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Distribution of Different Industrial Grades of Raw Cotton Stored in the Mound

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ABSTRACT: This article presents the results of theoretical studies, in particular: the difference in the degree of maturity of raw cotton on the layers of cotton, the moisture content of raw cotton, method of cotton picking, the density difference of the thickening layers of raw cotton depends on the compacting load, the availability of different grades of raw cotton in the composition obtained at acceptance for one grade of raw cotton.

According to the results of studies carried out in the cotton-cleaning enterprises in Syrdarya and Jizzakh regions, it is determined that in the composition of the formed mounds of III-IV-industrial grades of raw cotton there are 20-30%, in the V-industrial grade there are 15-20% of high industrial grade of raw cotton. The difference between the amount of cotton fiber grades in average is about 100-150 thousand soums. This article describes the ways to improve economic efficiency by separating the high industrial grade of raw cotton from the total amount of raw cotton.

I. INTRODUCTION

We know that currently in our republic the cotton industry is one of the main parts of production volume. At present time, before cotton industry enterprises the task of solving the issues on increasing production volume and improving the quality of industry products in accordance with international requirements. In order to fulfill the task in recent years in many cotton industry enterprises fully implemented the advanced technique and technology adapted to the technological requirements of the primary processing of cotton.

Production of high-quality fibers in accordance with international requirements has set an important task before specialists and scientists of the cotton processing industry to improve the existing equipment and technology [1].

The change of the moisture index is the main reason for increasing of the neps parameters sending processed raw cotton with different moisture to the textile industry [2].

In the Republic, as the maturation of cotton bolls 60-70% of cotton crop is harvested by hand and after the maturation of cotton bolls 80-90% of cotton crop is harvested by machine. Cotton does not open naturally at the same time and in one cotton bush there are varieties of industrial grades of raw cotton.

In case of availability in the raw cotton batch of uniform industrial grades more than the availability of the different industrial grades, the raw cotton is considered as high grade cotton raw. In this regard, in the composition of raw cotton laid in mounds, there are various industrial grades of raw cotton. During raw cotton processing, the availability of low-grade fibres in the composition of cotton will help to obtain high grade and class grade of fibres. In order to get high industrial and class grades of fibre mainly it is necessary to know the difference between them.

II. AN ALYSIS OF SCIENTIFIC-RESEARCH

Cotton fibre on its structure belongs to the difficult knitting fibrous material. Due to the elastic strength of the cotton fiber during their storage, the cotton fiber does not compressed itself, so the gap of the flaps of the internal volume is

replenished with air. These abilities of cotton fibre are used for heating and cooling of raw cotton. This ability of cotton is called porosity.

The porosity of raw cotton is determined by the following formula:

$$K = \frac{\gamma_x - \rho_x}{\gamma_x} \cdot 100 \%$$

here, γ_x - γ_c - specific weight of raw cotton,

$$\gamma_x = 12000 \text{ N/m}^3 \text{ or } 120 \text{ kg/m}^3$$

ρ_x - cotton density. This is the indicator for raw cotton $K = 93..96 \%$.

The porosity coefficient E is determined as follows:

$$E = \frac{\gamma_x - \rho_x}{\rho_x}$$

For medium fibrous raw cotton: $E = 20 \div 23$; for fine-stapled raw cotton: $E = 13 \div 14$.

During storing of raw cotton, the top layer presses the bottom layer and as the result of this they are subjected to the ramming. The density of raw cotton depends on moisture, type, method of cotton picking and ramming forces. The average density of freely poured out layers of cotton with the height of 500mm can be determined by the formula of A. Y. Yampolsky:

$$\rho_x = 26,3 + 0,05h + 0,93W$$

here, h - layer height, mm.

W - raw cotton humidity, %.

For I-grade hand-picked raw cotton is:

$$\rho_x = 40 + 0,05h + W$$

Depending on between the raw cotton density and ramming forces for the boundaries are determined by the empirical formula as:

$$P = (1...30) \cdot 103 \text{ Pa } \rho_x = mP^n$$

here, P - specific pressure force of compressed raw cotton, Pa.

m and n - coefficients that depend on the grade and moisture content of raw cotton.

For the I-grades with moisture as: $W = 7,9 \%$, $n = 0,3$ и $m = 11,4; 11,54; 11,45$.

For the I-grades fine-stapled cotton with moisture as: $W = 8\%$, $n = 0,25$; $m = 23,3$.

Changes in the volume mass depending on the industrial grade and specific pressure are presented in the Table 1.1.

During compacting of raw cotton without the possibility of lateral expansion, there is connection between compacting load and lateral pressure of raw cotton:

$$P_b = K \cdot P_N$$

here, K - coefficient of lateral pressure, which depends on the moisture content of raw cotton.

P_N - normal compacting force.

With the moisture content of raw cotton is $W = 8...11,5\%$, the value K will be equal to $K = 0,22...0,26$, its lower value will correspond to the upper value of the moisture.

Table 1 Changes of cotton density depending on specific load

Specific pressure, kPa	Density of raw cotton, kg/m ³		
	Upland raw cotton		Fine-stapled cotton
	I-grade	IV-grade	I-grade
Under the its own gravity loading	64	59	91
1.3	105	100	139
4.8	149	132	194
8.1	171	151	-
11.2	188	165	247
17.6	214	187	271
24.0	240	208	293
30.3	252	218	300

During transportation the raw cotton is resisting with the certain value. This resistance is indicated by signs τ and will be determined by the following formula:

$$\tau = P_N \cdot tg\varphi + C$$

here, τ - transfer (displacement) force;

$\mu=tg \varphi$ - coefficient of internal friction between the fibers, $\varphi=24...260$

$P_N=(1...3) \cdot 103, \text{ kg/cm}^2$;

C - the constant coefficient for medium fibres is equal to $C=0.012...0.022 \text{ kg/cm}^2$, and for fine fibres is equal to $C=0,03...0,08 \text{ kg/cm}^2$.

In the cotton industry, a comprehensive assessment of the fibre type in the mixture is carried out in accordance with the State standard for cotton fibre O'zDST604-2016, developed by the Uzbek cotton fibre certification center "Sifat" under the Cabinet of Ministers of the Republic of Uzbekistan.

Cotton fibre in terms of length, linear density, relative breaking load are determined on the basis of the State Standard "Technical conditions for cotton fibre" O'zDST 604-2016, which provides regulatory requirements in accordance with the classification of cotton fibre.

Fibre types of 1a, 1b, 1, 2 and 3 correspond to the breeding grades of long-stapled cotton fibers, and type of 4, 5, 6, 7 correspond to the breeding grades of medium-fiber cotton fibers [3,5-7].

Cotton fibre of each type depending on the coefficient of maturity, appearance, color and maturation is divided into five (I, II, III, IV, V) industrial grades.

In this case, the maturity coefficient for breeding varieties of long stapled fibres, depending on the industrial grade changes from 2.0 to 1.2, for medium fibre cotton fibers changes from 1.8 to 1.2. Fibre grade is determined by the lowest parameter. In addition to the content of defects and impurities industrial grades are divided into five classes.

It is known that the acceptance of the raw cotton in cotton purchasing centers is carried out on the basis of the Uzbek State Standard, depending on the maturity coefficient, external features, color and maturation. All harvested raw cotton is divided into industrial grades, and by the mass fraction of impurities and mass ratio of moisture is divided into 3 (1, 2, 3) classes of each industrial grade.

In this case, the grade of raw cotton is determined by the inspector under the established order on its external features, moisture and contamination comparing the average sample of raw cotton with the united standards under the systematic instrumental control of the purchasing center laboratory.

III. EXPERIMENTAL RESULTS

The results of the analysis show that 20-25% of the total amount of raw cotton grown in our country are III, IV, V industrial grades. In order to determine the number of high industrial grades of raw cotton in the composition of the accepted products, we carried out initial studies. Experimental studies were carried out under production conditions on the equipment of the cotton-cleaning enterprises of Syrdarya and Jizzakh regions [4,8-9].

It is determined that in the composition of the formed mounds of III-IV-industrial grades of raw cotton there are 20-30%, in the V-industrial grade there are 15-20% of high industrial grade of raw cotton (Figure 1).

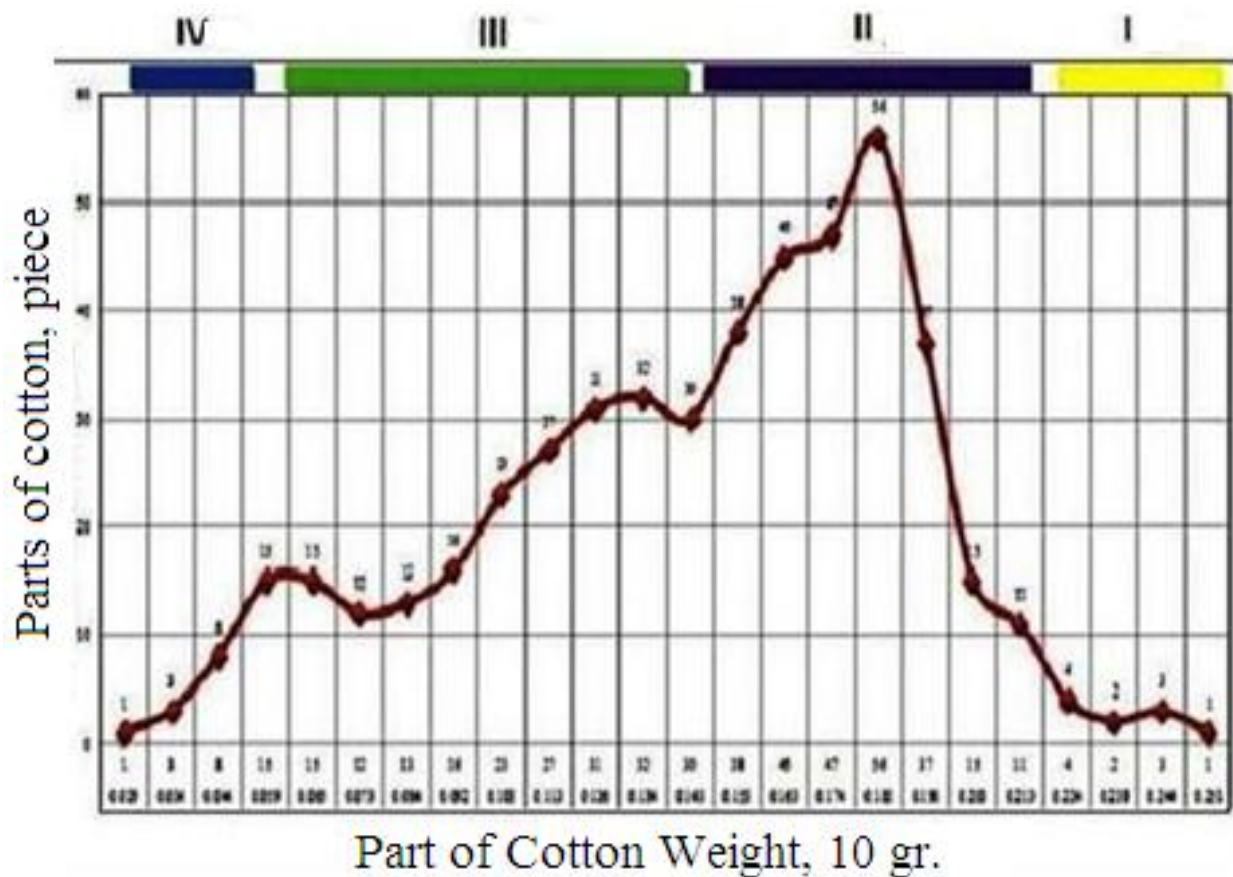


Fig 1. The availability of different industrial varieties of raw cotton in the composition of acceptance III- industrial grade of raw cotton

In figure 2 in the form of graph presented the availability of high industrial III-grades of raw cotton in the composition of the adopted as IV-grade of industrial grade of raw cotton. The analysis revealed that the number of high industrial III-grades of raw cotton from the total amount is in average of 20-22% [5-7].

It follows that in the different layers of raw cotton you can see the availability of the mixture of different grades of raw cotton. The most interesting situation was revealed during analysis of the composition of IV-industrial grade of raw cotton. On the basis of the carried out studies on the determination of the grade of raw cotton, availability of number of high grade fibres in the composition of low grade fibres was revealed [8].

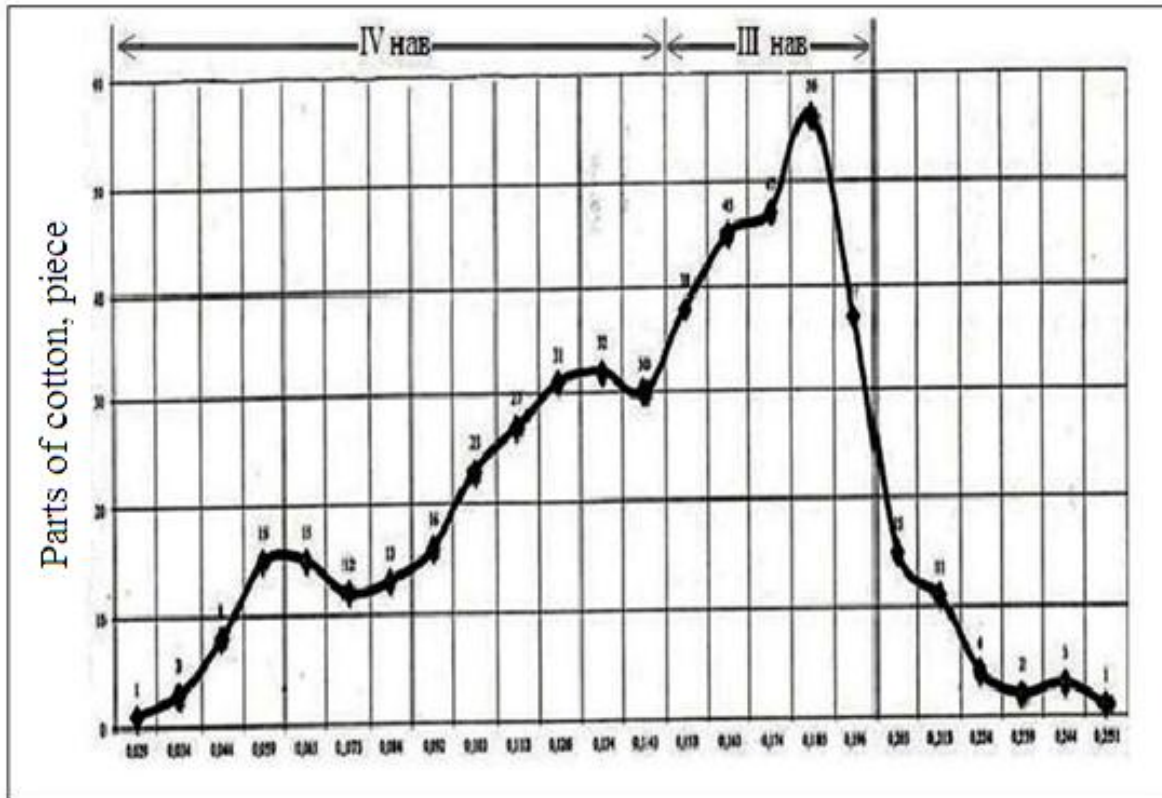


Fig 2. The availability of different varieties of raw cotton in the composition of the IV - industrial grade of raw cotton.

Cotton fibre that received from the cotton-cleaning enterprises of Kiziltepa was analysed by classes for reliability of obtained results experimental studies on processing of selection and industrial grades of raw cotton. Selection grades of raw cotton such as “Bukhoro-102”, “Bukhoro-6” and “An-Bayavut-2” were used during carrying out of the experimental studies.

IV. CONCLUSION

Between the classes of cotton fibre there is the difference in sale prices and amount is 100-150 thousand soums. If to separate high industrial grades of raw cotton out of the total amount of raw cotton laid in the mound can be achieved high economic efficiency.

In order to solve this vital task initially it is necessary to develop a technology of separation of raw cotton and on the basis of this it is required to create a new technique. During developing of the new technology, we need to know the peculiar features, structure of natural cotton fibres and components of industrial grades of raw cotton.

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