Available online at www.ijpab.com

DOI: http://dx.doi.org/10.18782/2320-7051.2606

ISSN: 2320 – 7051

Int. J. Pure App. Biosci. **5 (2):** 519-525 (2017)

Research Article

International Journal of Pure & Applied Bioscience

OPEN ACCESS

Comparative Study for Seed Cotton Yield and Fibre Quality Parameters in Cotton (*Gossypium sp*. L.)

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Received: 17.02.2017 | Revised: 28.02.2017 | Accepted: 2.03.2017

ABSTRACT

The present study investigates the seed cotton yield and fibre qualities in resistant and susceptible recombinant inbred lines of cotton. The seed cotton yield per hectare in protected condition was differed significantly compared to unprotected condition. The paired t test revealed that there was a statistically significant improvement in seed cotton yield per hectare in protected condition in both resistant and susceptible recombinant inbred lines. The fibre quality parameters like fibre length, fibre strength, fibre fineness and uniformity ratio were also more in resistant lines compared to susceptible recombinant inbred lines.

Key words: *cotton, fibre quality, seed cotton, recombinant inbred lines (RILs)*

INTRODUCTION

Cotton is an important fibre crop of global importance and known as the "king of fibre" and in recent times called as "white gold", is the most vital crop of commerce to many countries including India. Cultivated cotton (*Gossypium* spp.) is the world's leading natural fibre crop and it is the cornerstone of textile industries worldwide. Inspite of several competitions from synthetic fibres, cotton continues to enjoy a place of prime importance in textile industry. In India, cotton provides means of livelihood to millions of farmers and workers and sustains cotton textile industry which annually produces cloth of the value exceeding a thousand crore rupees. Cotton seed had also gained the additional economic importance as a major contributor to edible oil, protein and other by products. The valuable biomass from cotton stalks has become very useful raw material for manufacture of particle boards, paper and other stationaries. In total, cotton has become a highly agro-industrial crop producing 90 % raw material to textile industry and contributes 60 % of oil requirements.

Cotton fibre quality is defined by the physical properties that relate to its spin ability into yarn and contribute to textile performance and quality. Cotton fibre quality also depends on fibre properties such as average fibre length, fibre uniformity, micronaire value, and fibre strength[3]. Fibre length is the normal length of a typical portion of the fibres of a cotton sample.

Cite this article: Harijan, Y., Nishanth, G.K., Katageri, I. S. and Khadi, B. M., Comparative Study for Seed Cotton Yield and Fibre Quality Parameters in Cotton (*Gossypium sp*. L.), *Int. J. Pure App. Biosci.* **5(2):** 519-525 (2017). doi: http://dx.doi.org/10.18782/2320-7051.2606

Longer fibres can be processed at greater efficiencies and produce finer and stronger yarns by allowing fibres to twist around each other more times, while shorter fibre require increased twisting during spinning, causing low-strength and poor-quality yarns. Fibre fineness is another important component of fibre quality because of its direct impact on processing performance and the quality of end product. Fibre strength is important because the inherent breaking strength of individual cotton fibre is considered to be the most important factor in determining the strength of the yarn spun from those fibres[7].

Cotton fiber quality is mainly influenced by genotype of the cultivars but agronomic practices and environmental conditions are the secondary factors influencing fiber quality[9]. However, Smith and Coyle[8] noted that fibre length and strength were negatively correlated with basic within-boll yield components. Awareness of the importance of cotton fibre quality (*Gossypium sps.* L.) has increased as advances in spinning technology require better quality cotton fiber. Keeping in view the above mentioned facts, the present study was carried out to compare the seed cotton yield and fiber characteristics of cotton cultivars under protected and unprotected condition.

MATERIAL AND METHODS

The experiment was conducted during *Kharif*, 2012-13 at Agricultural Research Station, Dharwad Farm, University of Agricultural Sciences Dharwad, which is situated in the northern transitional zone (Zone No. 8) of Karnataka with latitude of 15° 26[1] north, longitude of 76° 7[1] east and altitude of 678m above mean sea level (MSL). Experiment was laid out in black cotton soil and plots were homogeneous with respect to nutrient status. The average rainfall for the year 2012-13 was 759.06 mm.

Out of 190 recombinant inbred lines (RILs) of F_9 generation from the cross DS28×SBYF425, best 5 resistant and 5 susceptible RILs were selected based on disease reaction (*Alternaria*, bacterial blight & grey mildew) along with checks were used in this study. Seeds of all RILs were not treated with any fungicides and pesticides to allow the crop to be infected by various diseases and pests in early growth stage. Seeds were hand dibbled in rows of each 6m length with spacing of 90cm between rows and 20 cm between the plants. Experiment was done in an augmented design suggested by Federer[6] with 10 blocks to obtain minimum of 12 error degrees of freedom and five checks *viz.,* DS-28, SBYF 425, Sahana, Suvin and Khanwa-2 repeated in each block. Package of practice recommended for cotton under assured rainfed conditions was followed. In unprotected condition didn't take any spray for pest and diseases unlike protected condition.

The following fibre quality characters were analyzed under HVI (High Volume Instrument) at Central Institute for Research on Cotton Technology (CIRCOT), Mumbai. 2.5 *per cent* span length (mm) is defined as the distance spanned by a specified percentage of fibre in the specimen being tested. Ratio of 50 % span length to 2.5 % span length indicates the uniformity of fibre length and expressed in percentage. Micronaire index (µg/inch) is the average weight per unit length of fibre and it helps to determine the fibre fineness, linear density of fibre. Fibre strength (g/tex) is the force required to break bundle of fibre of unit linear density.

RESULTS AND DISCUSSION

Seed cotton yield, number of bolls and boll weight observed in this study are in generally low because, experiment was conducted under unprotection for diseases and sucking pests, coupled with moisture stress as 2012-13 experienced severe droughts due to 27% low rainfall than the normal. Although only two protective irrigations were given during boll development it was not as useful as rainfall. But for protective condition timely practiced all the agronomic practices. As there are RILs from interspecific cross seems to be very sensitive to moisture stress. The resistant recombinant inbred lines showed higher the mean of 2.5 % span length, uniformity ratio, micronair value and fibre strength compared to the susceptible recombinant inbred lines (Table 3). It indicates that the fibre quality is more affected in susceptible than the resistant

RILs. Fibre development takes about 60 days, incidences of disease during this under unprotected natural condition is expected to be there to affect the crop and there by hinders fibre development due to this biotic stress.

Seed cotton yield kg per hectare: Data pertaining to seed cotton yield per hectare is varied in protective and unprotective condition (Table 1 Fig.2) indicated that seed cotton yield per hectare in protective condition is differed significantly compared to unprotective condition. The dependent sample or paired t test compares the differences in the means from two variables measured on the same set of subjects to a given number. N (5) is the number of valid (i.e non missing) observations used in the calculating the t test. 263.53, 172.62 & 112.97 are the mean within subject difference between the protected & unprotected condition of resistance, susceptible and parents including checks, respectively (Table 2). In our case this would be: $t(4) = 6.03, 4.16$ & 4.02, $p < 0.05$. Due to the means of the two conditions i.e protected and unprotected in resistance, susceptible and parents including checks of the *t*-value, we can conclude that there was a statistically significant improvement in seed cotton yield per hectare in protected condition since, all the values are less than 0.05 at two tailed t test (Table 2, Fig.3 & 4).

Quality related parameters: Fiber strength is an important trait in determining yarn spinning ability, cotton varieties which produce weak fiber (low strength), are difficult to be handled in manufacturing process. The maximum value for fiber strength (20.90 g/tex) was exhibited by resistant recombinant inbred lines compare to susceptible RILs (18.68 g/tex) (Table 3). Fiber strength is influenced by both genetics and environmental conditions[1]. Our results are supported by the findings of Bowman[2] and Faircloth[4] who reported that fiber strength was influenced by different genotypes. Maximum fiber fineness (3.6 micronaire) was obtained from resistance recombinant inbred lines which was more than that of susceptible RILs (3.02 micronaire). Similar differences in micronaire values due to cultivar have also been reported by Faircloth *et al*[5]. Fibre uniformity ratio (49.8) and fibre length (26.02) were also more in resistance recombinant inbred lines than the susceptible lines i.e 46.6 & 22.08, respectively (Table 3 & Fig.1).

Table 1: Seed cotton yield of selected recombinant inbred lines in protected and unprotected conditions

Sl. No.	Recombinant inbred lines	Reaction for diseases & pests	Seed cotton Yield(kg/ha)		
			Protected	Unprotected	Deviation of SCY (kg/ha) (protected-unprotected)
1	DCHRIL **1**	R	501.78	198.61	303.17
2	DCHRIL **37**	R	628.13	211.00	417.13
3	DCHRIL **125**	R	387.41	172.40	215.01
4	DCHRIL **126**	R	417.59	235.80	181.79
5	DCHRIL **149**	R	358.76	158.21	200.55
	Mean		**458.73**	**195.20**	**263.53**
6	DCHRIL **47**	S	302.45	102.78	199.67
7	DCHRIL **52**	S	318.09	118.52	199.57
8	DCHRIL **70**	S	414.08	114.90	299.18
9	DCHRIL **91**	S	256.75	156.94	99.81
10	DCHRIL **164**	S	118.63	53.78	64.83
	Mean		**282.00**	**109.38**	**172.62**
11	DS-28 (P_1)	R	386.27	211.91	174.36
12	SBYF-425 (P_2)	S	408.82	248.94	159.88
13	Sahana (C_1)	S	560.17	420.71	139.46
14	Suvin (C_2)	R	218.41	178.06	40.35
15	Khandwa-2 (C_3)	R	239.62	188.81	49.81

R= Resistant for all diseases (*Alternaria*, Bacterial blight and Grey mildew) and pests (Thrips and Jassids)

S= susceptible for all diseases (*Alternaria*, Bacterial blight and Grey mildew) and pests (Thrips and Jassids)

P_1, P_2= Parents, C_1, C_2 & C_3= Checks

Table 2: The paired sample't' test between resistant, susceptible recombinant inbred lines and parents (including checks) under protected and unprotected conditions in cotton

	Size (N)	Paired differences					't' value	df	Sig. (2-tailed) P<0.05
		Mean	Std. deviation	Std. Error Mean	95% confidence interval of the difference				
					Lower	Upper			
Resistant RILs	5	263.53	97.68	43.68	142.24	384.82	6.03	4	0.004
Susceptible RILs	5	172.62	92.72	41.47	57.48	287.75	4.16	4	0.014
Parents & checks	5	112.97	62.86	28.11	34.91	191.03	4.02	4	0.016

Table 3: Performance of selected recombinant inbred lines (RILs) for fibre quality parameters in cotton

Recombinant inbred lines	Reactions for Diseases & pests	Fibre quality			
		2.5% span length	Uniformity ratio (%)	Micronaire (µg/in)	Fibre strength3.2mm (g/tex)
DCH RIL 1	R	26.9	49	3.9	22.5
DCH RIL 37	R	27.2	50	3.8	22.4
DCH RIL 125	R	24.5	50	3.5	22.6
DCH RIL 126	R	25.2	51	3.5	19.8
DCH RIL 149	R	26.3	49	3.6	20.9
Mean		**26.02**	**49.8**	**3.66**	**20.9**
DCH RIL 47	S	23.1	47	3.1	18.7
DCH RIL 52	S	21.0	45	3.0	19.2
DCH RIL 70	S	22.5	48	2.9	19.4
DCH RIL 91	S	23.7	45	3.1	18.8
DCH RIL 164	S	20.1	48	3.0	17.3
Mean		**22.08**	**46.6**	**3.02**	**18.68**
DS-28 (P_1)	R	26.58	47.36	4.55	21.11
SBYF-425 (P_2)	S	32.52	47.50	3.20	25.40
Sahana (C_1)	S	27.42	48.00	4.49	20.00
Suvin (C_2)	R	30.42	49.50	3.10	25.30
Khandwa-2 (C_3)	R	26.50	46.80	4.23	20.90

R= Resistant for all diseases (*Alternaria*, Bacterial blight and Grey mildew) and pests (Thrips and Jassids)
S= susceptible for all diseases (*Alternaria*, Bacterial blight and Grey mildew) and pests (Thrips and Jassids)
P_1, P_2= Parents, C_1, C_2 & C_3= Checks

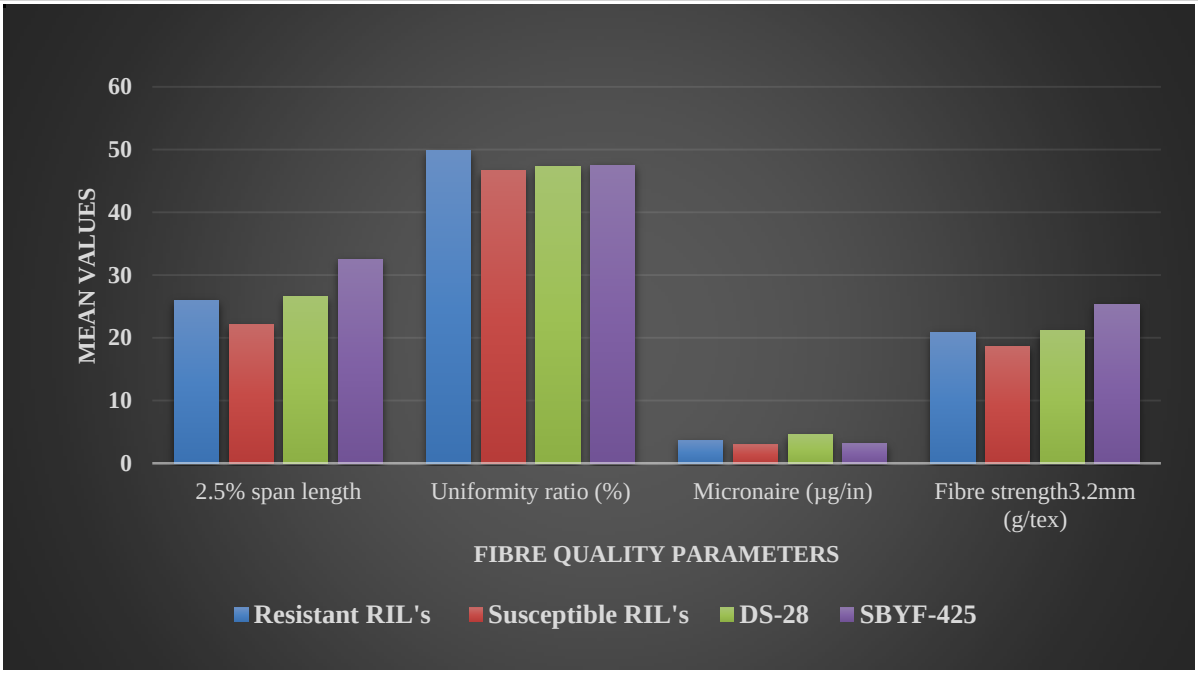

Fig. 1: Mean performance of quality parameters in resistant and susceptible recombinant inbred lines of cotton

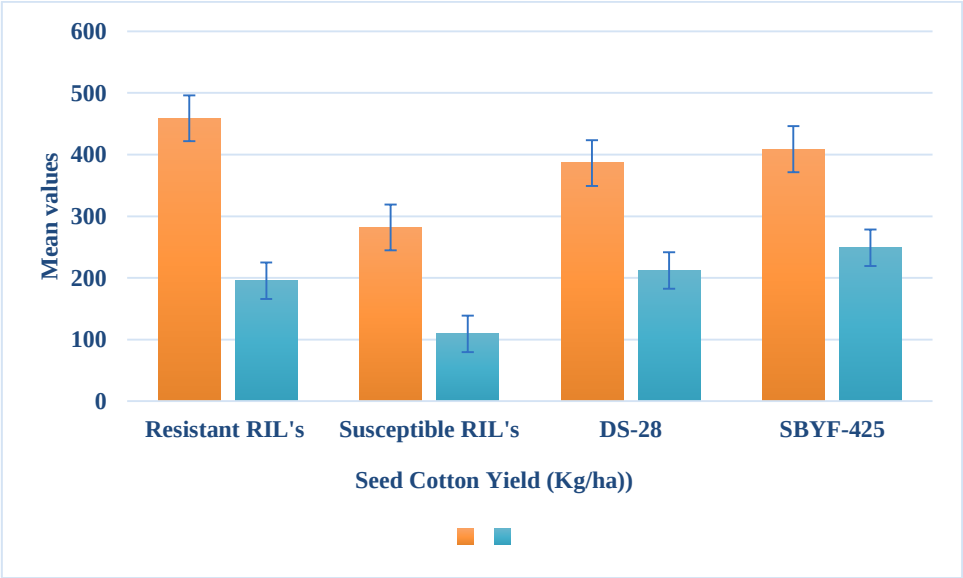

Fig. 2: Comparing the seed cotton yield in resistant and susceptible recombinant inbred lines of cotton

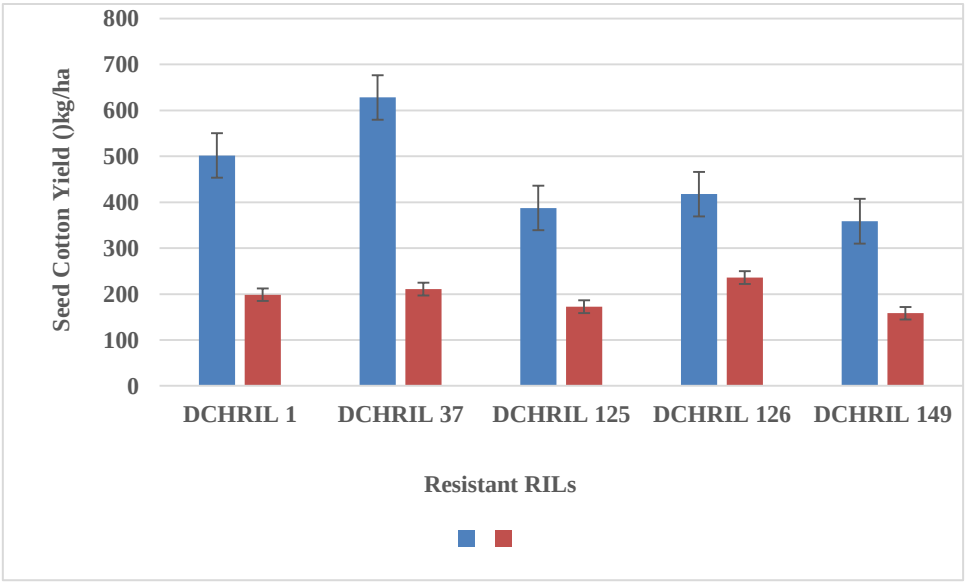

Fig. 3: Comparing seed cotton yield (kg/ha) under protected and unprotected condition in resistant recombinant inbred lines of cotton

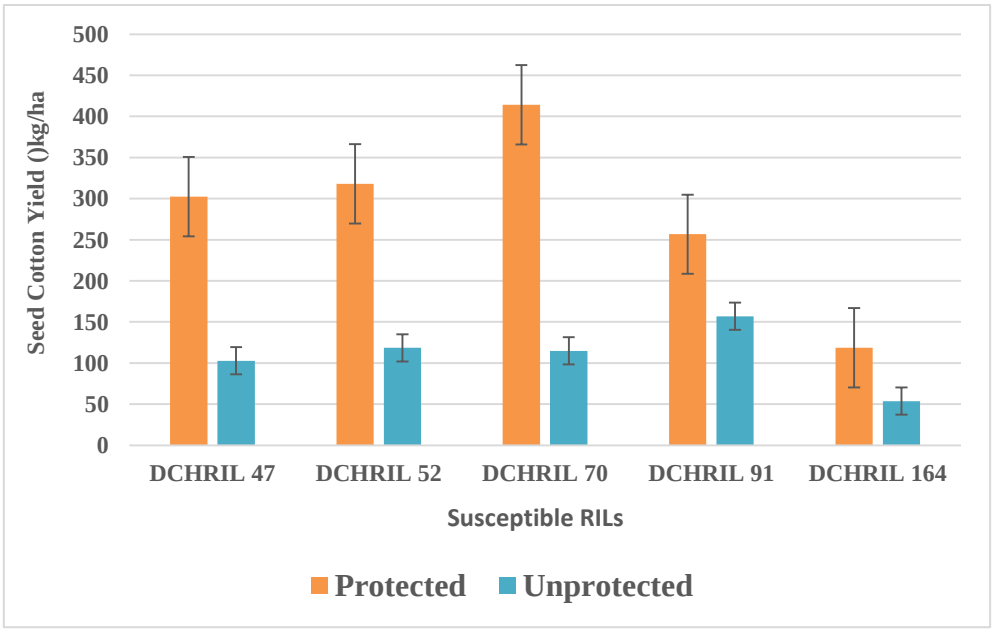

Fig. 4: Comparing seed cotton yield (kg/ha) under protected and unprotected condition in susceptible recombinant inbred lines of cotton

CONCLUSION

It may be concluded that amongst the tested recombinant inbred lines the resistant RILs showed maximum seed cotton yield per hectare than the susceptible RILs and also in protected condition compared to unprotected condition. The fibre quality parameters were also more in resistant RILs compare to susceptible RILs. The findings of study may be useful in further breeding programmes.

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