Long Linted *Gossypium arboreum* for Meeting Textile Industrial Needs

V.N. Kulkarni and B.M. Khadi
Agricultural Research Station Dharwad Farm-580007, Karnataka India

ABSTRACT

Drought tolerant G. aboreum is grown in rainfed areas of India. The fiber is coarse, making it difficult to spin at higher counts. Two sets of long linted, fine cotton genotypes, DLSA and PA, developed through inter-specific hybridization and selection, were evaluated for yield and quality under rainfed conditions. Industrially acceptable fiber properties were exhibited by these genotypes. About 38% advantage in yield of seed cotton was obtained over checks with significant differences in boll weight. No significant differences were observed in seed and lint indices. Ginning outturns as high as 43.5 percent were achieved. Fiber length up to 30.37 mm with micronaire values between 4.0 and 5.0 indicated improvement in length and fineness. The fiber strength was between 19 and 21 gm/tex (1/8" gauge) and the uniformity ratio exceeded 45 percent. These selections would be improvements for rainfed tracts of India where production of current cultivars has nearly satiated the spinning needs of the market. The genotypes are being utilized in the hybrid breeding programme of diploid cotton

Introduction

Gossypium arboreum is one of the cultivated diploid (2n=2x=26 (A_2A_2)) species that occupies major rainfed cotton area in Central India and considerable area in irrigated tracts of North India. Unlike tetraploid cottons, it is an inherently low yielding species but has tolerance to drought, pest and diseases and is immune to cotton leaf curl virus. The major problems with *G. arboreum* at present are fiber length that is generally short and micronaire that is coarse. The improvement in fiber properties from the available germplasm is unlikely. One of the possible solutions was interspecific hybridization between colchicin induced 4n *G. arboreum* and *G. hirsutum* and selection in the segregating generations of back crosses (Deshpande, *et al.,* 1992). The long linted *G. arboreum* genotypes produced were evaluated for yield and fiber properties.

Material and Methods

Long linted *G. arboreum* genotypes obtained from Parbhani (PA) and identified at Dharwad (DLSA) were evaluated for yield and fiber properties under rainfed conditions at Dharwad. Agronomically accepted widely cultivated diploid check Jayadhar was used for comparison. Four 5.4-m long rows were planted with a spacing 90 x 20 cm in three replications. All the necessary agronomic practices were followed to raise the crop. Observations on yield bolls per plant, boll weight (g), Ginning Outturn (GOT%), Seed Index (g), Lint Index (g) and seed cotton yield (kg/ha) were recorded apart. The fiber properties 2.5 percent Span Length, Micronaire, 3.2 mm gauge Strength (g/text), Uniformity ratio (UR%) and Elongation (EL%) were assessed. The data were statistically analyzed and genotypic and phenotypic co-efficient of variation (GCV and PCV) were estimated as per Burtorn and Davane (1953). Heritability (Hanson *et al.*, 1956) and expected genetic advance (Allard, 1960) were estimated.

Results and Discussion

Analysis of variance was significant for all yield and fiber parameters in both Parbhani and Dharwad genotypes except seed and lint indices in Dharwad and Uniformity Ratio in Parbhani lines.

Among 30 DLSA lines evaluated along with diploid *G. herbaceum* check Jahadhar, a total of 13 genotypes were significantly superior for bolls per plant and boll weight over Jayadhar (4.5 Boll/plant & 2.49 boll wt.) Following lines possessed big and good numbers of bolls together DLA Nos 8, 17, 24, 26 (Table 1). Significant improvement for GOT was observed with 18 lines and GOT as high as 49.0 per cent was observed with DLSA 17 and 20. The genotypes DLSA 1, 4,5,7,18,12, 13, 17, 24 and 30 (between 1020-1307 kg/ha) produced significantly superior seed cotton yield over check Jayadhar (760 kg) under rainfed conditions.

Fiber length upto 29.9mm was evidenced with DLSA-9 that was 7.7 mm more than check Jayadhar (22.2mm). Among DLSA lines exhibited fiber length more than 26 mm the length observed in these cotton were comparable to any cultivated *G. hirsutum* genotypes. Further, fiber length was similar to cultivated intra-*hirsutum* hybrids like DHH 11 (28 mm) and NHH 44. Such observations were also made by Deshpande *et al.*, (1992) in interspecific derivatives between *G. arboreums* and *G. hirsutum*. Significant improvement in fineness of the fiber was noticed as micronaire was reduced below five in most of the cultures. Four lines DLSA 7, 8, 9 and 16 exhibited micronaire below 4.5 which was comparable to

cultivated *G. hirsutums* genotypes (generally between 4-4.5) of this region. Strogner fiber significantly superior to Jayadhar (19.3 g/tex) was observed with 10 genotypes. (>20.5 g/tex). Uniformity ratio and elongation percentages were acceptable.

In another set of experiments of Pharbhani lines, similar observations were made on fiber properties. Fiber length up to 30.4 mm and micronaire values of 4.5 were observed. However, fiber strength was generally low compared with check Jaydhar and pre-released genotype DDhC 11. Conversely, significant seed cotton yield increases was noticed in PA lines.

Variability studies

All the characters related to yield and fiber exhibited considerable range of variation. The estimates of phenotypic co-efficient of variations (PCV) was more than genotypic coefficient variation (GCV) however, GCV was near to PCV in case of fiber properties indicating least effect of environment on these characters compared to genotypic variation. This provides ample scope for improvement in these traits. Wider differences between PCV and GCV were observed with respect to yield parameters.

Heritability estimates were high for GOT, seed cotton yield (kg/ha), seed and lint index and all the fiber properties. Duhoon and Lu (1989) and Dedania and Rethani (1994) also made such observations.

High heritability estimates alone will not guarantee significant gains after selection, unless sufficient expected genetic advance (GA) present. High heritability coupled with high genetic gains were observed with seed cotton yield, GOT, Fiber length, strength and uniformity ratio and this gives an opportunity for selection as involvement of additive gene action is expected in these traits.

Interspecific cross derivatives exhibited significant improvement in the fiber properties and seed cotton yield. Increasing fiber length, strength and fiber fineness are needed in diploid cottons that are drought tolerant and grow in rainfed areas. The genotypes DLSA-17, 1, 8, 4 and 24 possessed good yield and fiber properties and can be promoted for large scale cultivation under rainfed conditions after multilocation evaluation.

Acknowledgements

Our grateful thanks are due to Dr. L.A. Deshpande for exchanging genetic material and narrating his work. The feed back and constant interaction with SAI Lakshmi Industries Pvt. Ltd., Bangalore, Tungabhadra, Ginning and Pressing Factory and Balaji Ginning and Pressing Mill, Bellary are acknowledged. Their support will be remembered.

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Table 1. Yield and fiber parameters of Dharwad long linted *G.arboreums*.

Genotypes	Bolls/ plant	Bolls Wt.(g)	GOT (%)	Yield kg/ha	SI (g)	LI (g)	FL (mm)	Strength	Mic	UR %	EL %
DLSA-1	5.6	2.6	28.4	1129	7.2	4.7	27.6	18.1	4.7	43.5	5.4
DLSA-2	4.8	2.5	41.7	712	6.0	4.4	26.4	18.6	4.7	45.6	5.8
DLSA-3	3.1	2.5	28.5	269	7.1	3.4	21.1	18.9	6.8	4.75	5.7
DLSA-4	6.6	2.3	36.0	1270	6.2	3.5	26.9	21.3	4.7	46.0	5.8
DLSA-5	7.2	2.3	35.5	1069	6.6	3.8	26.3	23.1	4.6	47.9	6.2
DLSA-6	7.3	2.8	38.0	942	7.1	4.6	28.3	19.8	5.5	49.3	5.7
DLSA-7	6.8	2.6	36.6	1059	6.7	4.0	28.4	22.2	4.2	44.8	6.0
DLSA-8	8.1	2.6	42.4	1281	7.2	5.2	28.5	22.1	4.3	48.3	6.2
DLSA-9	6.3	2.6	37.8	985	7.6	4.7	29.9	20.9	4.4	47.9	6.1
DLSA-10	5.8	2.5	35.6	709	5.2	3.6	23.9	18.4	5.5	43.0	5.9
DLSA-11	4.3	2.7	37.0	534	7.4	4.3	25.4	18.9	5.3	50.3	6.4
DLSA-12	6.4	2.5	36.3	1020	6.5	3.8	28.0	21.1	4.9	46.8	6.0
DLSA-13	6.9	2.5	38.0	1210	6.1	4.1	27.6	22.2	4.7	48.0	6.1
DLSA-14	7.5	2.6	35.0	958	6.6	4.1	27.2	19.7	4.8	49.4	5.9
DLSA-15	6.1	2.6	48.0	1004	6.3	4.0	25.3	21.4	4.8	48.1	5.6
DLSA-16	7.5	2.5	46.5	800	6.2	3.8	29.3	23.4	4.4	44.8	6.1
DLSA-17	8.9	2.8	49.1	1162	6.2	4.0	25.9	21.9	5.7	51.5	5.6
DLSA-18	5.8	2.5	45.4	806	6.9	3.8	27.4	20.0	4.8	47.5	6.0
DLSA-19	4.7	3.0	44.7	794	7.8	5.3	25.7	16.9	6.1	48.4	6.0
DLSA-20	6.1	3.1	49.0	974	6.8	5.0	26.5	19.7	4.9	47.3	6.1
DLSA-21	4.5	2.4	43.3	920	6.0	4.2	24.6	12.8	5.2	47.1	7.0
DLSA-22	4.6	2.5	40.6	526	6.1	4.3	26.0	19.1	4.8	46.1	6.0
DLSA-23	5.8	2.4	37.5	821	5.9	3.6	26.2	19.3	5.1	50.1	5.9
DLSA-24	6.6	2.7	36.1	1307	6.8	4.2	26.3	21.5	5.0	49.4	7.0
DLSA-25	5.7	2.5	35.2	700	6.5	3.8	26.0	19.6	5.4	47.5	5.7
DLSA-26	7.6	2.6	37.8	857	7.3	4.6	25.3	19.6	4.7	47.3	6.0
DLSA-27	6.0	2.4	35.1	908	7.0	4.6	26.3	19.7	5.2	50.1	5.9
DLSA-28	6.0	2.4	37.7	861	6.6	4.4	26.1	19.6	5.1	46.0	6.3
DLSA-29	4.4	2.9	40.7	695	7.7	4.9	25.2	17.2	4.5	46.6	5.8
DLSA-30	7.5	2.5	38.8	1276	6.2	4.1	24.9	18.8	4.7	48.8	6.4
Jayadhar	4.5	2.4	30.0	760	6.0	3.4	22.2	19.3	5.5	49.8	6.0
CD at 5%	2.0	0.3	6.6	256	NS	NS	0.9	1.2	-	2.5	0.3
CV %	20.6	8.2	10.2	16.7	18.5	16.1	2.8	4.9	-	4.2	3.8

GOT = Ginning Out Turn : Yield = Seed Cotton Yield : FL = 2.5 % Span length UR = Uniformity Ratio: SI and LI = Seed and Lint Indices EL = Elongation : Strength = g/tex 3.2 mm gauge ; Mic = Micronaire

Table 2. Yield and fiber properties Parabhani long linted *G. arboreums.*

Genotype	Bolls/ plant	Boll Wt (g)	Yield kg/ha	FL (mm)	Strength	Mic	UR (%)	EL %
PA 255	7.1	2.2	876	30.1	18.1	4.4	48.3	6.2
PA 301	5.4	2.2	615	26.7	17.4	5.0	46.6	5.5
PA 302	5.0	2.1	609	30.4	19.3	4.1	48.1	7.3
PA 183	8.1	2.1	939	25.2	18.2	3.9	47.6	6.7
PA 304	5.0	2.2	694	29.3	16.6	4.5	48.8	6.0
PA 314	5.2	2.3	595	25.5	18.4	4.5	47.7	6.5
PA 343	7.1	1.9	745	27.0	18.9	4.1	46.3	6.9
PA 347	7.2	2.0	852	26.1	18.2	4.7	47.9	6.1
PA 375	7.3	2.2	938	26.5	16.7	4.9	48.2	5.4
DDhC11	3.5	1.7	241	23.0	17.8	5.0	49.9	6.1
Jaydhar	4.5	1.8	300	22.9	19.2	5.2	18.8	5.9
CD	0.7	0.2	166	0.8	1.1	-	NS	0.4
CV %	6.9	6.9	13.7	2.4	5.0	-	3.7	4.9

GOT = Ginning Out Turn : Yield = Seed Cotton Yield : FL = 2.5 % Span length
UR = Uniformity Ratio: EL = Elongation : Strength = g/tex 3.2 mm gauge ; Mic = Micronaire

Table 3. Variability parameters of yield and fiber traits of longlinted *G. arboreums.*

Character	Mean	Range	VG	VP	GCV	PCV	h^2	GA
Yield Parameters								
Bolls/Plant	6.14	3.1-8.9	1.12	2.73	17.20	26.90	41.0	1.40
Boll Wt (g)	2.60	2.3-3.1	0.02	0.06	5.40	9.40	33.3	0.17
GOT %	39.50	28.5-49.0	20.31	36.41	11.40	15.20	55.8	6.94
Seed Cotton Yield (kg/ha)	938.80	534-1307	74500	129017	29.00	38.00	75.2	48.80
Seed Index	6.66	6.0-7.8	0.56	1.10	11.20	15.70	57.7	1.05
Lint Index	4.23	3.4-5.3	0.58	1.04	18.00	24.10	55.8	1.17
Fiber Parameters								
Fiber Length(mm)	26.42	21.1-29.9	4.73	5.27	8.23	8.68	89.8	4.25
Strength (g/tex)	20.10	18.1-23.4	13.37	14.33	18.19	18.80	93.3	7.28
Uniformity (%)	47.50	43.0-50.3	18.11	22.07	8.95	9.80	82.1	7.95
Elongation (%)	6.03	5.4-7.0	0.18	0.23	7.01	7.95	78.3	0.77