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RESEARCH OF THE PROPERTIES OF RAW MATERIALS AND YARN FROM COTTON FIBERS COLLECTED BY DIFFERENT METHODS

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Abstract
The article presents the results of experiments conducted to study the quality indicators of machine- and hand-picked cotton fiber, semi-finished products and yarn.

Keywords: Cotton fibre, fiber properties, mechanical harvested raw cotton, tape, roving, yarn, Uster HVI 1000 system, Uster Tester 6 equipment.

Introduction

In the Republic of Uzbekistan, the further increase in the efficiency of cotton-textile clusters, the increase in the capacity of deep processing of raw cotton, the widespread introduction of scientifically based methods and innovative technologies are positively assessed, and work is also underway to eliminate problems in a timely manner in cotton-textile clusters [1].

In order to determine the priority areas of reforms aimed at further improving the well-being of the people, transforming sectors of the economy, accelerating the development of entrepreneurship, unconditionally ensuring human rights and interests, the formation of an active civil society in subsequent years based on the principle “In the name of the honor and dignity of man” with a deep analysis of complex global processes and the results of the past stages of the country’s development, the decree “On the Development Strategy of the new Uzbekistan for 2022 - 2026” was approved [2].

Currently, according to statistics from the International Cotton Advisory Committee (ICAC), global cotton fiber production is estimated at an average of 23.0 million tons. Globally, India and China are the leading producers of cotton fiber, accounting for 24.8% of all fiber produced. In our country, 3 million tons of cotton are also grown and 1 million tons of fiber are obtained. At this time, the production of competitive, high-quality textile products is due to the high level of demand for natural fiber and finished textile products [3].

In the Republic of Uzbekistan, 95% of cotton is harvested by hand. The Cabinet of the Minister adopted Resolution No. 21 of January 14, 2020 “On the phased production of cotton picking machines and delivery to the regions and cotton harvesting by machine in 2020-2026.” The implementation of this decision will be carried out in two stages. At the first stage (2020 - 2022), there will be a phased supply of harvesting machines to Jizzakh, Kashkadarya, Syrdarya and

Tashkent regions. At the second stage (2023 - 2026), it is planned to introduce mechanization of cotton harvesting in the rest of the countries [4,5].

Theoretical part. As a result of the increasing level of mechanization of the type of raw cotton harvesting from year to year, the negative impact of changes in the physical, mechanical and geometric properties of the fiber in cotton ginning shops and spinning processes is increasing. That is, it negatively affects the processes of cotton picking, bunting, storage, drying, ginning, ginning, fiber ginning, pressing, carding, drawing, combing, pre-spinning and spinning. Therefore, it is important to justify the optimal technological parameters for each process in cotton ginning and spinning shops [6].

It is known that the quality of textile products is assessed according to a number of indicators. The use of statistical methods in assessing them, conducting experiments and processing their results makes it possible to reduce the number of tests and the number of operations to be processed. And also, these methods in the technological process make it possible to associate product quality indicators with changes [7].

Subsequently, as a result of mechanized processes of growing and harvesting cotton, in subsequent technological processes of primary processing of cotton and the production of yarn from prepared fiber. One of the most pressing issues was to study the possibility of obtaining high-quality products from fiber separated from cotton with a high content of litter[8].

Experimental part. When solving these issues, as a result of rational selection of operating parameters of traditional cleaning machines used in the technological processes of storage and separation of machine-harvested cotton in Cotton textile clusters, it is optimal to obtain cotton fiber that meets the requirements of Uzbek GOST 604:2016 options must be developed and justified.

During the production process, practical experiments were carried out to study the quality of fiber, designs and semi-finished yarns separated from machine and hand-picked cotton.

1-experiment. Comparative analysis of indicative properties of fiber. When preparing the sample at the cotton gin plant, which is part of the “Poly tex Sirdaryo” MChJ, they used fibers of the “Sultan” selection, separated from machine- and hand-harvested raw cotton. The indicators of cotton fiber were assessed in the laboratory of the joint venture “Wakefield Inspection Services (Tashkent) Ltd” at the Tashkent Institute of Textile and Light Industry on the Uster® HVI 1000 system, and the results obtained are summarized in Table 1 [9].

Table 1 Indicators of cotton fiber of the selection variety "Sultan"

№	Name	Mic	Mat	Str, cH/ tex	Unf%	SFI % (12,7 mm)	Elog, %	Cnt, quantities	Rd, %	+b, %	Area	Len Dm	SCI
1	Manual collection	4.30	0.85	30.6	83.3	7.2	7.9	17	79.9	6.3	0.27	1.123	138.2
2	Machine collection	4.78	0.87	29.0	81.4	10.0	7.1	53	74.8	7.3	0.58	1.030	126,4
Difference in %		-10,0	-2,3	-5,2	+2,3	-28	-10	-67	-6,3	-13,6	-53	-8,3	8,5

Based on the indicators in the analysis of cotton fiber in table -1, micronaire (Mic) by 10.0% (lower), maturity (Mat) by 2.3% (increased), fiber strength (Str) by 5.2% (decreased), short fiber index (SFI) by 28% (increased), fiber impurity (Cnt) by 67% (increased), spin stability index (SCI) by 8.5% (deteriorated) of machine harvested cotton fiber compared to cotton fiber manual collection.

Delayed harvesting of the machine for the full expansion of cotton and long-term storage of raw cotton with a high level of contamination in stacks lead to a decrease in the properties of the fiber. That is, it has been established that quality indicators such as fiber micronaire (Mic), spinning stability index (SCI), fiber strength (Str) increase due to the short fiber index (SFI) in living seeds [10].

Research has scientifically proven that long-term storage of raw cotton in bales leads to the continuation of biological processes due to contaminants and seeds, deterioration of the properties of fiber and seeds, a decrease in fiber yield and an adverse effect on subsequent processes [11].

2-experiment. Comparative analysis of the properties of semi-finished products and yarn. LLC "REAL TEX TASHKENT" for the 1st option used hand-picked cotton of the Selection "C 65-24" and "Gulistan": 70% fiber of the first grade of the highest, good, middle class; 30% selection of good, medium grade II fibers; samples were selected from raw materials and yarn produced on a compact yarn production unit CCD-30/1.

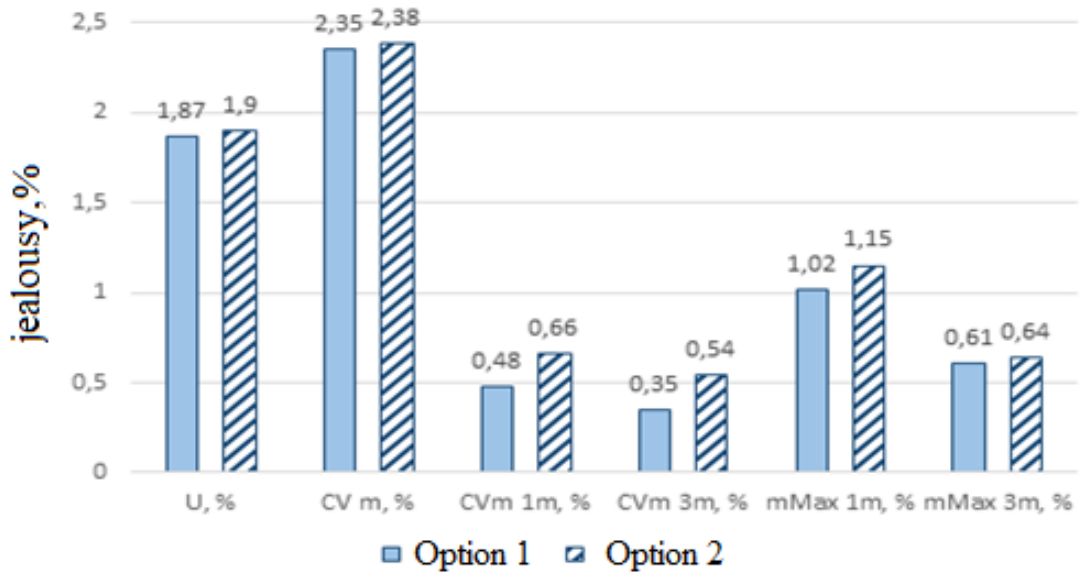
For the 2nd option, machine-harvested cotton of the selection varieties "S 65-24" and "Sultan" was used: I grade is good, 80% of grade I fiber is good, middle class; 20% selection of good, medium grade II fibers; samples were selected from raw materials and yarn produced on a compact yarn production unit CCD-30/1.

The properties of raw materials and yarn in samples obtained in both options were determined using modern instruments in the production laboratory of Real Tex Tashkent LLC.

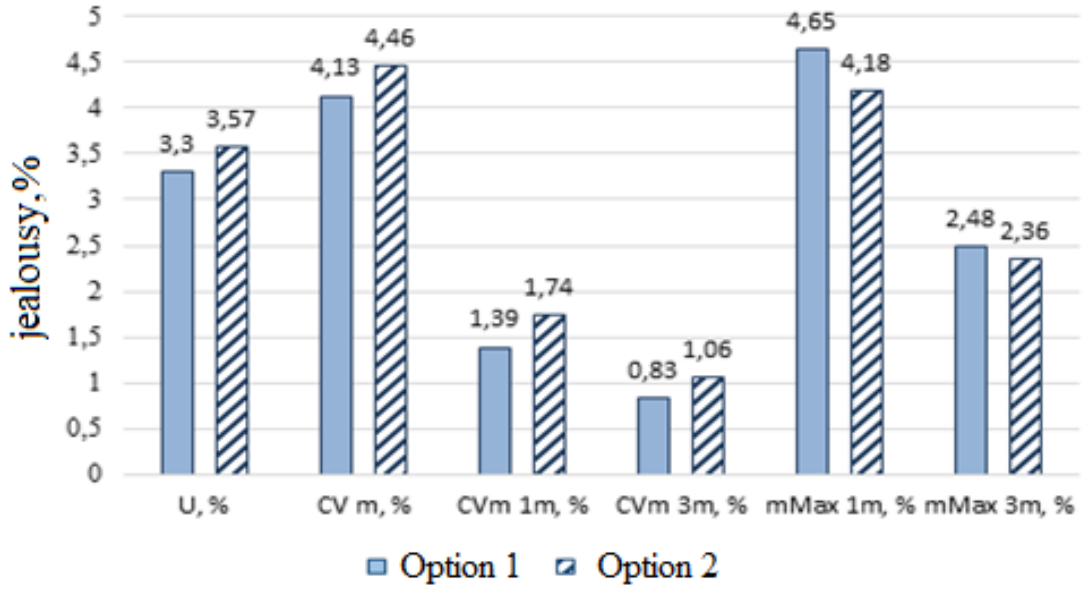
The properties of the sliver and rovings prepared in both versions were determined on an Uster Tester 6 device, and the results obtained are summarized in Table 2 and presented as a histogram in Figures 1-2.

Table 2 Indicators of unevenness of poufbricotta

Options	U, %	CV m, %	CVm 1m, %	CVm 3m, %	mMin 1m, %	mMin 3m, %	mMax 1m, %	mMax 3m, %	Realative count total,%
Tape tape (2-transition)									
Option 1	1,87	2,35	0,48	0,35	-1,29	-0,85	1,02	0,61	0,00
Option 2	1,90	2,38	0,66	0,54	-2,32	-1,48	1,15	0,64	0,00
Rovnica									
Option 1	3,30	4,13	1,39	0,83	-3,11	-1,67	4,65	2,48	0,00
Option 2	3,57	4,46	1,74	1,06	-3,58	-1,52	4,18	2,36	0,00



Picture 1. Histogram of tape ripples



Picture 2. Histogram of roving tension

From the histograms in Figure 1 and Figure 2 it is clear that the quality indicators of semi-finished products made from machine-harvested cotton fiber given in the 2nd option are significantly less. At the same time, it was established that the variants of semi-finished products developed for the production of yarn comply with the requirements of the standard.

The physical and mechanical characteristics of yarn CCD-30/1 were determined for both options. The results obtained are presented in Table 3 and in the form of a histogram in Figure 3.

Table 3 Indicators of unevenness of yarn linear density CCD -30/1

Linear density of yarn, Ne (100 m)	U, %	CV m, %	CVm 1m, %	CVm 3m, %	Thin -50%, /km	Thick 50%, /km	Neps 200%, /km	Total IP Stand., /km	H (нух)
Option 1	10,54	13,40	3,72	2,83	0	90	209	299	6,98
Option 2	10,71	13,67	3,98	3,02	1	93	233	326	6,57
Difference, %	-1,58	-1,97	-6,53	-6,29	-	-3,2	-10,3	-8,28	+5,8

Analysis of results

When analyzing semi-finished cotton fiber products from both options by comparing the roughness values obtained on the Uster Tester 6 system, it was found that the roughness values were better in the 1st option.

It has been determined that the main reason for the high levels of unevenness of semi-finished products (option 2) is that machine-harvested cotton has a high level of maturity and contamination. That is, due to the fact that cheese contains large amounts of impurities, during their primary processing and cleaning, intense impact is used by the working bodies, which leads to a decrease in quality indicators.

In the unevenness of yarn prepared according to option 1, compared with yarn prepared according to option 2, the following differences were observed: coefficient of variation for unevenness (CV m) by 1.97% (good), (CVm 1m) by 6.53 %. (good), (CVm 3 m) by 6.29% (good), and the total number of yarns neps (Total IP Stand. /km) was 8.28% lower.

Conclusion

In the future, collecting cotton in cotton harvesters and processing, preparing yarn in cotton-textile clusters will be technologically and economically beneficial. As a result of the above experiments, it was found that the properties of machine-harvested cotton fiber are reduced in technological processes compared to hand-harvested cotton fiber. As a result of the storage of machine-harvested raw cotton, primary processing and justification of the technological parameters of high-quality yarn from the fiber separated from it, optimal spinning options for production are recommended.

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