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Ken transgressive segregants in advanced generation for fiber quality and yield of desi cotton

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Abstract
Desi cotton or *herbaceum* cotton improvement programme mainly for long linted (>27.5 mm) genotypes play perfect balancing role in cotton cultivation with low input, best quality and sustainable utilization of natural resources. The present investigation involve 220 advanced breeding lines of F_5 generation which were selected mainly for yield, fiber quality and *G. herbaceum* type characters in every step of segregating generation obtained through interspecific cross of parents GVhv 585 and 824. All entries were evaluated in augmented design with four checks. Entry F_5-214/220 has recorded significantly higher lint yield of 157.1 gm/plant followed by F_5-146/220 (128.6 gm/plant) and F_5-187/220 (128.1 gm/plant) over the best check GADC-2 (53.8 gm/plant). The range of fiber length was observed between 21.5 mm (F_5-102/220) to 33.1 mm (F_5-140/220). Highest bundle strength was recorded with Entry F_5-143/220 (34.6 g/tex) and least strength with entry F_5-214/220 (20.7 g/tex). The range of GOT % was recorded between 20.7 % (F_5-195/220) to 43.8 % (F_5-156/220). Promising entries F_5-23/220 and F_5-178/220 produced seed cotton yield (298.2 g/plant, 122.7 g/plant) and also recorded good fiber length (29.5 mm, 30.2 mm) and bundle strength (29.2 g/tex, 28.8 g/tex), respectively.

Keywords: Transgressive segregants, generation, fiber

Introduction
Gossypium genus having four cultivated species among them *G. barbadense* and *G. hirsutum* are cultivating for extra-long staple cotton quality and higher yield coupled with long fibre, respectively; under suitable environmental conditions but these species are highly susceptible for biotic and abiotic stress condition. Whereas, *Gossypium herbaceum* race *wightianum* has naturally inherent capacity of resistance for biotic and abiotic stresses resulted in high seed cotton yield, ginning out turn and lint yield with low input resources in harsh environmental condition as compare to other cotton species. Although, *herbaceum* cotton is not popular among local, national as well as international market due to low fiber quality. There are plenty work has been done for fiber quality improvement in tetraploid cotton (Khan *et al*., 2009; Dutt *et al*., 2004; Manickam, 2007 and Magdum *et al*., 2012; Patil *et al*., 2014 and Latyr *et al*., 2018) [1, 2, 6, 7, 4] particularly for long staple length. Few research stations are engaged in improvement of *G. herbaceum* cotton in the world. Recently, Regional Cotton Research Station, Viramgam of Anand Agricultural University conducted research with an aim to evolve high yielding and long linted *herbaceum* cotton genotype.

Material and method
The study was conducted in the experimental field of Regional Cotton Research Station, Anand Agricultural University, Viramgam under rainfed condition during the year 2015-16 in Gujarat, India. Total 220 transgressive segregants were selected out of 960 plants of F_4 generation of interspecific cross of genotype GVhv 585 (*G. herbaceum*) and 824 (*G. arboretum*). These 220 transgressive segregants as F_5 were evaluated in augmented design suggested by Federer (1956) [3]. Four commercial cultivars *viz.* G Cot 13, G Cot 21, ADC-1 and GADC-2 were used as check. The experiment includes 10 blocks in which 220 lines equally divided with four checks in each block. The observations were recorded for five random plant selected in the line for the characters *viz.*, seed cotton yield (g/plant), ginning out turn (%) and Lint yield (g/plant). The recorded data were analyzed at Department of Agricultural Staticstics, B. A. College of Agriculture, Anand Agricultural University, Anand using Win STAT software. The fiber quality parameters *viz.*, fiber length, fiber strength and

fiber fineness were tested under HVI (high volume instrument) mode at ATIRA, Ahmedabad.

Result and discussion

Analysis of variance indicated that significant differences were found among the genotypes for Lint yield and GOT over checks, while non-significant differences were found for seed cotton yield (Table 1). Total 220 entries were evaluated in augmented design over four checks *viz.,* G Cot 13, G Cot 21, ADC 1 and GADC 2.

The findings suggested that large population of transgressive segregants in F_5 would explore huge possibilities for combination of pinnacle economic characters *viz.* different fiber quality parameters and yield. The observations indicated that extra-long linted line F_5-140/220 produced low seed cotton yield of 77 g/plant. The entry F_5-143/220 recorded highest fiber strength of 34.6 g/tex produced very low seed cotton yield of 50 g/plant. Entry F_5-214/220 (373 g/plant) had recorded numerically highest seed cotton yield followed by the entry F_5-187/200 (350.7 g/plant), F_5-127/220 (324.2 g/plant) over the best check GADC-2 (123.1 g/plant). F_5-214/220 has recorded significantly higher lint yield of 157.1 gm/plant followed by F_5-146/220 (128.6 gm/plant) and F_5-187/220 (128.1 gm/plant) over the best check GADC-2 (53.8 gm/plant). The entry F_5-214/220 produced highest seed cotton as well as lint yield recorded medium fiber length (23.9 mm) and weak fiber strength (20.7 g/tex) (Table 2). These entries *viz.*, F_5-214/220, F5-146/220, F_5-187/220 and check GADC-2 recorded ginning out turn of 40.2 %, 39.2 %, 35.5 % and 43.6 %, respectively.

The range of fiber length (UHML) was recorded between 21.5 mm to 33.1 mm. Extra-long staple length (Table 3) of 33.1 mm was recorded by entry F_5-140/220. Entry F_5-84/220 recorded long staple length of 32.0 mm followed by entry F_5-161/220 (31.9 mm) and F_5-38/220 (31.8 mm). The range of fiber strength was recorded between 20.7 g/tex to 34.6 g/tex. Entry F_5-143/220 recorded fiber strength of 34.6 mm followed by entry F_5-112/220 and F_5-164/220 (34.5 mm). The range of GOT was recorded between 21.2 % (F_5-120/220) to 44.5 % (ADC-1).

Entries *viz.*, F_5-19/220, F_5-23/220, F_5-63/220, F_5-88/220, F_5-103/220, F_5-127/220, F_5-137/220, F_5-146/220, F_5-178/220 and F_5-210/220 were found as elite genotypes completely resembled to *herbaceum* cotton and also recorded (Table 4) long staple length with high fiber strength. Promising entries F_5-23/220 and F_5-178/220 produced 298.2 g/plant and 122.7 g/plant seed cotton, respectively. These entries also recorded good fiber length (29.5 mm, 30.2 mm) and bundle strength (29.2 g/tex, 28.8 g/tex), respectively.

Table 1: Analysis of variance yield and related traits (g/plant)

Source of Variations	DF	Seed Cotton Yield (g/plant)	Lint yield (g/plant)	GP (%)
Block (ignoring Treatments)	9	3278.6*	280.1	14.5
Treatment (eliminating Blocks)	223	4324.2*	630.8*	32.3*
Checks	3	443.5	116.3	20.2*
Checks+Var vs. Var.	220	4377.1*	637.8*	32.5*
Block (eliminating Check+Var.)	9	1372.7	225.0	5.8
Entries (ignoring Blocks)	223	4401.1*	633.1*	32.7*
Varieties	219	4475.4*	625.8*	18.4*
Checks vs. Varieties	1	10.0	3778.5*	3190.9*
Error	27	1179.5	238.7	6.7

Table 2: Top ten entries recorded highest lint yield (g/plant) along with Ginning out turn (%), seed cotton yield and fiber quality.

SN	Entry	Lint Yield (gm/plant)	Adjusted Lint yield (gm/plant)	Ginning Out turn (%)	Adjusted GOT (%)	Seed Cotton yield (gm/ plant)	Adjusted Seed Cotton yield (gm/ plant)	UHML (mm)	Fiber Strength (g/tex)	Fineness (mic)
1	F_5-214/220	152.0	157.1	40.8	40.2	373.0	387.0	23.9	20.7	5.0
2	F_5-127/220	132.0	124.6	38.5	39.2	343.0	324.2	27.1	27.4	4.6
3	F_5-146/220	129.0	128.6	40.3	39.2	320.0	321.7	28.1	25.5	4.8
4	F_5-187/220	128.0	128.1	36.9	35.5	347.0	350.7	28.5	26.4	5.8
5	F_5-19/220	126.0	120.1	39.7	38.7	317.0	305.5	28.1	28.0	4.3
6	F_5-23/220	110.0	117.1	38.9	39.4	283.0	298.2	29.5	29.2	5.6
7	F_5-35/220	107.0	114.1	37.2	37.7	288.0	303.2	28.5	31.8	5.3
8	F_5-88/220	99.0	89.1	39.1	40.2	253.0	226.7	28.0	28.0	4.3
9	F_5-122/220	90.0	82.6	38.3	39.0	235.0	216.2	27.2	27.4	5.3
10	F_5-65/220	88.0	99.9	39.6	40.2	222.0	246.9	26.9	30.5	5.2
Mean										
11	G Cot 13 (C)		45.9		42.8		115.5	24.0	23.0	5.5
12	G Cot 21 (C)		49.2		44.5		107.3	23.9	24.4	5.4
13	ADC-1 (C)		47.5		41.1		112.0	24.8	25.7	5.0
14	GADC-2 (C)		53.8		43.6		123.1	24.3	23.5	4.8
Comparisons			C.D. 95%		C.D. 95%		C.D. 95%			
Ci - Cj			14.2		2.4		31.5			
BiVi - BiVj			44.8		7.5		99.7			
BiVi - BjVj			50.1		8.4		111.4			
Ci - Vj			37.7		6.3		83.8			

(C) = Check

Table 3: Entries with log staple length (mm) and high fiber strength (g/tex)

S .No	Entry	UHML (mm)	Entry	Fiber Strength (g/tex)
1	F_5-140/220	33.1	F_5-143/220	34.6
2	F_5-84/220	32.0	F_5-112/220	34.5
3	F_5-161/220	31.9	F_5-164/220	34.5
4	F_5-38/220	31.8	F_5-104/220	34.1
5	F_5-169/220	31.8	F_5-94/220	33.5
6	F_5-15/220	31.7	F_5-71/220	33.4
7	F_5-26/220	31.7	F_5-84/220	33.2
8	F_5-94/220	31.6	F_5-180/220	33.1
9	F_5-218/220	31.5	F_5-217/220	32.9
10	F_5-117/220	31.5	F_5-74/220	32.9
11	G Cot 13 (C)	24.0	G Cot 13 (C)	23.0
12	G Cot 21 (C)	23.9	G Cot 21 (C)	24.4
13	ADC-1 (C)	24.8	ADC-1 (C)	25.7
14	GADC-2 (C)	24.3	GADC-2 (C)	23.5

Table 4: Elite genotypes with high lint yield and superior fiber qualities

S. No	Entry	Lint Yield (gm /plant)	UHML (mm)	Fiber strength (g/tex)
1	F_5-19/220	126.0	28.1	28.0
2	F_5-23/220	110.0	29.5	29.2
3	F_5-63/220	31.0	29.1	31.0
4	F_5-88/220	99.0	28.0	28.0
5	F_5-103/220	73.0	28.0	28.0
6	F_5-127/220	132.0	27.1	27.4
7	F_5-137/220	75.0	28.0	32.6
8	F_5-146/220	129.0	28.1	25.5
9	F_5-178/220	41.0	30.2	28.8
10	F_5-210/220	38.0	28.1	28.5

Conclusion

Analysis of variance indicated that significant differences were found among the genotypes for Lint yield and GOT over checks, while non-significant differences were found for seed cotton yield. Entry F_5-214/220 had recorded numerically highest seed cotton yield followed by the entry F_5-187/200, F_5-127/220 over the best check GADC-2 can be utilized for yield improvement Cotton breeding program. The extra-long staple length was recorded by entry F_5-140/220 which will be utilize for fiber improvement program. Highest bundle strength was recorded with Entry F_5-143/220 (34.6 g/tex) and weak/low strength with entry F_5-214/220 (20.7 g/tex). The range of GOT % was recorded low to high. Promising entries with resemblance of herbaceum cotton which produced high yield with long staple length and high strength could be promoted for evaluation under preliminary and multilocation trials.

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