Study on the influence of the cotton storage process on the quality indicators of fiber and yarn

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Abstract. This article defines fiber quality indicators that differ in laboratory conditions from the upper, middle and lower layers of Bukhara-6 breeding varieties of cotton, in the modern system HVI 1000 SA. Based on the results of the study, histograms of changes in the quality of cotton fiber in the layers of the harem are presented. As an alternative, the quality indicators of yarn obtained in the laboratory spinning device “Sherli” of small size from fiber were determined. As can be seen from the analysis of the test results, it was found that the comparative elongation strength of cotton obtained from the lower layer of the stack, the upper average length, elongation at break, the light output coefficient, decreased compared to other layers of the stack, on the contrary, the index of hip fibers, increased, decreased compared to other layers of the stack. In addition, according to the results of the tests obtained, the fiber viscosity index was obtained – the correlation between the properties of fibers and the properties of yarn, the thread viscosity index was estimated by the CSP (COUNT STRENGTH PRODUKT) coefficient, which was determined by the formula for carded yarn obtained in the laboratory spinning device "Sherli" from fiber stored in the refrigerator. The obtained results showed that the relationship between fiber properties and yarn properties due to the fact that the maturity index of a thread is at the top of the stack compared to the middle and lower part of the stack.

1. Introduction
A number of important directions to further reform the textile industry of the Republic of Uzbekistan was the implementation of the cluster development model, which provides for the integration of production, starting with the production of raw cotton and ending with its primary processing, subsequent processing at cotton gins and the production of finished textile products with high added value [1-3]. The new cluster Institute system introduced in the Republic of Uzbekistan shows positive results in improving the competitiveness of the economy in the field of agriculture, including in attracting direct investment in the industry, creating innovative methods of production, deep processing and export. The experience of developed countries shows that the role and importance of clusters, international logistics centers, and free economic zones in ensuring sustainable socio-economic development, increasing investment activity, and producing competitive goods are high. After the independence of the Republic of Uzbekistan, the number of joint ventures for the production of yarn in cooperation with foreign countries increases every year and is equipped with equipment and technologies that meet modern requirements. In addition, many modern types of equipment for yarn quality control are installed in laboratories created under joint ventures.
Experiments have shown that at the first cotton wool processing enterprises, it was found that the processes of storing cotton raw materials in stacks, drying, cleaning from impurities, and separating fibers in a certain amount lose the natural properties of cotton raw materials, and the translation of these processes into the most optimal options is of great importance not only in terms of quality. As a result of compression in a high-density cave, pressure increases, large impurities are crushed, and the degree of adhesion of foreign bodies to fibers increases, which leads to a decrease in the efficiency of its cleaning. Therefore, it is necessary to create reasonable conditions for storing cotton raw materials in stacks.

A number of scientists have achieved positive results in various issues, taking into account raw cotton and its natural properties. Currently, the quality indicators of cotton fiber in all regions of the world are studied on the basis of modern systems such as HVI 900, 1000 CA. Cotton plant is divided into varieties according to color, appearance, ripening time [4-8].

In the classer method, according to the international standard, the quality of cotton fiber is determined by the color of the fiber, the contamination and quality of denim, the (Staple Length) of 1/32 inches, and micronaire values. Linear fiber density is expressed in Tex or millitex units in the standards of the Republic and European countries and is estimated depending on the length and type of fiber. According to modern standards, cotton with long fibers is subdivided into types I-III, and cotton middle-fibre types IV-VII, which means the linear density of the fiber increases depending on the growth order, type, and length decreases to the contrary. If the fiber goes beyond the linear density or length, it passes into subtypes, which ultimately reduces the possibility of spinning the thread and leads to poor-quality finished products [9-11].

The color of cotton fiber according to the American standard is characterized by Rd (%) and yellow (+b). The color of cotton fiber has always been considered one of the highest requirements. Therefore, the reception of cotton fiber in the country is carried out only in the daytime, when laboratory technicians determine the color of the fiber by subjective, class style and in comparison with special samples [12].

In our case, the fiber length is estimated by the staple, and the modal mass is estimated by the length size. The first, i.e. the length of the main mass, most affects the characteristics of the spinning rod, while the second, i.e. the modal length, is the most common length. However, in the American state, one of the geometric properties of cotton fiber is that the fiber length estimate is pre-developed, and the staple is formed not in the form of a diagram, but in the form of a fibrogram [13-16].

2. Materials and Methods

The HV1 900 SA system consists of two blocks: a large length / strength block; small block - color / dirt and micronaire module. The system includes an alphanumeric keypad, monitor and scale. The measurement results are displayed on the monitor. Upon completion of the measurement, the results are transferred to a printer or external computer. The system consists of the following measuring modules: length / strength module; micronaire module; color / impurity module. Individual indicators of cotton fiber, if necessary, can be obtained using each module separately or according to a general system, the following indicators are obtained: type and class of cotton fiber, light reflection (Rd),% and yellowing diagram (+b), micronaire indicator, staple length, flatness in length, relative tensile strength, elongation at break.

2.1. Measurements

Sample movement pattern during measurement. Samples of cotton fiber are placed in trays and placed on equipment that quickly brings humidity to normal levels under standard climatic conditions for the period specified in the equipment instructions. If rapid humidity control equipment is not used, samples should be placed on open shelves in a room with standard climatic conditions and stored for at least 24 hours prior to measurement. If, after conditioning, the samples have the above humidity, they are considered suitable for measurement. Before starting the measurements, the operator identifies the samples using a barcode reader, which brings the coupon surface closer to the
equipment, so that the code printed on the coupon can be photographed. In the absence of a barcode reader, the identification of the toy is performed by the operator using a manual keyboard.

In the HVI 900 SA system, the sample is measured in the following order: micronaire index; color and impurity indicators (light output coefficient Rd, degree of yellowness +b, area and amount of dirt impurities); length indicator (high average length, uniformity coefficient, short fiber index) and ripeness (specific tensile strength, elongation at break).

2.2. Measuring Micronaire Performance

The Micronaire Index indicates the fineness of a fiber in terms of maturity and natural linear density [17]. This method is based on the correlation between the air permeability of the fiber sample and the fineness of the fiber in the sample. For measurements in the HVI 900 SA system, the sample mass should be 10±1.5 g. The sample mass is controlled by the HVI system computer. The operator manually takes from a sample of cotton fiber that has reached the moisture norm, weighs it on the electronic scales of the HVI 900 SA system and transfers the mass to the required amount (3.0–3.3 g). Before weighing, remove a large, clearly visible foreign object from the sample. The weighed sample is placed in the micronaire chamber. The sample should only be inserted into the chamber with your fingers; pens, sticks and other objects cannot be used. After the sample is placed in the chamber, the chamber lid is closed and then the measurement is performed automatically. At the end of the measurement, the lid is opened and the sample is squeezed out of the chamber. The micronaire indicator (Mic) appears on the monitor.

The micronaire index can be used to assess the thickness and maturity of cotton fibers [18-20]. If the micronaire index is less than 3.0 the fiber is considered too thin. If the thickness is 3.0–3.9, if the thickness is 4.0–4.9, if the thickness is 5.0–5.9; 6.0 and above is considered too thick. The base range is 3.5 to 4.9. The price decreases depending on the degree of difference between these values, lower or higher. The type of cotton fiber does not change with an increase or decrease in the micronaire index. If the micronaire value is less than 2.0 or higher than 7.0 the display will show “Invalid micronaire”. In this case, the measurement operation is repeated.

The cotton fiber color index is determined by measuring the light reflected from the surface of a cotton fiber sample compressed onto the window surface of the HVI 900 SA system [21]. The light return coefficient (Rd) and the degree of yellowing of the fiber color (+ b) are determined using photodiodes and light filters through the light returned from the fiber surface. Based on the measured Rd and + b, the HVI computer determines the type of cotton fiber according to the Pima Upland Medium and Long Fiber Classification System. In the process of determining the color index of the fiber, the contamination of the cotton fiber is determined by measuring the area of dirty impurities on the surface of the sample. The area (Area) and quantity (Count) of dirty impurities are determined using a video camera. The video camera, photographing the surface of the sample, releases dirty impurities with a diameter of 0.25 mm. The computer calculates the fiber contamination code (Trash) by multiplying the area of contaminants by ten and rounding it to an integer. The size and thickness of the sample must be sufficient to completely cover the luminous window with a surface of 10x10 cm and ensure that light does not pass through the sample.

The cotton fiber sample is placed in the light window of the Color / Dirt module. In this case, the surface of the sample pressed into the light window should be sufficiently flat, without various nodes, folds and pits, as they will distort the measurement results. Color and contamination indicators are automatically measured when the sample is pressed against the glass by the HVI pressure plate. Each sample is measured at least twice on both sides of the surface. The results are displayed on the monitor as -Rd, + b, color code (CG), area of impurities (Area), amount of impurities (Count) and code of impurities (Trash).

Cotton fiber length is expressed in units of medium length (ML) and high medium length (UHM). Fibers less than 0.5 inches (12.7 mm) in length constitute the Short Fiber Index (SFI). This value is the percentage of short fibers in the total sample weight. The lengths are determined by calculating the light transmission curve created by scanning with light the cross-section of compressed fibers from the
point of compression to the end of the staple-shaped bracket on special clamps. Depending on the change in the intensity of light passing through the bracket, a high average length, an index of longitudinal uniformity and the proportion of short fibers are determined. The Upper Average Length (UHM) is defined as half the sample weight. This length is on the graph. The graph shows the percentage of fibers compressed by the clamp along the ordinate (0; 50; 100%). The abscissa shows the length of the fibers protruding from the clamp. To define UHML, an attempt is made on the fibrogram curve from the 50% point on the ordinate. The point of intersection of the test line with the abscissa gives the number of UHML. The average length of all ML fibers is checked from the starting point of the fibrogram (100%) to determine this length. The point of intersection of this experiment with the abscissa gives the average length ML (Fig. 1). The coverage lengths of 50% and 2.5% fibers on a fibrogram are explained as follows. The 50% cover length is the length of 50% of the fiber exiting the randomly compressed nip. The 2.5% cover length is the 2.5% fiber length exiting the clamp. This is the longest length.

Currently, the “HVI” system is widely used, calculated from modern methods for determining the length [22]. In this system, a “geometric fibrogram ” is obtained. This is basically like a simple staple diagram, where the ordinate axis shows the fiber length as a percentage, and the abscissa axis shows the fiber length.

In the HVI system, it is customary to determine the following parameters of fiber length:
The top average length refers to the average length of the longest fibers in the sample, and 2.5% is called the coating length.

![Figure 1. Fibrogram showing fiber length values in the HVI system](image)

Preparation of the sample for measuring the length indicator in the form of a "scallops" (handle) is carried out using a special hardware fiber sampler. The teeth of the comb clip are directed upwards and fixed on the fiber sampler. The cotton fiber sample is placed in the fiber sampler cylinder, and it is manually pressed by the inner side of the cylinder against the plate with the hole. The equipment handle turns exactly once counterclockwise. In this case, the comb clip is filled with fiber, and the fiber bundle is formed by combing on the needles of the fiber sampler. The clip should be filled evenly, without gaps in the row of the comb [23, 24].
A comb with a fiber bundle made on a fiber sampler is placed in a box of the length/ripeness module. The system automatically combs out fibers that are not clamped in the comb, and the comb clip directs the length and ripeness indicators of the system to the measuring part. First, the pen is scanned by the beam and detached. If the sample stack is too large or too small for the measuring mechanisms, the monitor will display "large sample" or "small sample". In this case, another bundle is made from the same fiber sample. Each sample is measured at least 2 times in length, by back-checking the newly taken fiber bundle. The results are automatically displayed on the monitor. The criteria for the average length of fibers by quantity are shown in Table 1.

| Inch          | mm        | criteria | length code |
|---------------|-----------|----------|-------------|
| small than 0.99 | small than 25.15 | short    | 31 and low  |
| 0.99-1.10    | 25.15-27.94 | medium   | 32-35       |
| 1.10-1.26    | 29.94-32.00 | long     | 36-40       |
| high than 1.26 | high than 32.00 | too long | 41 and high |

When measured in the XVI system, the length value is expressed in inches or millimeters. The base length in the pricing for medium-fiber upland cotton is 1-3/32 inches (code 35). This length corresponds to 32-32 mm (Type 5) according to the methods used in the CIS countries. When the length of a cotton fiber above or below 1-3/32 inches belongs to the length group, the price addition or subtraction calculation is performed. But this process will also depend on the fiber grade. These measurements are used to calculate the uniformity of the fibers along the length. The flatness along the length of the cotton fiber is determined by the ratio of the average length (ML) to the high average length (UNML) (in%). If the fibers in the wedges were of the same length, the plane along the length of the fibers would be 100%. However, cotton fiber inherently has different lengths. An estimate of the uniformity of cotton fiber lengthwise in the HVI system is shown in Table 2 below.

| Level of flatness | Determined value in the HVI system (%) |
|-------------------|----------------------------------------|
| too high          | high than 85                            |
| high              | 83-85                                   |
| medium            | 80-82                                   |
| low               | 77-79                                   |
| too low           | low than 77                             |

The durability of cotton fibers is expressed in kg/teks (sN/teks) by the definition of comparable Strength(Str) elongation strength. Elongation at elongation (Elg) is the elongation at break of the dynamometer in the HVI system, expressed in%. The measurement of indicators is carried out on a measuring analyzer by the dynamometric method. The spacing between the clamps is 1/8 inch (3.2 mm) and the breaking force determines the break of the flat fiber bundle. A fiber length indicator is used to measure fiber strength. The sample is measured by checking the newly obtained fiber bundle at least 2 times in terms of
tensile strength and elongation at break. The criteria for assessing the strength of cotton fiber are shown in Table 3.

| Elongation, % | Evaluation |
|--------------|------------|
| small than 5.0 | too small |
| 5.0-5.8     | small     |
| 5.9-6.7     | medium    |
| 6.8-7.6     | high      |
| high than 7.6 | too high |

In the process of breaking cotton fibers, their elongation at break is determined in%. Fiber elongation is an important indicator. This is because the elongation index can be used to determine the fiber's ability to spin. The criteria for evaluating the elongation of cotton fibers are shown in Table 4.

2.3. Theoretical Studies

All calculations are performed on each sample taken using the programmed internal microprocessor of the HVI 900 SA system, which shows the average value of the results of parallel tests. The final measurement result for cotton fiber is output to the printer. The nomenclature of published indicators can be supplemented or reduced by mutual agreement between the supplier and the consumer.

To determine changes in the parameters of the fiber stored in stacks and obtained from stack cotton, experiments were conducted on samples of yarn from the fibers of different layers of the stack. The laboratory spinning device of small size "Sherli" is used for yarn production. The weight of the removable sample should be 42 grams. The device includes carding, band spinning and ring spinning machines.

Before starting work, the technological transitions of the machines, the productivity of the working parts of the equipment were selected depending on the technological regime and the fiber length. For each type of test, the experiment is performed in the following order:

1. Before starting work, all machines that make up the device are cleaned of debris;
2. The combing machine will be started;
3. The qualitative and quantitative composition of waste on the combing machine is analyzed;
4. Comb wick placed in the wicking machine;
5. In during this process a wick sample is taken from a wick machine to adjust the length of the fiber and determine its parallelism;
6. The finished necessary wick is placed in the spinning machine;
7. The Spinning machine is additionally prepared and put into operation according to the spinning plan;
8. After receiving the thread, quality indicators were determined.

For research, samples of cotton were taken from the upper, middle and lower layers of the harem and turned into fiber in the laboratory. 20.0 teks of yarn were obtained from 4 samples on a small-sized laboratory spinning machine "Sherli". The relationship between the properties of the fiber and the properties of the yarn can be calculated using the following formula, estimating using the coefficient of CSP (COUNT STRENGTH PRODUCT), which is called the yarn viscosity index:

For Carda yarn

\[ CSP = 280\sqrt{FQI} + 700 - 13C \]  

(1)

For re-combed yarn

\[ CSP = \left(280\sqrt{FQI} + 700 - 13C \right)\left(1 + W/100\right) \]  

(2)
Here:

\[ FQI = \frac{L_{sm}}{f} \]

- fiber quality index;
- \( L, s, m \) - HVI system indicators and
- \( m \) - Required ripening coefficient when using Sherli device;
- \( L \) - 50% coating length, mm;
- \( s \) - comparable elongation power of fiber, sN/teks;
- \( f \) - micronaire index;
- \( W \) - repeated combing, %.

The top layer of the stack

\[ FQI = \frac{L_{sm}}{f} = \frac{1,16 \cdot 32,07 \cdot 2,0}{4,0} = 18,6 \]

For Carda yarn

\[ CSP = \{280, \sqrt{FQI} + 700 - 13C\} \times \left\{1 + \frac{W}{100}\right\} = \{280, \sqrt{18,6} + 700 - 13 \cdot 20\} \times \left\{1 + \frac{20}{100}\right\} = 2472 \]

For re-combed yarn

\[ CSP = \{280, \sqrt{FQI} + 700 - 13C\} \times \left\{1 + \frac{W}{100}\right\} = \{280, \sqrt{17,3} + 700 - 13 \cdot 20\} \times \left\{1 + \frac{20}{100}\right\} = 2406 \]

After the fiber cleaning process

\[ FQI = \frac{L_{sm}}{f} = \frac{1,15 \cdot 30,02 \cdot 2,0}{4,0} = 17,3 \]

For Carda yarn

\[ CSP = \{280, \sqrt{FQI} + 700 - 13C\} \times \left\{1 + \frac{W}{100}\right\} = \{280, \sqrt{17,6} + 700 - 13 \cdot 20\} \times \left\{1 + \frac{20}{100}\right\} = 2406 \]

For re-combed yarn

\[ CSP = \{280, \sqrt{FQI} + 700 - 13C\} \times \left\{1 + \frac{W}{100}\right\} = \{280, \sqrt{17,6} + 700 - 13 \cdot 20\} \times \left\{1 + \frac{20}{100}\right\} = 2406 \]

The middle layer of the stack

\[ FQI = \frac{L_{sm}}{f} = \frac{1,12 \cdot 31,36 \cdot 2,0}{4,0} = 17,6 \]

For Carda yarn

\[ CSP = \{280, \sqrt{FQI} + 700 - 13C\} \times \left\{1 + \frac{W}{100}\right\} = \{280, \sqrt{15,9} + 700 - 13 \cdot 20\} \times \left\{1 + \frac{20}{100}\right\} = 2423 \]

After the fiber cleaning process

\[ FQI = \frac{L_{sm}}{f} = \frac{1,09 \cdot 29,15 \cdot 2,0}{4,0} = 15,9 \]

For Carda yarn

\[ CSP = \{280, \sqrt{FQI} + 700 - 13C\} \times \left\{1 + \frac{W}{100}\right\} = \{280, \sqrt{15,9} + 700 - 13 \cdot 20\} \times \left\{1 + \frac{20}{100}\right\} = 2335 \]

For re-combed yarn

\[ CSP = \{280, \sqrt{FQI} + 700 - 13C\} \times \left\{1 + \frac{W}{100}\right\} = \{280, \sqrt{15,9} + 700 - 13 \cdot 20\} \times \left\{1 + \frac{20}{100}\right\} = 2335 \]

The bottom layer of the stack

\[ FQI = \frac{L_{sm}}{f} = \frac{1,09 \cdot 29,15 \cdot 2,0}{4,0} = 15,9 \]

For Carda yarn

\[ CSP = \{280, \sqrt{FQI} + 700 - 13C\} \times \left\{1 + \frac{W}{100}\right\} = \{280, \sqrt{15,9} + 700 - 13 \cdot 20\} \times \left\{1 + \frac{20}{100}\right\} = 2335 \]

For re-combed yarn

\[ CSP = \{280, \sqrt{FQI} + 700 - 13C\} \times \left\{1 + \frac{W}{100}\right\} = \{280, \sqrt{15,9} + 700 - 13 \cdot 20\} \times \left\{1 + \frac{20}{100}\right\} = 2335 \]
The relationship between fiber properties and yarn properties is shown in Table 5.

### Table 5. The relationship between fiber properties and yarn properties

| o/n | Indicators                        | Stack layers | Cotton in the stack |
|-----|-----------------------------------|--------------|---------------------|
|     |                                   |              | top layer | middle layer | bottom layer |
| 1.  | For Carda yarn                     |              | 1648      | 1615        | 1631        |
| 2.  | For re-combed yarn                 |              | 2472      | 2423        | 2447        |

After the fiber cleaning process

| o/n | Indicators                        | Stack layers | Cotton in the stack |
|-----|-----------------------------------|--------------|---------------------|
|     |                                   |              | top layer | middle layer | bottom layer |
| 1.  | For Carda yarn                     |              | 1604      | 1556        | 1510        |
| 2.  | For re-combed yarn                 |              | 2406      | 2335        | 2265        |

### 3. Results and Discussions

At the enterprises of primary processing of cotton, research work was carried out to obtain high-quality raw materials. For it, in the modern system HVI 1000 SA, quality indicators of fiber obtained under the influence of various layers of stack and technological processes were determined [15].

### Table 6. Influence of stack layers on fiber quality indicators

| o/n | Indicators                        | Cottont without harem | Stack layers |
|-----|-----------------------------------|-----------------------|--------------|
|     |                                   | top layer | middle layer | bottom layer |
| 1.  | Mic-micronaire                     | 4.0        | 4.0         | 4.1         | 4.1         |
| 2.  | Str- comparable elongation power of fiber, sN/teks | 32.23 | 32.07 | 31.36 | 31.44 |
| 3.  | Len- The top average length        | 1.18       | 1.16        | 1.12        | 1.15        |
| 4.  | Unf- longitudinal uniformity index, % | 82.8 | 82.0 | 82.8 | 83.6 |
| 5.  | SFI- short fibers index            | 3.8        | 4.1         | 5.7         | 7.4         |
| 6.  | Elg- Elongation at break, %        | 9.6        | 9.7         | 8.7         | 7.6         |
| 7.  | Cnt- amount of dirty impurities    | 2          | 2           | 4           | 6           |
| 8.  | Rd- coefficient of light return    | 82.5       | 82.2        | 81.5        | 79.9        |
| 9.  | +b- degree of yellowing            | 7.8        | 8.1         | 8.9         | 9.8         |
The results of the study included histograms of changes in the quality indicators of cotton fibers by layers of stacks in Figures 2, 3, 4, 5 and 6.

![Figure 2. Changes in Micronaire Fiber Index and Short Fiber Index](image)

The unheated micronaire index of fiber was 4.0 at the top of the stack and 4.1 in the middle and bottom layers of the stack. The change in the short fiber index in raw cotton was 3.8%.

The elongation of fiber at break was 9.6 percent in non-stackable part of cotton, 9.7% in the upper part of the stack, 8.7% in the middle layer of the stack, 7.6 percent in the lower part of the stack, the change in the degree of yellowness was 7.8 in non-stackable part 8.1 in the upper part of the stack, 8.9 in the middle layer of the stack, to 9.8 in the lower layer of the stack.

The index of uniformity of fiber length amounted to 82.8% in non-stackable part of the cotton, 82% in the upper layer of the stack, at 82.8% in the middle layer of the stack, was 83.6% in the lower layer of the stack and the adjustment of the light output decreased to 82.5% in non-stackable part, 82.2% in the upper layer of the stack, was 81.5% in the middle layer of the stack, 79.9% in the lower layer of the stack.
The change in the upper average fiber length was 1.18% in the non-stackable cotton layer, 1.16% in the upper stack layer, 1.15% in the middle stack layer, and 1.15% in the lower stack layer.

Changes in the relative strength elongation fiber made 32.23 sN/teks in a non-stackable part of the cotton 32.07 sN/teks in the upper layer is stack, of 31.36 sN/teks in the middle layer stack, the 31.4 sN/teks in the lower part stack.

Analyzing the test results obtained in determining the quality indicators of the fiber, it can be concluded that the micronaire index of the fiber obtained from cotton non stackable is 4.0 the relative strength elongation is 32.23 sN/teks, the high average length is 1.18 inches, the length uniformity index is 82.8%, the short fiber index is 3.8%, the elongation at break is 9.6%, the light output coefficient is 82.5%, the yellowing rate is 7.8, the micronaire index of the fiber obtained from cotton fabric is 4.0 the relative strength elongation is 32.07 sN/teks, and the upper average length is 1.16 inches, the length uniformity index is 82.0%, the short fiber index is 4.1%, the elongation at break is 9.2%, the light output coefficient is 82.2%, the degree of yellowness is 8.1 the micronaire index of cotton fiber in the middle layer of the stack is 4.1 the relative strength elongation is 31.36 sN/teks, the
upper average length is 1.15 inches, the length uniformity index is 82.8% the fiber is 5.7% elongation at break-8.7% light output coefficient-81.5% yellowing degree 8.9 the micronaire index of cotton fiber in the lower layer of the stack is 4.1 the relative strength elongation is 31.4 sN/teks the high average length is 1.15 inches, the length uniformity index is 83.6% the short fiber index is 7.4% the elongation at break is 7.6% the light refractive index is 79.9% the yellowing degree is 9.8.

Figure 6. Changes in the relative strength elongation fiber

System HVI must be located in standard climatic conditions: air temperature (21±1) Relative humidity (65±2)% - 0.1°C on the Accman psychrometer scale or on devices that measure temperature and humidity, which is equivalent to its accuracy. Samples taken in accordance with the UzDst 614-2009 standard for measurement must have a mass humidity ratio of 6.75% to 8.25%. Before samples are delivered and measured according to system HVI to the required humidity level, they must be stored for 24 hours on high-speed equipment used for this purpose, which brings the humidity to normal, or under established standard climatic conditions. Before determining the quality of the cotton fiber, the HVI 900 SA system must be calibrated with standard samples and templates in accordance with the operating instructions. Calibration means correcting the accuracy of instrument measurements by checking them with another instrument, a tool. It is recommended to perform calibration twice a day: before starting work and every 4-5 hours of operation. Ambient air parameters affect the properties of the fiber, so calibrated standard fibers must also be stored under standard conditions.

4. Conclusions
The As can be seen from the analysis of the test results, it was found that the specific tensile strength of the fiber obtained from cotton in the lower layer of the stack, the high average length, elongation in the gap, the light output coefficient decreased compared to the layers in another stack, on the contrary, the index of short fiber, an increased level of yellowness.
In addition, based on the test results obtained, the ripeness index of the threads obtained from the fiber was determined.
Based on the analysis of the obtained results it was found that the relationship between fiber properties and yarn properties is that the maturity index of the yarn is higher in the upper part of the stack compared to the middle and lower part of the stack.

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