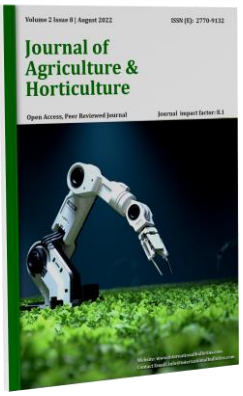

EVALUATION OF FIBER QUALITY INDEXES IN DIFFERENT VARIETIES OF COTTON PLANTS

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Abstract. The cultivation of cotton and in particular the quality characteristics of the fiber are mainly influenced by the growing conditions, the cultivation techniques as well as the climatic changes of the environment.

The results of this work demonstrated that the effect of the environment and the interaction of the environment with year (season), were the important source of variance for almost all the qualitative characteristics studied. Regional climatic characteristics such as temperature, humidity and rainfall also significantly affected to a greater or lesser extent all quality characteristics. In conclusion, the different cultivation regions, in the broader sense of an environment that incorporates both climatic and management parameters, show stability in terms of the studied groups of quality parameters. This stability is independent of the high or low performance of the group features.

Keywords: Gossypium hirsutum; Gossypium barbadense method, cotton, varieties, plant, fiber maturity; micronaire; fiber length; color grade; database; regional climatic.

In cotton, fiber yield, length, fineness and strength are important fiberquality parameters. This study was carried out to determine fiber yield and quality parameters (length, fineness and strength) of 46 cotton genotypes, two of which belong to barbadense and forty-four of hirsutum species, under ecological district conditions of Qibray, Uzbekistan.

The students will get acquainted with contemporary laboratory equipment to test cotton fibers, cotton fiber types, quality indexes of cotton fibers and fiber grades on appearance, report fiber qualities of different cotton varieties and fiber acceptance rules.

Necessary teaching sources to conduct training. Notes of lectures and laboratory practices, a manual on the practical and laboratory training, cotton fiber samples of different cotton varieties, and stationery.

Cotton fiber. Cotton is currently the leading plant fiber crop worldwide and is grown commercially in the temperate and tropical regions of more than 50 countries. It is estimated that cotton is cultivated on approximately 2.4% of the world‘s arable land. Mostly, cotton varieties from four species of cotton are grown worldwide.

1. The length of hirsutum, or upland cotton fibers, ranges from 28 to 36 mms or more and has a medium coarseness.

2. Barbadense or Sea Island cottons, as well as American Egyptian cottons, have extra long, fine fibers that can be 37-41 mm long or longer in some cases. The lint is readily detached from the seed.

The Asiatic cottons are classified as G. arboretum and G. herbaseum. Their fibers are coarse and short, their length being mostly between 25 and 28 mm.

To date, almost all cotton fiber producing countries have up to date cotton fiber analyzing laboratories like our Uzbek Center for Certification of Cotton Fiber "Sifat" under the Cabinet of Ministers of the Republic of Uzbekistan. It renders its service to all applicants to identify the quality of their cotton fiber. The center has a laboratory equipped with modifications of USTER® instrument-based cotton classing that is able to test 70 grams of fiber sample and produce test results that are the most accurate and repeatable in the world. Testing can be completed in seconds, by only one operator. And the USTER® HVI 1000 quickly generates full reports on fourteen important quality characteristics, including the fiber's length, strength, fineness, color, and moisture content. The result is consistent and objective fiber quality data, allowing breeders and spinners to make smarter and simpler pricing and purchasing decisions. In today‘s demanding market environment, that‘s the way to keep breeders and spinners profitable and their customers satisfied.

According to the state standard on cotton fiber (Uz.DST 604:2001), cotton fiber is divided into nine (9) types: 1a, 1b, 1, 2, 3, 4, 5, 6, 7 by length indices in accordance with the norms, which are given in the table 1.

Table 1.

Types of cotton fiber

Type	UHML		Staple		(Str) for sorts 1 and 2 cN/tex (df/tex)
	mm	inch	Inch	code	29.4-34.3 (30.0-35.0)
1a	33.7-34.3	1.33-1.35	1.11/32	43	
1b	32.9-33.6	1.30-1.32	1.5/16	42	
1	32.2-32.8	1.27-1.29	1.9/32	41	
2	31.4-32.1	1.24-1.26	1.1/4	40	
3	30.7-31.3	1.21-1.23	1.7/32	39	
	29.9-30.6	1.18-1.20	1.3/16	38	
4	28.9-29.8	1.14-1.17	1.5/32	37	23.0-27.8 (24.5-28.4)
	28.1-28.8	1.11-1.13	1.1/8	36	
5	27.4-28.0	1.08-1.10	1.3/32	35	
	26.6-27.3	1.05-1.07	1.1/16	34	
6	25.8-26.5	1.02-1.04	1.1/32	33	
7	25.1-25.7	0.90-1.01	1	32	

Where: - dependence on the HVI method; - dependence on the classer method; and - dependence on the special methods.

UHML: upper half mean length, the average length of the longest fibers, which constitute half of the tested sample by weight and expressed in mm or inches. This term is also known as "upper half of mean length" in the correct translation.

Staple- staple length 32-nds, is a fiber length that a classer defines visually by a staple of parallel fibers laid out by him or her manually (photo ..). It is expressed in 1/32 inch (for

example, 1 1/32) or by a code equal to the number of intervals in 1/32, in the example given, code 33.

The inch (in) is a unit of measurement equal to 2.5 cm. If there is divergence while specifying different quality characteristics, the priority is given to the Upper Half Mean Length (UHML), expressed in mm.

Types 1a, 1b, 1, 2, and 3 are referred to as G. barbadense (Long Staple Fiber), while types 4, 5, 6, and 7 are referred to as G. hirsutum (Middle Staple Fiber).

Depending on appearance, color, and presence of spots, cotton fiber of each type is sub-divided into five grades: The first (1), the second (2), the third (3), the fourth (4), and the fifth (5) in compliance with the requirements of table 2 and standards of cotton appearance (boxes), approved by the established procedure.

We know, that cotton is harvested as "seed cotton," which is then "ginned" to separate the seed and lint. The long "lint" fibers are further processed by spinning to produce yarn that is knitted or woven into fabrics.

The ginned G.hirsutum seed is covered in short, fuzzy fibers, known as "linters". These must be removed before the seed can be used for planting or crushed for oil. The linters are produced as first-cut or second-cut linters. The first cut linters have a longer fiber length and are used in the production of mattresses, furniture upholstery, and mops. The second-cut linters have a much shorter fiber length and are a major source of cellulose for both chemical and food uses.

Table 2.

Fiber grades on appearance

Industrial Grade	Fiber color and appearance by fiber types	
	1a, 1b, 1, 2, 3	4-7
I	White, or white with natural creamy shade or creamy according to breeding variety or region of cotton cultivation. Lustrous, silky and dense by appearance.	White, or white with natural creamy shade
II	From mat-white to creamy or yellow of uneven coloration with yellow spots. Lustre, silkiness and density are lower that in case of the sort I	From mat-white to creamy with light yellow spots
III	From mat-white to creamy or yellow of uneven coloration with yellow spots. Greyish shade, almost lusterless.	From dull-white to creamy with yellowish spots with matgreyish shade
IV	Yellow or light yellow of uneven coloration with grey shade and brown spots. Lustre less	. From dull white and creamcolored to yellow-creamy with grey shade and brown spots.
V	From brown to yellow with spots. Grey.	.Dull-white or dull-creamy to bright yellow with brown spots. Grey

Note. Cotton fiber with color shades different from the requirements of table 3 and standards of appearance (boxes) is supplied in co-ordination with the consumer.

The dignity of cotton varieties in regard to their fiber quality is reported usually as the table 3 and 4. Here, breeders exhibit the main fiber qualities that are understandable to any expert to evaluate given cotton varieties' dignity.

Table 3.
Deltapine select TM cotton varieties and the fiber quality characteristics.

Deltapine select ™ products	Fiber quality characteristics				
	Lint %	Staple	Micronaire	Strength	Lint unif
DP 1646 B2XF	41.7	39.0	4.5	29.9	83.0
DP 1820 B3XF	43.0	39.3	4.6	32.7	83.3
DP 1845 B3XF	40.3	39.5	3.80	30.06	81.5

Table 4.
Uzbek cotton varieties and their fiber quality characteristics.

Cotton varieties	Fiber quality characteristics				
	Lint %	Staple	Micronaire	Strength	Lint unif
Sultan	34-35	37	4.5-4.6	26.4	--
Bukhara-102	37.0	36	4.3-4.4	26.5	-
Porloq -1	33.3	41	4.1-4.3	36	-
Porloq-2	32.4	42	3.9-4.2	36	-

Where: Micronaire (Mic) – the characteristic of cotton fiber fineness and maturity, which is defined by the air-flow method. (A micronaire reading below 3.0 is considered very fine, and 5.0 and above is considered coarse; 3.5 to 4.9 is the most desirable range for upland cotton varieties).

Besides these indexes, other below listed indexes are also defined to provide a detailed characterization of fiber quality:

Mean Length (ML) – the average length of all fibers in the sample.

The Uniformity Index (Unf) is the ratio of fiber mean length to upper half mean length expressed in percentage.

Short Fiber Index (SFI) – a percentage of short fibers in a sample with a length of less than 0.5 inch (12.2 mm).

Reflectance (Rd) is the percentage of light reflected by the surface of the tested sample.

Yellowness (+b) – the amount of yellow color in the tested sample.

Trash Code (T) – a non-fiber contamination characteristic defined by multiplying the area of admixtures by ten. For example, if the portion of admixture area is 0.4%, the trash code is 4.

Trash Area: the ratio of the accumulated areas of all the trash particles measured instrumentally on the HVI machine by scanning of a sample surface to the area of the viewing window expressed in percentage.

Trash Count (Cnt) – the number of individual trash particles in a sample of 0.01 inch (0.25 mm) or greater in diameter.

Strength (Str) – the strength of cotton fiber expressed in the graduation of HVI

Elongation (Elg): the cotton fiber elongation to the moment of its breakage on the dynamometer of the HVI system, expressed in percentage.

Cotton fiber is supplied and accepted in lots. A lot is the quantity of bales of the same type, variety, and industrial grade that are accompanied by one document certifying their quality.

The maximum lot size is no more than a railroad car. The standard moisture regain for the calculation of conditioned weight is 8.5 %.

The minimal moisture gain is – 5 %. A formula is used to calculate conditioned weight (Mc) in kilograms.

$$M_c = M_A \frac{100 + W_S}{100 + W_A}$$

Where: M_A –actual weight of the cotton fiber lot which is submitted for acceptance, kg.

W_S – standardized moisture regain, equal to 8.5 %.

W_A – actual moisture regain in cotton fiber lot, %.

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