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THE CONDITION OF COTTON SEEDS EXITING THE GIN MACHINE AND ITS EFFECT ON COTTON FIBER QUALITY

Shalola Ubaydullo qizi Anafiyeva
Assistant Lecturer, Andijan State Institute of Technology

Abstract: This article analyzes the condition of cotton seeds exiting the gin machine and their impact on cotton fiber quality within. During the research, quality indicators of fibers were studied based on factors such as surface smoothness of the seeds, deformation, and ejection speed. The analysis is supported by graphs and tables to determine optimal processing conditions.

1. Introduction

The cotton industry is one of the vital sectors of Uzbekistan's economy, and improving the quality of cotton fiber requires thorough examination of each stage of the technological process. Gin machines play a critical role in separating the fiber from the seed. The condition in which the seeds exit these machines directly affects fiber quality.

Research shows that factors like seed smoothness, level of deformation, rotational speed, and comb distance influence fiber cleanliness, length, and the likelihood of breakage.

2. Methodology

2.1 Research Objects

The study was conducted on a DR-109B model gin machine used at a modern cotton cleaning plant in the Tashkent region. Samples were analyzed based on different machine settings.

2.2 Operating Conditions

The study analyzed cotton seeds and fibers processed under the following settings:
- Optimal setting: 1200 RPM, 3.2 mm comb distance
- High rotational speed: 1500 RPM
- Very close comb setting: 2.0 mm
- Low speed + appropriate distance: 1000 RPM and 3.5 mm
- Dry and brittle seeds: moisture < 8%

3. Results

Gin Parameter	Seed Condition	Fiber Length (%)	Breakage Probability (%)	Quality Rating (1–5)
Optimal setting	Undeformed	95	3	4.8
High rotational speed	Crushed	82	10	3.5
Very close comb setting	Compressed	78	13	3.0

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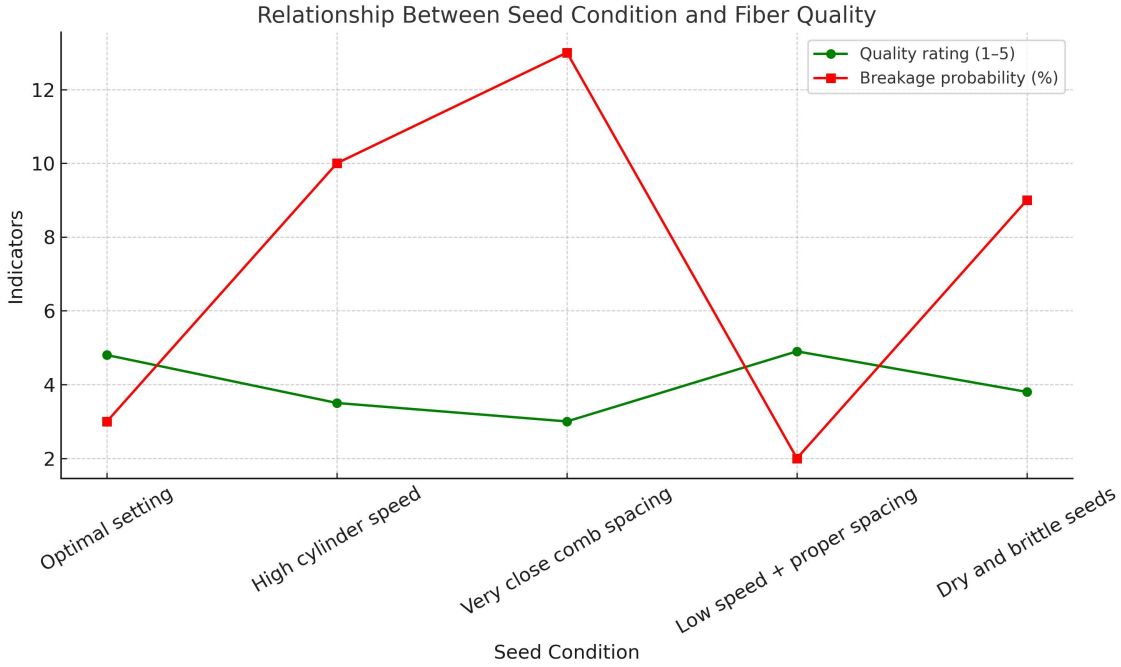
Low speed + proper spacing	Good condition	96	2	4.9
Dry and brittle seeds	Broken	84	9	3.8

The graph below illustrates the relationship between seed condition and fiber quality.



4. Discussion

The research yields the following key conclusions:
- Optimal settings: seeds exit undeformed, maximum fiber length, minimal breakage.
- High rotational speed: seeds are crushed, resulting in short and uneven fibers.
- Very close comb setting: seeds become compressed, causing fiber stretching and breakage.
- Brittle seeds: structural failure leads to shorter fibers.

Statistical analysis reveals a strong negative correlation between fiber length and seed deformation ($r = -0.79$). This means the more the seed is deformed, the shorter the fiber becomes.

5. New Approaches and Proposals

Based on the research, the following proposals are suggested:
1. Real-time monitoring of seed ejection using infrared sensors
2. Equipping gin combs with elastic coatings
3. Implementing systems to monitor seed temperature in real-time
4. AI-based control systems for automatic adjustment of machine settings

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6. Conclusion

The mechanical condition of seeds exiting the gin machine directly affects cotton fiber quality. By selecting optimal operating parameters, fiber length and smoothness can be maximized while breakage is minimized. The technological suggestions presented in this study aim to improve the efficiency of the cotton industry.

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