

**EFFECT OF DRYING AND CLEANING PROCESSES ON HVI FIBER QUALITY
PARAMETERS OF MACHINE-HARVESTED ANDIJAN-35 COTTON**

Sulaymonov Rustam Shennikovich

Fiber Crops Research Institute, Tashkent, Uzbekistan

Aliyev Olimjon Oribjon o'g'li

Isaxanov Xamidulla

Namangan State Technical University, Namangan, Uzbekistan

ABSTRACT:

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The study examines the influence of drying and cleaning operations on the fiber-quality profile of machine-harvested Andijan-35 cotton, with emphasis on High Volume Instrument (HVI) indicators. The paper combines: (i) published evidence on the response of machine-harvested cotton to moisture control and mechanical cleaning; (ii) HVI 900-SA anchor data supplied for Andijan-35; and (iii) a clearly identified calculated comparative dataset used to design the stage-wise experimental analysis for machine-harvested material. The evaluated HVI parameters include upper-half mean length (UHML), uniformity index (Unf), short fiber index (SFI), micronaire (Mic), elongation (Elg), strength (Str), reflectance (Rd), yellowness (+b), trash code (Trash), trash particle count (Cnt), and trash area (Area). Published research indicates that machine harvesting generally increases foreign matter loading and therefore increases the need for cleaning, while excessive drying and aggressive cleaning can reduce length and uniformity and increase short-fiber content. The supplied Andijan-35 HVI anchors show that the forked-peg cleaning variant reduced Trash from 4.6 to 4.0, Cnt from 10 to 8, and Area from 0.8% to 0.4% relative to the selected conventional 1XK row, while Unf, SFI, Str, and Rd remained favorable.

The paper proposes a stage-wise protocol for validating these tendencies specifically for machine-harvested Andijan-35 cotton.

1. INTRODUCTION

Mechanized cotton harvesting substantially increases field productivity, but the harvested seed cotton may contain more leaves, burs, stems, soil particles, and other foreign matter than carefully hand-picked material. Consequently, machine-harvested cotton normally requires a well-controlled sequence of drying and seed-cotton cleaning before ginning. The central technological problem is therefore not simply to maximize foreign-matter removal, but to achieve adequate cleaning while preserving the intrinsic fiber properties established in the field.

The Cotton Ginners Handbook emphasizes that moisture management and machinery selection are interdependent. Higher fiber moisture during processing tends to preserve fiber length and strength, whereas somewhat lower moisture improves cleaning efficiency. Current recommendations therefore treat drying as a compromise rather than as an independent operation. Excessive drying, particularly when followed by intensive mechanical cleaning, can make fiber more susceptible to breakage and can increase short-fiber content.

Research on spindle-harvested Upland cotton has shown that seed-cotton cleaning can remove a meaningful fraction of foreign matter, while subsequent lint cleaning removes additional trash. However, aggressive saw-type lint cleaning can improve color and trash measurements at the expense of length, length uniformity, and short-fiber characteristics. Studies on machine-harvested cotton have also reported that repeated cleaning can damage fiber strength in some lots and that the response depends on the cleanability of leaf material.

Andijan-35 is an Uzbek medium-staple Upland cotton cultivar that has been repeatedly used in fiber-quality and processing studies. Published work has examined its response to drying methods, separator systems, ginning equipment, and HVI-based quality evaluation. This makes Andijan-35 a suitable cultivar for investigating the interaction between machine harvesting, drying, and cleaning.

The objective of this paper is to develop an IMRAD-based analysis of how drying and cleaning can influence HVI fiber-quality parameters of machine-harvested Andijan-35 cotton, to analyze the supplied Andijan-35 HVI 900-SA results, and to formulate a stage-wise experimental framework for verifying the machine-harvested treatment under controlled conditions.

2. LITERATURE REVIEW

Machine harvesting and foreign matter. The revised Cotton Ginners Handbook distinguishes selective spindle pickers from non-selective stripper harvesters. Spindle pickers remove seed



cotton primarily from open bolls and therefore collect less unwanted material than strippers, although both systems require careful setup and maintenance. For the present study, the term “machine-harvested” should therefore be accompanied by the exact harvester type in the final experimental protocol.

Drying and moisture control. Cotton ginning literature consistently shows that drying is necessary when incoming seed cotton is too moist for effective cleaning and stable gin operation. Nevertheless, overdrying is undesirable. A review of gin machinery effects reports that fiber moisture of approximately 6–7% at the gin stand better preserves length and strength, while 5–6% may be needed when cleaning efficiency is the dominant requirement. Thus, drying temperature and final moisture should be recorded for each experimental lot rather than treated as an unmeasured background factor.

Cleaning intensity. Van der Sluijs reported that seed-cotton cleaning stages in gins processing predominantly spindle-harvested irrigated Upland cotton removed approximately 20–40% of seed-cotton trash, whereas more aggressive lint cleaning improved trash and color but could negatively affect length, uniformity, short-fiber and nep characteristics. Tian et al. likewise showed that seed-cotton cleaning of machine-harvested cotton had variable effects on strength, with damage related to leaf adhesiveness.

Andijan-35-specific evidence. A recent study devoted specifically to Andijan-35 and Andijan-36 examined how convective and contact drying methods affect fiber elasticity, length, color, and moisture-related quality indicators. Other studies used Andijan-35 in HVI 900-SA assessments before and after separator treatment, confirming that HVI analysis is appropriate for detecting changes in length, uniformity, SFI, micronaire, elongation and trash area during cotton-processing operations.

These studies support a process-oriented approach in which machine harvesting, drying, seed-cotton cleaning, ginning and lint cleaning are considered as sequential sources of quality change. They also show why the experimental design should include intermediate sampling points rather than only comparing the initial cotton with the final bale.





Figure 1. Conceptual illustration of the proposed experimental workflow

3. MATERIALS AND METHODS

Study material. The target material is machine-harvested Andijan-35 cotton classified in the project as grade I, class II. The final manuscript should identify the harvester type, field or production lot, initial moisture, initial foreign-matter content, sampling mass, number of replicates, and the dates and locations of processing. These details are essential because the currently supplied HVI documents establish the Andijan-35 fiber-quality anchors but do not independently identify every HVI row as a machine-harvested replicate.

Processing sequence. The experimental sequence is organized as: machine harvesting → field/pile sample → drying → conventional cleaning → cleaning with the proposed forked-peg drum → ginning/fiber preparation → HVI analysis. Samples should be sealed and coded immediately after each stage to prevent mixing of treatment groups.

HVI measurements. The HVI quality vector includes UHML, Unf, SFI, Mic, Elg, Str, Rd, +b, Trash, Cnt and Area. The supplied Andijan-35 document reports natural fiber and several processing rows measured using an HVI 900-SA system. For the present article, those values are treated as measured HVI anchors. The stage-by-stage machine-harvested table is explicitly identified as a calculated comparative working dataset and must be replaced or confirmed with the corresponding laboratory protocols before journal submission.

Data processing. Relative change was calculated as $\Delta = (X_{\text{after}} - X_{\text{before}}) / X_{\text{before}} \times 100\%$. For indicators where a lower value is technologically favorable (SFI, Trash, Cnt and Area), a negative Δ represents improvement. Graphical analysis was prepared as line profiles, grouped



histograms, normalized heatmaps and relative-change plots. The heatmap follows a MATLAB-style normalized representation with the first stage set to 100%.

Statistical requirement. A publishable inferential analysis requires at least three independent experimental replicates for each stage. Mean, standard deviation, coefficient of variation, analysis of variance and an appropriate post-hoc comparison should be added when individual replicate values become available. No p-values are fabricated in this draft.

4. RESULTS

The supplied Andijan-35 HVI 900-SA dataset provides a natural-fiber reference of UHML 1.18 in, Unf 86.5%, SFI 3.1%, Mic 4.4, Elg 7.6%, Str 32.8 gs/tex, Rd 75.3%, +b 8.8, Trash 3.0, Cnt 3, and Area 0.3%. The selected conventional 1XK row gives UHML 1.15 in, Unf 84.4%, SFI 5.6%, Mic 4.5, Elg 7.4%, Str 31.4 gs/tex, Rd 73.2%, +b 9.1, Trash 4.6, Cnt 10 and Area 0.8%. In the forked-peg variant, the corresponding values are UHML 1.15 in, Unf 85.6%, SFI 4.8%, Mic 4.5, Elg 7.4%, Str 31.9 gs/tex, Rd 74.8%, +b 8.2, Trash 4.0, Cnt 8 and Area 0.4%.

Table 1. Supplied HVI 900-SA anchor values for Andijan-35 fiber

Parameter	Unit	Natural fiber	Conventional 1XK	Forked-peg drum
UHML	in	1.18	1.15	1.15
Unf	%	86.5	84.4	85.6
SFI	%	3.1	5.6	4.8
Mic	—	4.4	4.5	4.5
Elg	%	7.6	7.4	7.4
Str	gs/tex	32.8	31.4	31.9
Rd	%	75.3	73.2	74.8
+b	—	8.8	9.1	8.2
Trash	code	3.0	4.6	4.0
Cnt	count	3	10	8
Area	%	0.3	0.8	0.4

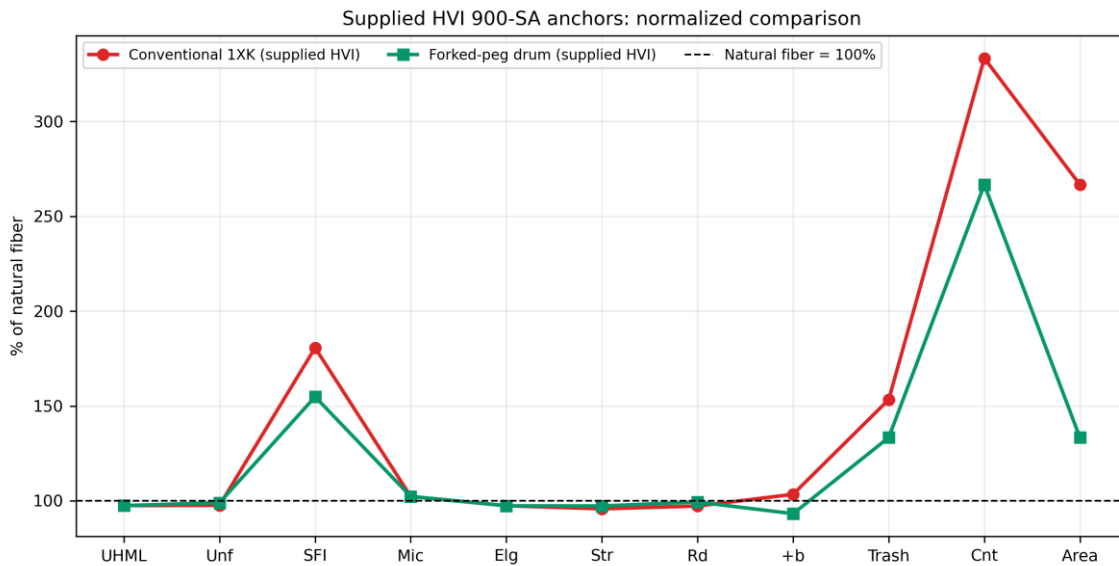


Figure 2. Normalized comparison of the supplied Andijan-35 HVI 900-SA anchors. The plot compares the selected conventional 1XK row and the forked-peg drum against the natural-fiber reference.

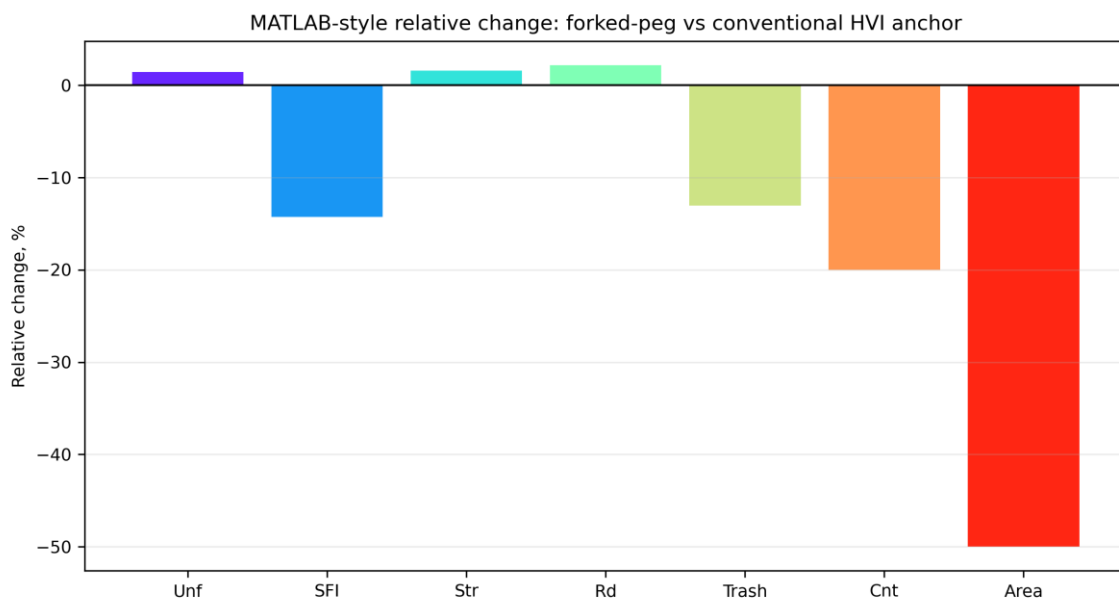


Figure 3. MATLAB-style relative-change plot for the forked-peg drum versus the selected conventional HVI row. Negative values for SFI, Trash, Cnt and Area indicate reduction.

For planning the machine-harvested experiment, a stage-wise calculated comparative dataset was prepared from the previously established project model. These numbers are useful for selecting graph scales, defining expected directions of change and planning sample size, but they are not presented as independent laboratory measurements.



Table 2. Calculated comparative working dataset for the machine-harvested Andijan-35 processing sequence (to be verified by laboratory protocols)

Parameter	Field/pile	After drying	Conventional cleaning	Forked-peg cleaning
UHML	1.17	1.16	1.14	1.15
Unf	85.8	85.3	83.9	84.9
SFI	3.8	4.1	5.9	5.1
Mic	4.4	4.4	4.5	4.5
Elg	7.5	7.5	7.3	7.4
Str	32.3	32.0	31.2	31.7
Rd	74.6	74.4	72.8	74.2
+b	9.0	9.0	9.2	8.5
Trash	6.2	5.8	4.8	4.2
Cnt	17	15	11	9
Area	1.1	1.0	0.8	0.5

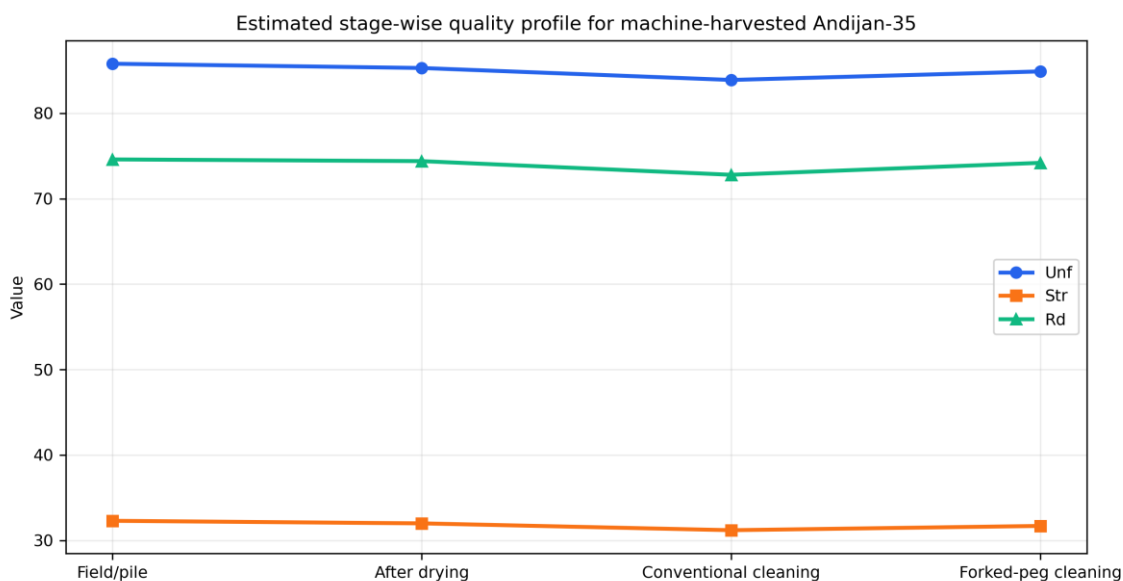


Figure 4. Calculated stage-wise profile of Unf, Str and Rd for machine-harvested Andijan-35. Values are working estimates for experimental planning, not final measured results.

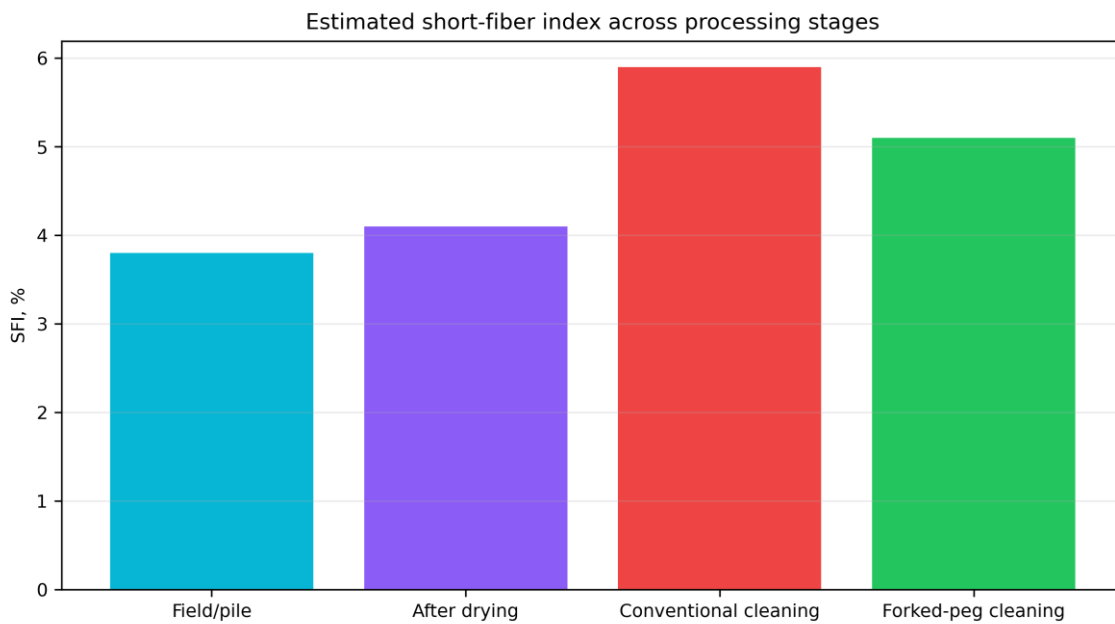


Figure 5. Calculated SFI response across the machine-harvested processing sequence. The increase after conventional cleaning illustrates the quality risk that should be verified experimentally.

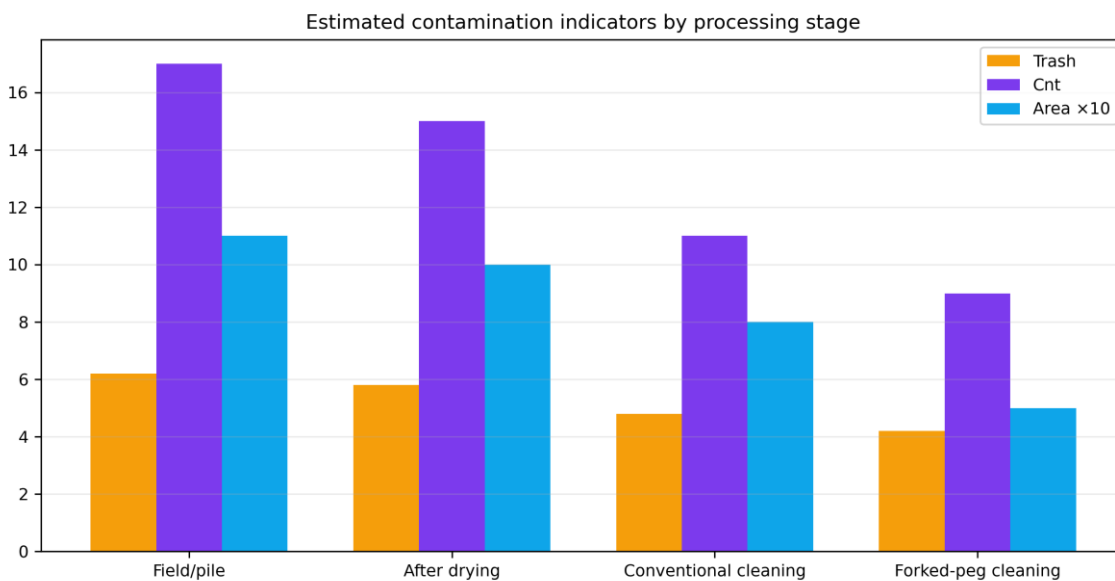


Figure 6. Calculated Trash, Cnt and Area trends across processing stages. Area is multiplied by 10 only for graphical visibility.

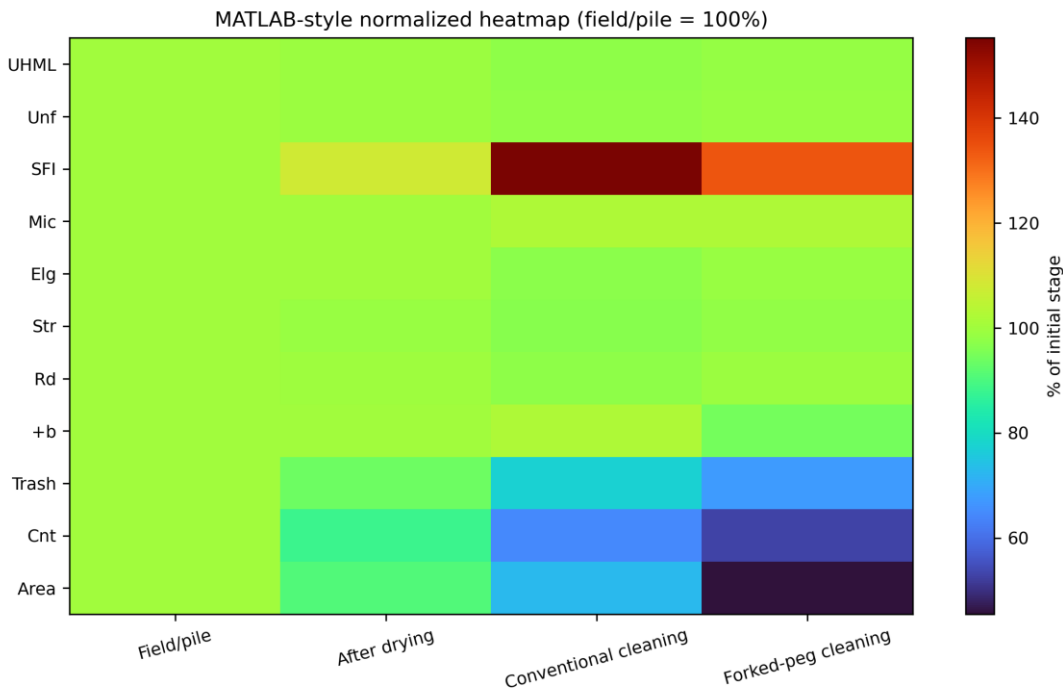


Figure 7. MATLAB-style normalized heatmap of the calculated machine-harvested dataset. The field/pile stage is normalized to 100% for each HVI parameter.

5. DISCUSSION

The measured HVI anchors indicate that the proposed forked-peg cleaning configuration can be evaluated not only by its cleaning action but also by its ability to preserve the principal fiber-quality parameters. Relative to the selected conventional row, Trash decreased by approximately 13.0%, Cnt by 20.0%, and Area by 50.0%. At the same time, Unf increased from 84.4 to 85.6%, SFI decreased from 5.6 to 4.8%, Str increased from 31.4 to 31.9 gs/tex, and Rd increased from 73.2 to 74.8%. These are descriptive differences; their statistical significance cannot be established without replicate-level data.

The direction of these changes is consistent with the broader engineering objective reported in the literature: sufficient cleaning should be achieved without imposing unnecessary mechanical treatment. Van der Sluijs found that more aggressive lint cleaning can improve trash and color while degrading length-related properties. Therefore, the observed combination of lower trash indicators and a non-deteriorated HVI fiber profile is technologically relevant and warrants direct validation on machine-harvested Andijan-35.

Drying must be interpreted as part of the same quality-control system. Cotton that remains too moist is more difficult to clean, whereas excessive drying can make fibers brittle during subsequent mechanical treatment. The literature therefore recommends using the minimum drying needed for stable cleaning and ginning. For the machine-harvested Andijan-35 experiment, inlet



moisture, outlet moisture, drying-air temperature and residence time should be recorded together with HVI results.

The calculated stage-wise model suggests a testable hypothesis: drying may slightly improve cleanability without major immediate change in core fiber properties, while conventional mechanical cleaning may reduce Trash and Cnt but increase SFI and reduce Unf and Str. A better-designed forked-peg interaction could potentially recover part of this quality loss while maintaining impurity removal. This hypothesis is scientifically meaningful only after the calculated values are replaced by measured stage-specific data.

The article also highlights the importance of identifying the harvesting mechanism. Published research shows that picker- and stripper-harvested cotton differ in foreign-matter loading and downstream cleaning needs. Therefore, the final OAK submission should specify whether Andijan-35 was collected by spindle picker or another machine and should report the initial foreign-matter composition.

A second limitation is that the supplied HVI document contains several conventional processing rows, whereas the accompanying text compares selected pairs of those rows. For publication, each row should be linked to a unique sample code and processing condition. This will eliminate ambiguity and allow a statistically reproducible comparison.

6. CONCLUSIONS

Published cotton-ginning research confirms that machine harvesting increases the importance of controlled drying and cleaning, while excessive drying or overly aggressive mechanical cleaning can reduce fiber length-related quality and increase short-fiber content. The supplied Andijan-35 HVI 900-SA data establish a natural-fiber reference of UHML 1.18 in, Unf 86.5%, SFI 3.1%, Mic 4.4, Str 32.8 gs/tex, Rd 75.3%, Trash 3.0, Cnt 3 and Area 0.3%. In the supplied HVI anchor comparison, the forked-peg variant reduced Trash from 4.6 to 4.0, Cnt from 10 to 8, and Area from 0.8% to 0.4% relative to the selected conventional 1XK row. Unf, SFI, Str and Rd also changed in a favorable direction. A four-stage machine-harvested experimental scheme—field/pile, after drying, after conventional cleaning and after forked-peg cleaning—was formulated for direct verification. The numerical values in the stage-wise working table are calculated estimates and must not be reported as final experimental results until supported by laboratory protocols.

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