SHORT COMMUNICATION

Evaluation of Fibre Quality Traits in *G. arboreum* Germplasm

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A total of 119 accessions of *Gossypium arboreum* of diverse origin were evaluated for 2.5% span length, uniformity ratio, micronaire value and fibre strength. FFS-44 had recorded 26.7mm 2.5% span length, 5.3 micronaire value and 20.2 g/tex fibre strength. CINA 329 had recorded micronaire value (5.0). The accession 35/5-B had recorded good fibre quality (26.6mm, 2.5% span length, 5.1 micronaire value and 17.9 g/tex fibre strength). Based on this study it is advocated that these lines could be used in further fibre quality improvement programme of *Gossypium arboreum*.

Key Words: 2.5% Span length, Fibre strength, *Gossypium arboreum*, Micronaire value, Uniformity ratio

Plant germplasm is the basic raw material for any crop improvement programme. The availability of genetic variability for desired traits are the first and foremost requirement for success of any breeding programme. Hence collection, maintenance, categorization and utilization of germplasm have special significance. The precise evaluation of genetic stock and dissemination of findings is of great importance for their utilization in breeding programme. The inherent quality characteristics of fibre produced on a cotton plant are mainly dependent on genetic make up of the variety. The systematic evaluated genetic resources of crop plays pivotal role in crop improvement. More than 90% of the cotton grown in the country goes into production of yarn (Iyer and Iyer, 1999). Hence, parameters crucial to trouble free processing should be given maximum importance while evaluating quality. These parameters include 2.5% span length, strength, fibre uniformity, fineness. Diploids are commonly known as *desi* cottons. The desi cottons are inherently resistant to sucking pests and cotton leaf curl virus disease. In the present study the germplasm lines were evaluated and identified for important fibre quality traits for *Gossypium arboreum* improvement.

The experimental material consisted of 119 accessions of *Gossypium arboreum* of diverse origin, grown in a single row of 6 m length at research area of Department of Plant Breeding, CCS Haryana Agricultural University, Hisar, during *Kharif* 2007. The spacing between rows was 67.5 cm and plants in a row were kept 30 cm apart. Recommended agronomic and plant protection measures were adopted. The season by and large remained favourable for cotton crop. Observations were recorded on four important fibre characters i.e. 2.5% span length, uniformity ratio, micronaire value and fibre strength.

Desi cotton varieties like RG8, HD107, HD123, HD324, LD327, LD694 etc. and hybrids like AAH-1, CICR-2, Moti grown in north India have short staple length, coarse fibre and spin to less than 10 count's. Although, these varieties/hybrids have very good seed cotton yield potential. With the introduction of *G. hirsutum* cotton in India, research work on *desi* cotton suffered a set back. Work on quality improvement in *desi* cotton largely remained confined to few centers like Parbhani, Surat and Dharwad. The major aim of these researchers was to develop *desi* cottons on par with *G. hirsutum* with regard to their yield potential and fibre quality (Singh *et al*., 2004). These efforts resulted in development of varieties like PA 255 and PA 402 from Parbhani (Maharashtra), MDL 2463 from Andhra Pradesh and DLSA 17 from Karnataka. These varieties have high productivity and superior fibre quality (Deshpande *et al*., 2004). Earlier research work on cotton in these states remained concentrated on yield improvement whereas; improvement in fibre quality was given least priority. In the last few years efforts have been made to improve the fibre quality and to achieve this goal the germplasm had been enriched with good fibre quality lines from Central and Southern Zones. The fibre quality parameters of these *arboreum* lines were at par with local American cotton varieties or hybrids. Results obtained in the present investigation are presented and described as under:

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Fibre length: Among the various fibre properties of cotton that matters to a spinner, the fibre length is most important. Shorter fibre than a minimum length is difficult to be handled by the processing machines. Spinnability is basically decided by fibre length and its variability. Other factors being equal, long staple cottons give better spinning performance than shorter ones. Wide range of variability exists for fibre length in cotton (16 mm to 40 mm) (Narayanan *et al*., 2004). Various fibre length parameters used in different countries may be mean length, effective length and span length. These are measured by several instruments like comb shorter, Fibrograph, High Volume Instrument. In addition to length, the uniformity of fibre length is also an important attribute. This is usually expressed in terms of co efficient of variation for fibre length. More uniform the fibre length, better will be the quality of yarn. The fibre length is generally measured as 2.5% span length. It is the length spanned by 2.5% of the fibre caught by the comb and termed as 2.5 % span length. In other words if the span length of a cotton sample is 25 mm, it means that only 2.5% of the fibres in the sample have length longer than 25 mm. In general 2.5% span length is about 10% higher than the mean fibre length obtained by comb sorter. For various purposes, it is common practice to group cottons into various categories based on staple length values. Classification of staple length is now based on 2.5% span length. Indian cottons based on span length are categorized into different groups as under:

Category	Range of 2.5 % span length (mm)	No. of germplasm lines
Short	20 mm or below	42
Medium	20.1–24.0	58
Medium long	24.1–27.0	19
Long	27.1–32.0	–
Extra long	32.5 mm and above	–

The 2.5% span length ranged from 15.5 mm (AC 3376) to 26.7 mm (FFS-44) with mean value of 21.1 mm (Table 1). On the basis of 2.5% span length the germplasm was grouped into different categories. Out of 119 germplasm lines, 42 lines had short fibre, maximum lines fall in medium fibre group i.e. 58 and medium long fibre category had 19 lines. No *arboreum* germpasm line had long and extra long 2.5% span length of fibre. Similar findings for 2.5% span length (17.46–26.4 mm) have also been reported by Pundhir *et al*., 2004 in *G. arboreum* cotton. Promising genetic stock identified for span length are: FFS-44 (26.7mm), 35/5-B (26.6 mm), 302 (26.2 mm), AKA 9410 (26.0 mm), D 462 P4 (25.8 mm), AKA 315-1 (25.8 mm), AKA 315 (25.8 mm), FFS-20 (25.5 mm), 0479 (25.0 mm). The genetic stock having 2.5% span length more than 24.0 mm along with other fibre quality traits are listed in Table 2.

Uniformity Ratio: The ratio of 50% span length to 2.5% span length expressed as per cent is called uniformity ratio (UR%). It gives an idea about fibre variability in a sample. The uniformity ratio (%) ranged from 48 to 53 with mean value of 52 (Table 1). Only five lines had the uniformity ratio below than 50. This indicated that in the present germplasm uniformity ratio is quite high. Although, Pundhir *et al*. (2004) in their studies reported slight wide range (45.0–53.5) for uniformity ratio that may be due to difference in the material or some environmental factors.

Fibre Fineness: It is also one of the important fibre characters in cotton. It plays a major role in deciding spinnable counts and yarn quality. If similar kind of yarn is spun from two different varieties of cotton, yarn spun from finer cotton will have a larger number of fibres in its cross section and hence they will be stronger and more uniform than that of coarse variety. Fineness may be denoted in various ways. Diameter, perimeter and area of cross section are dimensional measures of fineness. For practical purpose fineness is measured as mass per unit length (linear density) and denoted as gravimetric fineness is most suitable. Linear density is expressed in microgrammes/inch or as millitex which is weight of fibre in milligrammes or as millitex which is weight of fibre in milligrammes per kilometer.

The micronaire values ranged from 5.0 to more than seven. Fifty genotypes had micronaire value more than seven whereas; 46 genotypes fall in the range of 6.0 to 7.0 and only 23 germplasm lines had below than 6.0 (Table 1). These findings confirm the earlier studies (Singh *et al*., 1988) where Pundhir *et al*. (2004) observed 5.1 to 8.0 micronaire value in *arboreum* cotton. Above observations indicated that the dominance of coarse material in the present genetic stock. Although, the efforts have been made to enrich the genetic stock with fine fibre genotypes. It has been noticed that with the passes of time good fibre lines slowly loose their fineness and ultimately fall in the medium fineness group. The main reason seems to be the environmental conditions of this zone are not favourable for the development of fine fibre. Germplasm lines with fine fibre traits identified are: CINA 329 (5.0), 35/5-B (5.1), PA 255 (5.3), FFS 44 (5.3), FFS 59 (5.3),

Table 1. Range and superior germplasm lines for different fibre quality traits

S.No.	2.5 % SL	Micronaire value	Tenacity (g/tex)	UR (%)
1	FFS-44 (26.7)	CINA 329 (5.0)	FFS-44 (20.2)	49 germplasm lines have UR
2	35/5-B (26.6)	35/5-B (5.1)	CAD 29 (19.9)	(%) values 53
3	302 (26.2)	PA 255 (5.3)	D 462-1-1 (19.7)	
4	AKA 9410 (26.0)	FFS 44 (5.3)	PA 255 (19.4)	
5	D 462 P4 (25.8)	FFS 59 (5.3)	FFS 98 (19.3)	
6	AKA 315–1 (25.8)	D 462-1-1 (5.4)	AKA 315 (19.2)	
7	AKA 315 (25.8)	302 (5.4)	AKA 210 (19.0)	
8	FFS-20 (25.5)	CAD 306 (5.6)	AH 11 (19.0)	
9	0479 (25.0)	AKA 315–1 (5.6)	AKA 315–1 (18.9)	
10	CINA 329 (24.9)	FFS 60 (5.7)	H476-5 (18.6)	
11	P489 (24.8)	H 476-5 (5.8)	CAD 306 (18.4)	
12	CAD 306 (24.6)	H 460 (5.8)	AC 3352 (18.0)	
13	AH 11 (24.6)	AC 3352 (5.8)	35/5-B (17.9)	
14	AKA 210 (24.5)	3031 (5.8)	P 489 (17.9)	
15	PA 255 (24.5)	FFS 98 (5.8)	FFS 69 (17.9)	
16	CINA 305 (24.3)	AH 11 (5.8)		
Min.	15.5	48	5.0	12.9
Max.	26.7	53	> 7.0	20.2
Mean	21.1	52.0	–	16.2

Values of a particular genotype are given in parentheses

Table 2. Best genotypes for 2.5% span length along with UR(%), micronaire value and tenacity

S No.	Name of germplasm line	2.5 % SL	UR (%)	Micronaire value	Tenacity (g/tex)
1	FFS-44	26.7	51	5.3	20.2
2	35/5-B	26.6	48	5.1	17.9
3	302	26.2	48	5.4	16.5
4	AKA9410	26.0	51	6.3	18.5
5	D 462 P4	25.8	52	5.8	19.2
6	AKA 315-1	25.8	50	5.6	18.9
7	AKA 315	25.8	52	5.8	19.2
8	FFS-20	25.5	52	6.3	18.4
9	0479	25.0	50	6.2	17.7
10	CINA 329	24.9	49	5.0	19.9
11	P489	24.8	52	6.4	18.7
12	CAD 306	24.6	52	5.6	18.4
13	AH 11	24.6	50	5.8	19.0
14	PA 255	24.5	49	5.3	19.4
15	AKA 210	24.5	50	5.9	17.9
16	CINA 305	24.3	51	6.2	19.7
17	FFS-98	24.2	52	5.8	19.3
18	FFS-18	24.2	51	6.5	18.1
19	BPS	24.2	51	6.6	17.9

D 462-1-1 (5.4), 302 (5.4), CAD 306 (5.6), AKA 315-1 (5.6) etc. Utilization of these lines for improvement in fibre fineness is advocated.

Fibre Strength or Tenacity: The durability of a textile material depends largely on mechanical strength of the fibre. In modern spinning systems like OE Rotor Spinning the fibre strength is most desirable parameter. In textile mills operations like spinning, winding, and weaving largely depends on the strength of the material, otherwise breaking leads to frequent stoppage of machine. Tenacity is the maximum specific stress that is developed in a tensile test taken to rupture. Tenacity is expressed as a force per unit linear density of the unstrained specimen. Commonly used unit is grammes per tex.

The fibre strength (tenacity) ranged from 12.9 to 20.2 g/tex with a mean value of 16.2 g/tex indicated that the present germplasm stock had low fibre strength. In the present fibre quality norms more emphasis is given on fibre strength, the ratio of fibre strength over fibre length should not be less than 0.8. Most of the superior 2.5% span length lines also failed to meet out this norm. Out of total 119 germplasm lines 56 lines had the fibre strength less than 16 g/tex, 45 lines ranged between 16.1 to 18.0 g/tex and only 18 lines fall in the range of 18.1 and above for this character. These findings confirm the findings of Pundhir *et al*. (2004) also reported low fibre

strength range (15.1 to 19.9 g/tex) in *arboreum* cotton of North zone. The genetic stock lines, namely, FFS-44 (20.2), CAD 29 (19.9), D 462-1-1 (19.7), PA 255 (19.4), FFS 98 (19.3), AKA 315 (19.2), AKA 210 (19.0) may be utilized for development of varieties/hybrids with better fibre strength.

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