cotton ginning industry, and its operation is mainly based on the principle of air in an aerodynamic state. In the SS-15A separator, the cotton moves along with the air flow sucked through the mesh surface with the help of a fan, hits the mesh surface and is separated by scrapers and thrown into the vacuum valve.

The improvement of the SS-15A separator was carried out in the following directions:

At the entrance of the separators, the cotton layer does not hit its right back wall at a high speed, and it is equally distributed along the working lengths of the vacuum valve, and the main goal is to preserve the natural properties of the cotton falling into the vacuum valve. In the present case, it causes the cotton mass to hit the rear wall of the separator with force, as a result of which the mechanical increase of the seed occurs. This is one of the shortcomings that causes mechanical damage to the seeds, rapid corrosion of the back wall of the separator, and a decrease in the service life of the separator. Long-term operation of the pneumatic transport due to the prevention of premature failure of the surface of the inner wall of the separator and the vacuum valve by eliminating the incoming air cotton hitting the right SS-15A separator wall and directing it to the vacuum valve, reducing its speed to 7-8 m/s The main goal is to create a separator that provides

The purpose of the proposed improved separator is to use a new guide device in the separator structure to preserve the natural properties of the cotton and significantly extend its life. In the separator, a sheet metal guide is installed to ensure the stability of the equipment by filling with the device installed in the inlet of the air separation chamber.

In order to increase the performance of the equipment along the circuit connecting the air pipe with the separator, the diverter is installed with the help of existing bolt fasteners, in addition, the installation of the diverter, especially the possibility of its easy replacement, allows to increase the service life of the separator. If the diverter fails, it can be easily replaced with a new one, while reducing the impact of the raw cotton on the partition wall.

The essence of the proposed device is that the separation chamber of the separator is equipped with a diverter, which allows changing the direction of the cotton raw material being conveyed. When the cotton raw material is piped to the entrance area of the separation chamber, the built-in diverter allows us to change the direction of the cotton raw material not to the back wall of the separator, but to the increased packing zone of the cotton raw material, that is, to the central part of the mesh surface, that is, to the vacuum valve.

The cotton separator has a separation chamber, in the working part of which there is a mesh surface with scrapers, in the lower part of the chamber there is a rubber vacuum valve. A diverter is installed at the entrance of the separator chamber. In this case, the guide is made of a metal sheet with a thickness of d = 2 mm and is installed so that it oscillates around its axis. In addition, the angle of rotation of the guide relative to the center of the incoming cotton movement is a = 25° ÷ 35°.

**Posing the matter.** A cross-section of the improved diverter separator is shown.

The separator works as follows: a cotton inlet box-along with the air flow through 2, it enters the separation chamber 1. When the main amount of cotton enters the separation chamber, it is directed to the scraper 6, reducing its speed through the guide 3, and is discharged from the separator by means of a vacuum valve. The remaining 30-40% of the cotton moves towards the mesh surface together with the air flow. In this case, the main cotton mass is directed to the vacuum valve through the 250-degree deviation angle installed after the nozzle, as a result of which the speed is reduced by 30-35%, the mechanical damage to the seed is reduced, the straight wall is prevented, and the distribution of cotton through the vacuum valve is improved. The cotton stream coming from the inlet pipe hits the diverter 3. In order for the impact not to be strong, the guide is made in an arc shape along the flow, and the direct impact of the cotton flow on the back wall 8 of the separator is prevented.

The main flow of cotton moves along the surface of the guide and is directed directly to the central part of the mesh surface, as a result, the main flow of cotton is directed to the vacuum valve 7 without going to the rear wall of the separator, overcoming the suction force of the air.

It is clear from the above scheme that the advantage of the proposed improved separator with a diverter is that the diverter device directs the cotton stream to the correct vacuum valve, preventing the cotton stream entering from the inlet pipe from hitting the back wall of the separator. Improvement of the separator design, reduction of the friction force between the cotton fibers and the hole surfaces of the perforated discs, as well as the selection of the necessary ratio of the values of the diameters of the bases of the conical holes in the grid are the proposed new hole construction.

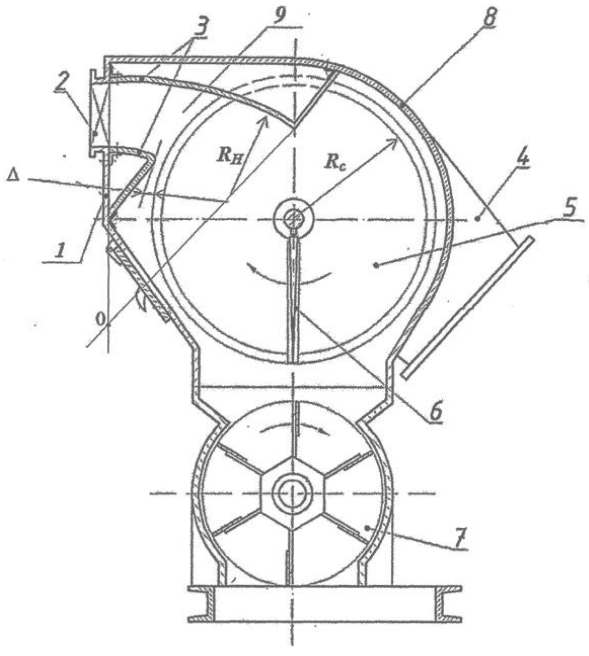


**Fig.1. Cross-sectional view of the separator.**

It consists of a separation chamber with branched inlet and outlet pipes, perforated disks (net) on the side walls of the chamber, in which the holes in the disks are made at an angle of 45-60° relative to the horizontal, and cotton raw material containing scrapers with belt shovels, mounted on the extension shaft, falling on the disks. separator is proposed. The holes of the perforated disks are made in a conical shape with a curved surface, in which the ratio of the diameters of the hole bases is chosen as $d_2=(1.15\div1.25)d_1$ , where $d_1$ is the diameter of the small base, $d_2$ is the diameter of the large base.

The main purpose of this proposed separator is that the cotton fiber passes through the surface holes as a result of the air suction in the mesh surface holes in it. As a result, when separating seeded cotton from the mesh surface using a scraper, the fibers passing through the hole are cut off and come out together with the air. A mesh surface construction made in the same approach prevents fiber breakage. Figure 2 shows the improved separator longitudinal shear scheme. Figure 5 shows the view of the mesh surface opening in the new construction. The seed cotton separator consists of body 1, inlet 2 and outlet 3 nozzles, and consists of a vacuum-valve grid. The body 1 has a cylindrical chamber 5 and a mesh surface 6 on both sides. There is a scrubber 7, which is mounted on a shaft 8, to remove seed cotton from the mesh surface. Making mesh surface holes in the form of $d_2=(1.15\div1.25)d_1$ and having mesh surface holes at a slope of 45-60° prevents fiber breakage, as a result, allows cotton to preserve its natural properties.

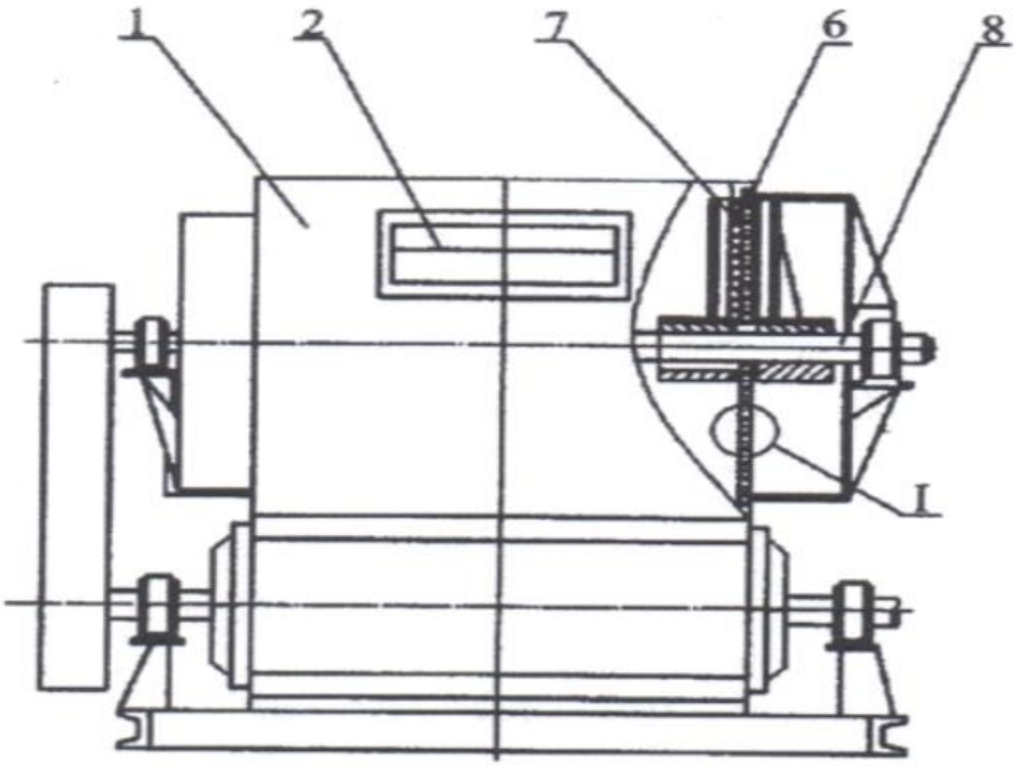


**Fig.2. Improved separator longitudinal shear scheme.**

In order to test this, an improved separator with a diverter and a new construction of a mesh surface was prepared, and test works were carried out at the Kumkurgan LLC cotton ginning enterprise of Surkhandarya region.

The solution. The tests used a simple SS-15A separator located at the top of the drying drum and an improved SS-15A separator installed in the UXK cleaning stream.

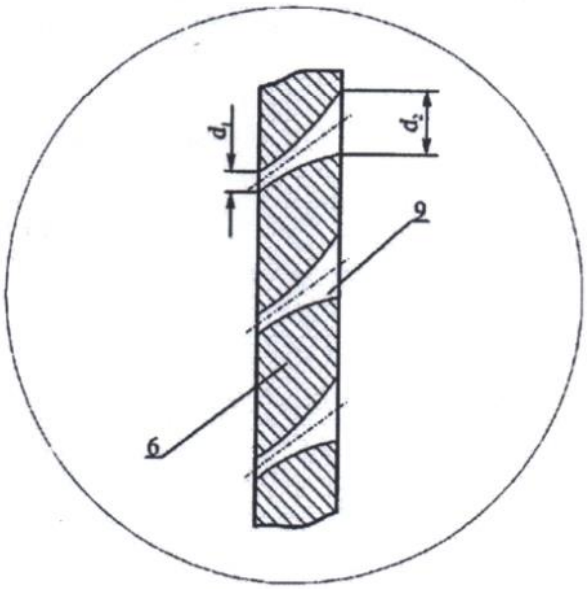


**Fig.3. Clipping scheme of the mesh surface**

The amount of fiber added to the waste was selected as the main object of analysis, and the following method was used to determine its amount. During 40 minutes of working time, the waste separated in the dust collector was collected in a mesh bag and its weight was determined with an accuracy of 0.01 g. Then this waste was passed through a 3x3 mm mesh screen to remove all impurities. The remainder was fiber, which was then weighed on a weight scale.

And the level of mechanical lat eating of the seed was determined based on the existing method. Cottons of industrial grade I, III, IV and V were used in the experiment. In the experimental testing of the separators, cotton from one gram was used.

Bukhara-102 selected cotton variety is used in the experiment. The dirtiness of industrial grade I cotton is 2.15%, moisture level is 8.2%. The dirtiness of industrial grade III cotton is 3.98%, the moisture level is 10.90%, the dirtiness of industrial grade IV cotton is 6.8%, the moisture level is 14.0%, and the dirtiness of industrial grade V cotton is 12.4%, and the moisture level is 16.5%. Air consumption was the same in both separators, and the efficiency was 10-15 t/s.

As can be seen from Table 1, the mass of fibers added to the waste composition of the improved separator was 0.56 kg/h when cottons of grade I were passed through the separator, and 1.65 kg/h for cotton of grade III. Compared to a simple separator, it was 0.33 kg/h for I grade cotton and 0.92 kg/h for III grade cotton.

The results obtained in the experiments are presented in Table 1.

**Table 1**

**Actual test results of improved separator with SS-15A separator.**

| The sort of cotton | The brand of separator | The amount of mechanical damage to the seed, % | The amount of fiber separated from the waste composition | The degree of dirtiness and moisture of cotton,% |
|---|---|---|---|---|
| I | CC-15A | 1,12 | 0,70 | 3=2,15<br>W=8,2 |
| | Improved separator | 1,0 | 0,40 | 3=2,15<br>W=8,2 |

| | | | | |
|---|---|---|---|---|
| II | CC-15A | 1,31 | 1,18 | 3=3,0<br>W=9,3 |
| | Improved separator | 1,21 | 0,76 | 3=3,0<br>W=9,3 |
| III | CC-15A | 1,5 | 1,70 | 3=3,98<br>W=10,90 |
| | Improved separator | 1,28 | 0,95 | 3=3,98<br>W=10,92 |
| IV | CC-15A | 2,17 | 4,0 | 3=6,8<br>W=14,0 |
| | Improved separator | 1,67 | 2,5 | 3=6,8<br>W=14,0 |
| V | CC-15A | 3,5 | 4,4 | 3=12,4<br>W=16,5 |
| | Improved separator | 2,17 | 3,0 | 3=12,4<br>W=16,5 |

It is known that the degree of mechanical damage to the seed is one of the main indicators when separating cotton from air. In the experiments, this indicator was determined both in the simple SS-15A separator and in the improved version. The obtained results are presented in the form of a histogram in Figures 4 and 5.

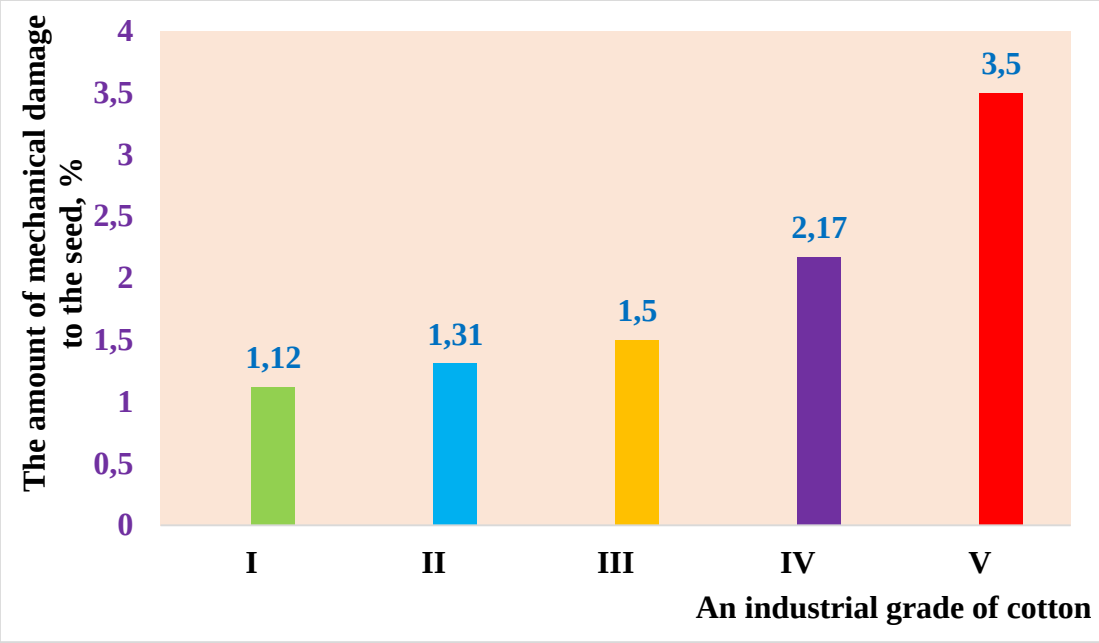


**Fig.4. The degree of mechanical damage to the seed by the varieties of cotton using the SS-15A separator.**

Figure 4 shows the results obtained in the simple version of the SS-15A separator. As can be seen from this obtained histogram, there is a certain relationship between the degree of mechanical damage to the seed according to the types of cotton, when the mechanical damage of the seed increased by 1.32% in industrial grade I cotton passing through the separator, in grade II - by 1.41%, in grade III - by 1.41% - by 1.52%, in type IV - by 2.07% and in type V by 3.38%. When cotton from the same batch was passed through the improved SS-15A separator, the degree of mechanical damage to the seed decreased by about 15-18%.

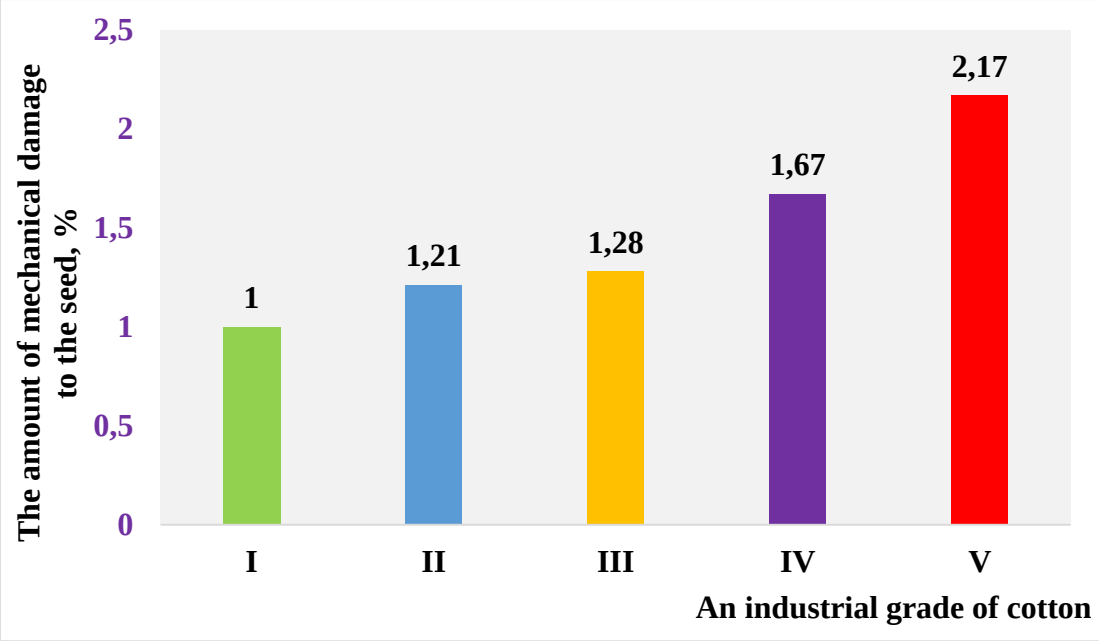


**Fig.5. The degree of mechanical damage of the seed by cotton varieties in the improved separator.**

The obtained results are available in the histograms presented in Figure 5. The degree of mechanical damage of the cotton passed through the improved SS-15A separator was equal to the following amounts according to the varieties:

It was equal to 1.08% in I grade cotton, 1.21% in II grade cotton, 1.38% in III grade cotton, 1.87% in IV grade cotton and 2.57% in V grade cotton. Now, the next main indicator is the amount of short fiber in industrial cotton varieties, this indicator is also important, and this indicator is directly related to the length of the fiber and the degree of fiber output.

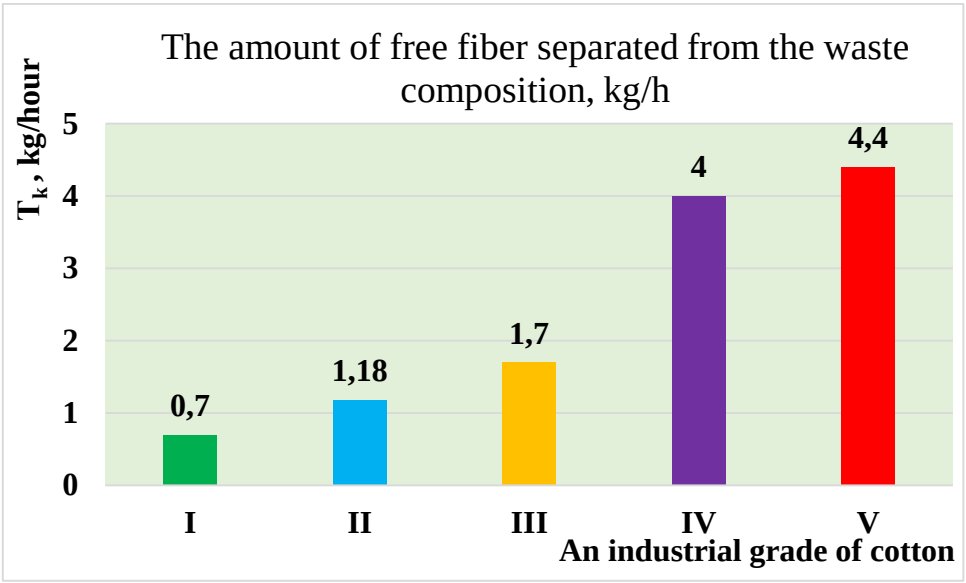


**Fig.6. Changes in the amount of short fibers in the SS-15A separator according to the industrial grades of cotton.**

Figure 6 shows the change in the amount of short fibers as a result of the extraction of cotton from a simple separator.

As can be seen from this histogram, the amount of short fiber when passing cotton of grade I is 0.7 kg/hour, in cotton of grade II it is 1.18 kg/hour, in cotton of grade III it is 1.78 kg/hour, and cotton of grade IV is 2.07 kg/hour. hour and 2.28 kg/hour in grade V cotton. $k_k$

The change of these indicators is also presented for the cotton varieties passed through the improved separator given in Figure 7. In this histogram, the amount of short fiber by species is equal to: 0.46 kg/h in grade I cotton; 0.76 kg/h in grade II cotton; 1.05 kg/hour in grade III cotton; It was 1.16 kg/h in IV grade cotton and 1.32 kg/h in V grade cotton. Comparing the histogram in Fig. 6 with the histogram in Fig. 7, it was found that the amount of short fiber in the improved SS-15A separator is about 23-30% less.

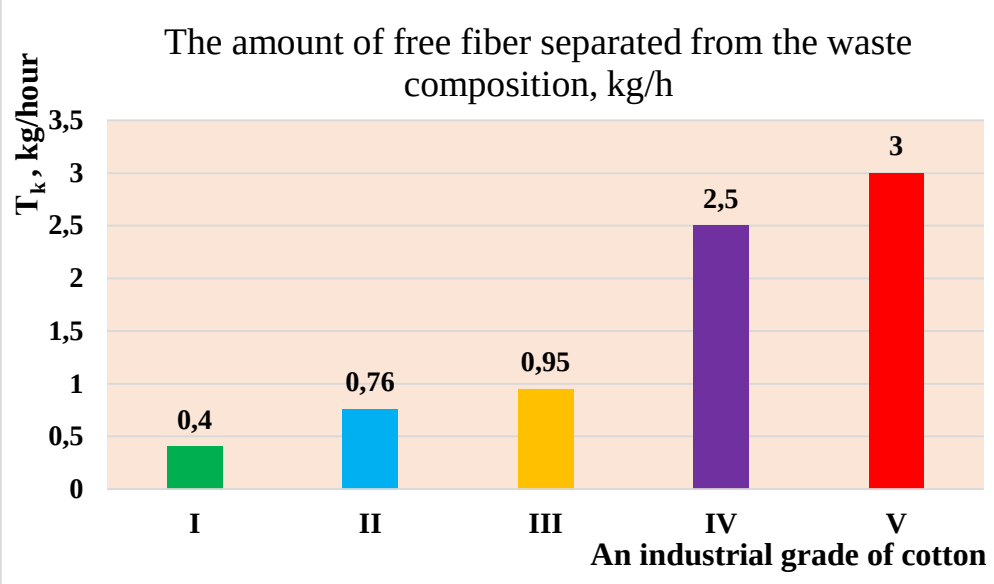


**Fig.7. Changes in the amount of short fiber by industrial varieties of cotton in an improved separator.**

**Conclusion.** So, in conclusion, it should be said that the improved new design of the separator proposed by us has been improved in 2 directions, firstly, the discovery of a new design guide that moves the cotton flow entering the separator directly to the vacuum valve without reaching its back wall, and secondly, by expanding the holes of the mesh surface and A 55° slope prevents fiber breakage and reduces mechanical damage to the seed. In general, it allows cotton to maintain its natural properties.

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