A study of the effect of changes in seed comb construction on the quality of cotton seed

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Abstract. In Uzbekistan, cotton is a significant agricultural product, serving as raw material for the textile industry and oil factories. Ensuring the quality of cotton fiber and seed is crucial, and this study investigates the factors affecting seed quality during cotton processing. The focus is on the working chamber of the ginning machine, which separates fiber from seed. The study examines the effects of seed comb tooth shape and angle relative to the horizon on seed quality. The research identifies factors causing a decrease in seed quality during ginning and proposes changing the shape of seed comb teeth to mitigate this issue. The study also investigates the effect of seed comb location on seed quality and recommends using seed combs with additional slits to accelerate the exit of fiber-picked seeds from the working chamber. This approach ensures high-quality cotton seed suitable for oil plants and seed planting in fields. The study's findings contribute to improving cotton processing and ensuring the quality of cotton seed in Uzbekistan.

1 Introduction

Since the independence of our republic, the rapid development of the production of finished products with high added value based on the deep processing of raw cotton in our country, the improvement and modernization of the technology of the cotton ginning industry, the improvement of the production efficiency of cotton products in the domestic and foreign markets, the percentage of cotton fiber yield, and the quality indicators of cotton seed increase By increasing the percentage of spinnable fibers, reducing the percentage of short fibers, and improving other quality indicators, special attention is paid to ensuring the competitiveness of the manufactured products. In this regard, significant results have been achieved in the restoration of cotton ginning machinery, the establishment of the production of the necessary equipment and technologies in our country, including cleaning cotton from large and small impurities, machines for separating fiber and lint from seed and seed sorting devices, packing (pressing) cotton products) equipment and enterprises that manufacture components for them and provide them with service have been launched.

In front of experts in the field, while maintaining the natural quality of the products obtained from the primary processing enterprises of cotton in Uzbekistan, increasing the

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production potential of productivity in textile and oil enterprises, as well as farms, as well as providing the above enterprises for as long as possible while satisfying the population's demand for textile and light industrial products, as well as cotton oils. there is an important issue [1-4].

In this regard, in the third priority direction of the Action Strategy for the further development of the Republic of Uzbekistan, put forward by the President of the Republic of Uzbekistan Sh.M. Mirziyoev, special attention is paid to the issues of "Modernization and rapid development of agriculture" and to increase the production of winter agricultural products, their storage and processing the need to create new capacities is determined.

A number of scientific research works have been carried out to maintain the quality of the product and increase the productivity of the machine during the technological process of fiber separation and seed and technical seed preparation.

In order to improve the structure of the seed comb in order to remove the fully separated seeds from the working chamber faster to preserve its quality indicators, the construction of the seed comb in three variants was prepared and experiments were conducted at the Sofiqishloq cotton ginning enterprise of "Alyorteks" LLC, Jalakuduq district, Andijan region [5].

2 Methods

New constructions of seed combs prepared for experiments are presented in the following figure (Figure 1, a, b, c).

a) Option 1 b) Option 2 c) Option 3

Fig. 1. Improved seed comb designs.

Figure 1 shows that the construction of the seed comb of the existing option 1, the new seed comb of the oval shape in the option 2, and the new seed comb of the rectangular shape in the options 3 were prepared with additional slots in order to accelerate the exit of the seeds from the working chamber.

The seed comb of the new construction was installed on the fiber separation machine, and after the machine started working at full voltage, an experiment was conducted for 5 minutes, the seeds coming out of the working chamber were weighed, and the effect of the seed combs of the new construction on the amount of seed coming out of the working chamber and its hairiness was determined. For the experiments, the An-36 selective variety of cotton was

carried out in three repetitions in the 1st grade 2nd grade and 4th grade 1st grade cottons [6-7].

3 Results

Figure 2 shows the histogram of the dependence of the gin equipment on the seed comb design. As can be seen from the histogram, when processing 1st grade cotton, the seed productivity of the gin equipment was 2087 kg in the 1st option, and 2401 and 2505 kg in the 2nd and 3rd options. When processing 4 types of cotton, the productivity of gin equipment is 1540; 1771 and 1848 kg.

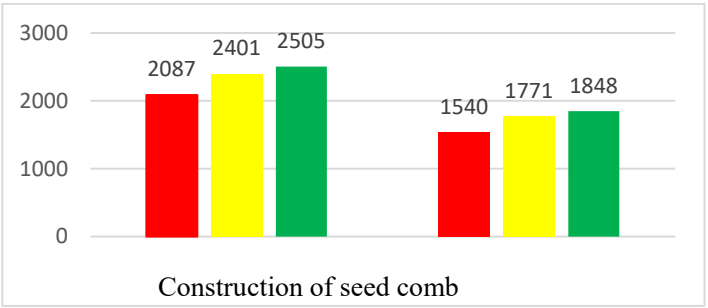

Fig. 2. Histogram of the dependence of the productivity of the sawmill on the seed on the construction of the seed comb.

Figures 3 and 4 show a histogram of the dependence of the productivity of the gin equipment on the seed on the location of the seed comb. As can be seen from the histogram in Fig. 3, when using the seed comb in the construction of option 1 and the location of the seed comb relative to the horizon is 20^0, the working productivity of the seed equipment is 2080 kg, while the seed comb is 30^0 and 40^0 when the seed comb is located relative to the horizon. productivity increases to 2128 and 2146 kg. Similarly, when using the construction of the seed comb prepared in the 2nd option, the productivity of the gin equipment is 2380 depending on the angle of the seed comb with respect to the horizon; 2410 and 2456 kg.

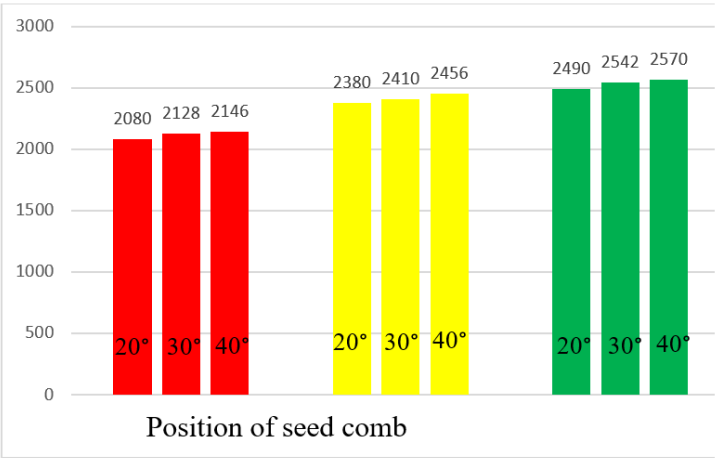

Fig. 3. Histogram of the dependence of seed productivity on the location of the seed comb (row 1).

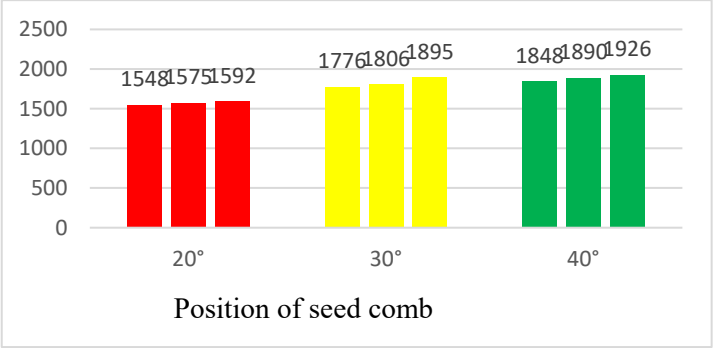

Fig. 4. Histogram of the dependence of the productivity of the seeding equipment on the location of the seed comb (sort 4).

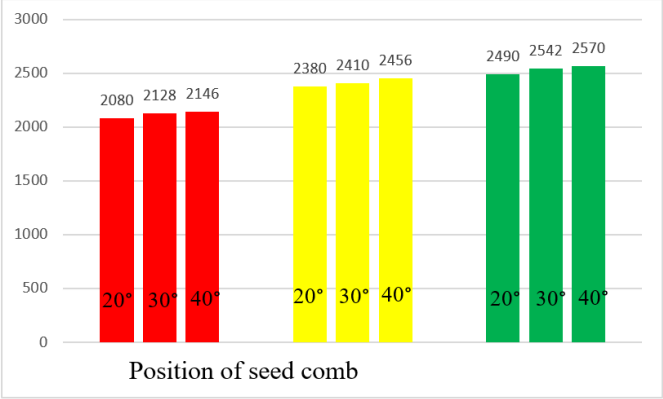

Fig. 5. Histogram of the dependence of seed productivity on the location of the seed comb (row 1).

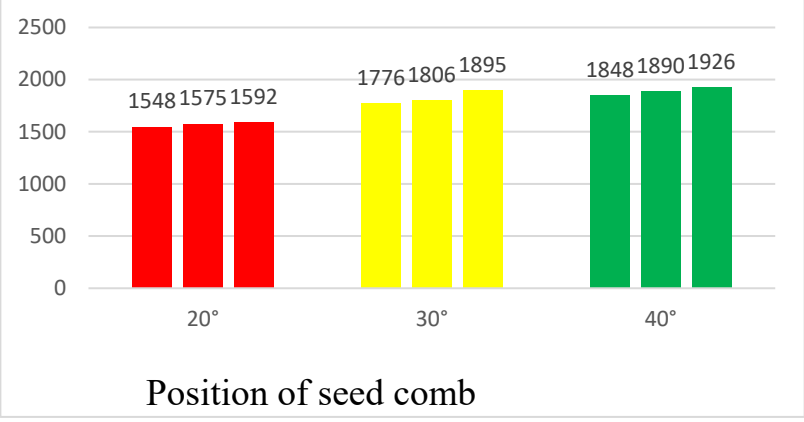

Fig. 6. Histogram of the dependence of the productivity of the seeding equipment on the location of the seed comb (sort 4).

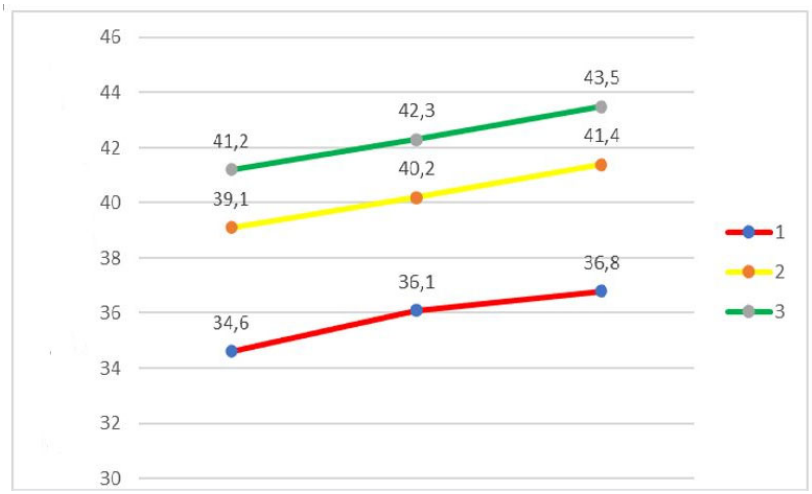

Fig. 7. Graph of the dependence of the amount of seed coming out of the working chamber on the design of the seed comb.

When using the construction of the seed comb prepared in 3 options, this indicator is 2490; It is expected to increase to 2542 and 2570 kg [8].

If we analyze the histogram in Figure 4, we will see the following. When 4th grade cotton was processed using the construction of the seed comb made in the 1st option, the seed productivity of the gin equipment was 1546 kg when the position of the seed comb relative to the horizon was 20^0, while the position of the seed comb relative to the horizon was 30^0 and 40^0 when it was established, the productivity of the seed equipment is 1575 and 1591 kg.

When using the construction of the seed comb prepared in options 2 and 3, it is observed that the productivity of the seed equipment increases from 1848 kg to 1890 and 1926 kg.

Figure 7 shows the graph of the dependence of the amount of seed coming out of the working chamber on the design of the seed comb. As can be seen from the graph, when the seed comb prepared in option 1 is located at 20 $^{0\text{ relative to the horizon}}$, that is, when the distance between the seed comb and the colosnik is 20 mm, 34.6 kg of seed came out of the working chamber within 5 minutes, when using the construction of the seed comb prepared in option 2. When 39.1 kg and 3 variants of seed comb construction are used, it is observed that 41.2 kg of fully separated seeds leave the working chamber. 36.1 kg when using the seed comb made in option 1, 40.2 kg in option 2, and 42.3 kg when using the seed comb made in option 3, with the location of the seed comb in relation to the horizon being 30 ^{0}, it was observed that the fully separated seeds leave the working chamber, when the seed comb is located at 40 ^{0} to the horizon , 36.8 from the working chamber; 41.4 and 43.5 kg of fully extracted seeds are observed to leave the working chamber. The obtained results show that increasing the location of the seed comb relative to the horizon from 20 ^{0} to 40 ^{0}, that is, increasing the distance between the seed comb and the colosnik from 20 mm to 26 mm, increased the amount of seed leaving the working chamber by 2.1-2.3 kg, 2 and 3 it is observed that when using the seed comb prepared in the options, the amount of fully separated seed from the working chamber increases to 6.5-7.0 kg.

4 Discussion

In the existing sawing gin equipment, completely de-fibered seeds are discharged from the working chamber through a narrow slot of 18-21 mm between the seed comb and the colostrum surface. This limited slitting space fails to guarantee the prompt exit of fully

plucked seeds from the machine. Consequently, the working chamber experiences the emergence of multiple factors that detrimentally impact equipment productivity and lead to heightened mechanical seed damage. Issues like crushing, breakage, and contamination arise within the seeds, resulting in a decline in their quality indicators.

The most important aspect of this research work is that the seed comb fiber with a new additional seed exit slot avoids the above shortcomings by ensuring timely exit of fully plucked seeds from the working chamber.

5 Conclusion

The study's findings indicate that the defects in cotton seeds, such as crushing, breaking, and dirtiness, are primarily influenced by the seed comb's construction rather than its horizontal positioning. The most favorable results were observed in the experiments conducted on the seed comb's 3rd design option, with a 40-degree deviation from the horizon.

The modifications in the seed comb's construction resulted in increased productivity of gin equipment in terms of fiber, from 10.1 kg/saw hour in the existing design to 11.62 kg/saw hour in the oval design and 12.12 kg/saw hour in the rectangular design.

Furthermore, adjusting the seed comb's position relative to the horizon, specifically increasing the distance between the seed comb and the colostrum from 20 mm to 26 mm, led to a 2.1-2.3 kg increase in seed discharge from the working chamber. This adjustment resulted in a rise in the amount of fully separated seeds from the working chamber to 6.5-7.0 kg.

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