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Improvement of Egyptian cotton variety Suvin (*Gossypium barbadense* L.) for yield and its attributes

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ABSTRACT : An attempt has been made to improve the genetic background of variety Suvin with desirable traits of high yield and ginning percentage from the variety Giza; short duration in the sense of early maturity from variey Pima and high fibre strength and length from the variety Sudan, respectively. Promising single plant each was selected from the BC_2F_1 populations involving the crosses of Suvin x Giza, Suvin x Pima, Suvin x Sudan, (Suvin x Giza) x (Suvin x Pima) and was advanced upto BC_2F_6 generation. The selected progenies of each cross combination was raised in RBD with three replications during *Kharif* season of the years from 2011-12, 2012-13 and 2013-14 and advanced upto BC_2F_6. The data were recorded for the traits seed cotton yield, lint yield, ginning outturn, 100 seed weight, boll weight, 2.5 per cent span length, micronaire and elongation. The cross derivatives of all the eight progenies evaluated during the years 2011-2014 had exhibited increased mean value over control for the traits boll weight (g), seed cotton yield (kg/ha), lint yield (kg/ha) and ginning outturn (in percentage) consistently. However, in regard to quality parameters such as 100 seed weight, 2.5 per cent span length, strength (g/tex), micronaire value and elongation, the lines showed both positive and negative shift of mean value over control. The results indicates that F_1s of all the cross combinations required to be backcrossed further with Suvin beyond BC_3 and, thereafter, the progenies selected in BC_3F_1, needs to be advanced up to BC_3F_6 for improvement of yield parameters without altering the fibre qualities of Suvin.

KEY **W**ORDS : Egyptian cotton, Suvin, Pima, Giza, Sudan, *Gossypium barbadense* L., Improvement, Quality parameters, Seed cotton yield, Ginning outturn, 2.5 per cent span length

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The annual production of extra long staple cotton in India is only around 2.65 lakh bales. The textile mills are, therefore, compelled to import extra long staple (ELS) cotton from countries like USA Egypt, etc. As per the 2008-09 estimates, it costs around Rs.1, 300 crores to import 5 lakh bales of ELS cotton. It is imperative that domestic production of ELS cotton has to be increased to meet the growing demand of the consumer industry. As a first of kind, the Central Institute for Cotton Research, Regional Station, Coimbatore owns the pride of releasing the world famous super fine ELS cotton variety Suvin. It was derived as a progeny, re-selected from the crosses involving the parents Sujatha and St.Vincent and which was named as Suvin in the year 1971 -72 (Dharmarajulu *et al*., 1976).

It has a uniform fibre characters and can spun upto

120s count similar to that of Egyptian variety Giza with yield potential of 18.8 to 24.6q/ha. However, the variety was identified susceptible to sucking pests like Jassids and pink bollworm but relatively less susceptible to spotted boll worm. During the period 1975-76, ICMF Cotton development Research Association has undertaken Suvin development programme in an area of 12,000 acres in Tamil Nadu and 30,000 in Andhra Pradesh and it was reported that the yield in the range of 4 to 15.6 quitals per acre and 12 to 14 quintals per acre, respectively were obtained. A similar programme for development of Suvin has been undertaken in Madurai and Coimbatore districts of Tamil Nadu under aegis of SIMA Cotton Development Association.

In the year 1995, SIMA CD and RA had undertaken the renovation and improvement activity in the world's superfine extralong staple variety Suvin. In 2003, improvement in yield in the range of 18-22q/ha, ginning outturn of 34.0 to 35 per cent, micronaire of 3.4 to 3.6, 2.5 per cent span lenth of 39.8mm, bundle strength of 29.3 (g/tex) and reduction in duration from 210 days to 170 days, respectively were achieved. Since then an extensive hybridization programme was undertaken during the year 2005-2014, for further enhancement of yield, fibre quality and reduction in duration by crossing the variety Suvin with Giza, Pima and Sudan through backcross method and with an objective to bring out a suitable new barbadense variety an addition to variety Suvin that can serve the purpose of cotton growers and consumer industries.

RESEARCH PROCEDURE

The female parent Suvin and the male parents Giza, Pima, Sudan were raised in single rows of 6m length alternatively *i.e.* one row of female parent was alternated with one row of male parent with a spacing of 90 x 60 cm to accommodate 20 plants per row. Recommended agronomic practice was followed. Hybridization between selected combinations was done. The crossed bolls were collected and ginned separately to obtain the F_1 seeds.

Seeds of all the 4 F_1 hybrids were raised along with their parents in a Randomised Block Design with five replications. Five flowers in each F_1 hybrids were backcrossed with Suvin to get BC_1 seeds. BC_1 progeny of each cross combination were raised in five rows along with their parents. Five plants each in BC_1 were selfed to get BC_1F_1 generation and the same procedure was repeated to get BC_2F_1. Each of the BC_2F_1 generations was raised in 10 rows and the promising single plant progeny was advanced upto BC_2F_6 and also a progeny from a double cross involving parents (Suvin x Giza) x (Suvin x Pima) was also advanced upto F_6 following the procedures as mentioned above. Five plants were randomly selected from each replication of all the crosses and parents and observations were recorded on individual plants on the following yield and its attributes.

Boll weight :

Mean kapas weight of ten fully opened matured bolls at harvest in grams.

Yield of seed cotton per plant :

Each of the five plants was harvested individually and the weight of the seed cotton from all the mature bolls was recorded in grams.

100-seed cotton weight :

One hundred healthy seeds along with cotton from selected plant of each cross combination were weighed out in grams and recorded.

Ginning outturn :

Ginning outturn or ginning percentage was determined as the ratio of lint weight to seed cotton weight, measured as percentage. A sample quantity of 100 well filled seed cotton was ginned in a laboratory-gin and the weight of lint and the weight of seeds were recorded and the ginning percentage was calculated using the formula:

$$\text{Ginning percentage} = \frac{\text{Weight of lint}}{\text{Weight of seed cotton}} \times 100$$

Fibre length :

Fibre length was measured as 2.5 per cent span-length with the digital fibrograph.

Uniformity ratio :

50 per cent span-length and 2.5 per cent span-length were first obtained from digital fibrograph. Uniformity ratio was then calculated by the formula:

$$\%\ UR = \frac{\text{50 per cent span length}}{\text{2.5 per cent span length}} \times 100$$

Fibre fineness:

Fibre fineness of cotton was determined by using

"Sheffield Micronaire". The micronaire instrument employs the principle of measuring the resistance to air flow through a plug of fibres as an indication of the fineness of those fibres. A sample weight of 3.24 g was placed in the specimen holder and compressed to a fixed volume. Air at fixed pressure was forced through the plug. The amount of flow is indicated by the position of the float in the vertical tube connected to the compression chamber. Fineness is read directly on the micronaire scale.

Fibre strength :

The fibre strength was determined by using 'O' gauge length of the fibres. The stelometer gives the tensile strength and is expressed in gram per tex. These tests namely fibre length, uniformity ratio, fibre fineness, maturity co-efficient and fibre strength were conducted by utilizing the facilities available in the Central Institute for Research on Cotton Technology (CIRCOT), a unit of Cotton Breeding Station at Coimbatore.

Maturity co-efficient :

About 100 fibres were placed on a slide from an aligned end of the silver with the help of a tweezer in such a manner that the fibres are approximately parallel to one another. The fibre were covered with a coverslip and irrigated the fibres with 18 per cent caustic soda (NaOH) solution. The mounted slide were placed on the microscope stage in such a manner that the central portion of the fibres were beneath the objective lens. The fibres were examined one by one by moving the stage of the microscope in the transverse direction. Maturity co-efficients were then obtained by using the formula :

$$MC = \frac{M - 0.41}{100}$$

where,

M= Percentage of mature fibres and

I = Percentage of immature fibres

RESEARCH ANALYSIS AND REASONING

The progenies from derivatives of parents involving different cross combinations were cropped during the year 2012-2014 and their performance over check variety

Table 1: Performance of *Gossypium barbadense* cotton genotypes evaluated during 2011-12

Name of culture	Seed cotton yield (kg/ha)	Lint yield (kg/ha)	Ginning outturn	100 seed weight (g)	Boll weight (g)	2.5% span length	Strength (g/tex)	Micronaire	Elongation
SB-SG-1-1	1523	518	34	12.2	3.7	38.22	26.2	3	6.8
SB-SG-1-4	1606	546	34	12.6	3.7	36.64	26.5	3.4	7.2
SB-SG-1-5	1581	538	34	13.4	3.7	37.51	25.1	3.21	6.5
SB-SP-2.2	1568	533	33	11.8	3.6	37.49	26.6	2.93	7.1
SB-SP-5.6	1540	524	34	12.2	3.7	38.2	26.1	3.48	7.8
SB-SS-1-1	1536	507	33	11.8	3.7	38.53	26.2	3.48	7.7
SB-SS-2.2	1560	515	33	11.8	3.7	39.49	26.6	3.4	7.5
SB-SGSS-3-3	1585	539	34	12	3.7	38.53	27.8	3.3	7.3
Suvin-C	1284	411	31	12.3	3.5	39.26	26.4	3.11	7.2

Table 2 : Performance of *Gossypium barbadense* cotton genotypes evaluated during 2012-13

Name of culture	Seed cotton yield (kg/ha)	Lint yield (kg/ha)	Ginning outturn	100 seed weight (g)	Boll weight (g)	2.5% span lenth	Strength (g/tex)	Micronaire	Elongation
SB-SG-1-1	1594	526	33	12.2	3.7	39.28	37.8	3.22	7.9
SB-SG-1-4	1518	516	34	12.3	3.7	38.47	35.8	3.83	8.5
SB-SG-1-5	1546	526	34	13	3.6	38.34	34.2	3.7	7.5
SB-SP-2.2	1570	518	33	12	3.6	38.75	34.8	3.44	9
SB-SP-5.6	1538	508	33	11.5	3.7	38.91	33.8	3.65	8
SB-SS-1-1	1570	502	32	11	3.6	38.26	33.7	3.75	8.5
SB-SS-2.2	1514	484	32	11.2	3.6	39.34	34.8	3.85	7.8
SB-SGSS-3-3	1554	513	33	11.9	3.7	38.91	34.8	3.68	8.3
Suvin-C	1241	372	30	12.3	3.5	38.36	32.9	3.63	7.5

Suvin for the traits seed cotton yield, lint yield, ginning outturn, 100 seed weight, boll weight, 2.5 per cent span length, micronaire value and elongation was assessed and presented in Table 1, 2 and 3. During first year evaluation (2011-2012), all the eight progenies recorded increased mean value over standard variety Suvin for the traits seed cotton yield, lint yield, ginning outturn and boll weight. For the traits 100 seed weight only two progenies *viz.*, SB-SG-1-4 and SB-SG-1-5 showed increased value. The progeny SB-SS-2-2 alone registered improvement on 2.2 per cent span length but all other progenies showed values similar to that of control. The progenies SB-SP-2-2, SB-SS-2-2 and SB-SGSS-3-3 were found to be superior to control for the trait fibre strength. A substantial portion of micronaire value an influencing factor of fibre finess was found to be improved in all lines except a progeny SB-SG-1-1 The values closer to control was exhibited by all lines for the trait fibre elongation and out of which, the lines SB-SP-5-6, SB-SS-1-1, SB-SS-2-2 and SB-SGSS-3-3, respectively showed increased fibre elongation (Table 1).

In subsequent second year evaluation during the crop season 2012-2013, all the lines recorded increased mean value for seed cotton yield, lint yield, ginning outturn, boll weight and fibre strength and elongation. However, for fibre length (2.5% Span length), only two progenies (SB-SG-1-5, SB-SS-1-1) showed increased fibre length. Although the value of micronaire between the ranges of 3.5 to 3.8 is considered to be ideal for extralong staple barbadense variety like suvin, five progeny lines (SB-SG-1-4, SB-SG-1-5, SB-SP-5-6, SB-SS-1-1 and SB-SGSS-3-3), respectively showed increased value for this trait in the range of 3.65 to 3.85 (Table 2).

In consecutive third year evaluation, during the crop season 2013 to 2014 also, all eight progeny lines were found to show increased seed cotton yield, lint yield and ginning outturn except the line SB-SG-1-5, of which the highest yield of seed cotton (1983 kg/ha) was recorded by the line SB-SP-2-2 followed by the line SB-SP-5-6 (1874 kg/ha) than that of control check variety Suvin (1684 kg/ha). There has been a positive shift of mean value over control for the traits seed cotton yield, lint yield and ginning outturn attributing to minor loss of seed weight (100 seed weight) in all lines but it was reverse in the case of two progenies *viz.*, SB-SG-1-5 and SB-SP-2-2. Single boll weight is yet another important trait and can determine the yield of seed cotton. For this trait also, all progenies except SB-SS-1-1 were found promising. Similarly fibre length of lines were positive, of which a highest mean fibre length (40.3) was registered by the line SB-SP-2-2 followed by SB-SGSS-3-3. The progeny lines SB-SG-1-5, SB-SS-1-1, SB-SP-2-2, respectively showed positive shift of mean value for the trait fibre strength. Whereas for the trait micronaire value, progenies SB-SG-1-4 and SB-SGSS-3-3 and for fibre elongation the progenies SB-SG-1-4, SB-SP-2-2, SB-SS-1-1 and SB-SGSS-3-3, respectively found promising that of control (Table 3).

The results indicate that, the existing genetic background of variety Suvin was improved for the traits *viz.*, boll weight (g), seed cotton yield (kg/ha), lint yield (kg/ha) and ginning outturn (in percentage). Among the single plant derivatives, the progeny SB-SG-1-4, involving the parents Suvin x Giza recorded increased mean value over control for seven traits such as seed cotton yield, lint yield, ginning outturn, 100 seed weight, boll weight, micronaire value and fibre elongation followed by the line SB-SGSS-3-3 involving the crosses (Suvin x Giza) x (Suvin x pima) showed increased mean value for all the above traits except for 2.5 per cent span length. In a

Table 3: Performance of *Gossypium barbadense* cotton genotypes evaluated during 2013-14

Name of culture	Seed cotton yield (kg/ha)	Lint yield (kg/ha)	Ginning outturn	100 seed weight (g)	Boll weight (g)	2.5% span Lenth	Strength (g/tex)	Micronaire	Elongation
SB-SG-1-1	1802	614	34	12.4	3.8	38.47	27.5	3.42	7.3
SB-SG-1-4	1839	608	33	13	3.7	36.45	26.5	3.74	7.9
SB-SG-1-5	1786	572	32	13.3	3.7	38.89	29.5	3.4	6.9
SB-SP-2.2	1983	674	34	13	3.8	37.39	28	3.24	8.1
SB-SP-5.6	1874	637	34	12.7	3.7	39.21	28.2	3.24	7.5
SB-SS-1-1	1807	596	33	12.3	3.6	38.51	29.1	3.56	8
SB-SS-2.2	1777	604	34	13.7	3.7	40.3	29.4	2.74	7.5
SB-SGSS-3-3	1872	636	34	12.8	3.7	39.73	27.7	3.91	9.3
Suvin-C	1684	539	32	13	3.6	36.62	28.2	3.41	7.8

study of cross between the elite barbadense lines DB 533 and DB 534, thirteen out of 53 lines advanced upto F_5 were reported to be found promising for higher *per se* performance for seed cotton yield, bolls per plant, mean boll weight, seed index, ginning outturn, lint index, 2.5 per cent span length and fibre micronaire value than Suvin (Alkuddsi *et al*., 2013).

Since, the trait micronaire value represents fibre weight per unit length, wall thickness and hair diameter; the finer fibres will have lower estimates for this character. Negative heterotic effects are, therefore, desirable for this trait. However, in majority of cases, the fibres with high micronaire are also desirable for medium and coarse cloth. Under such situations positive heterosis is of significance (Patil *et al.*, 1988). Whereas Marani (1968 a, b and c) and Gupta and Singh (1970) reported that micronaire was influenced by both additive and non-additive gene effects. It is in conformity with the findings of present study that the progenies exhibited both positive and negative mean value over control for this trait. Similarly the line SB-SS-1-1 involving parents Suvin x Sudan was found promising for 6 out of 9 characters

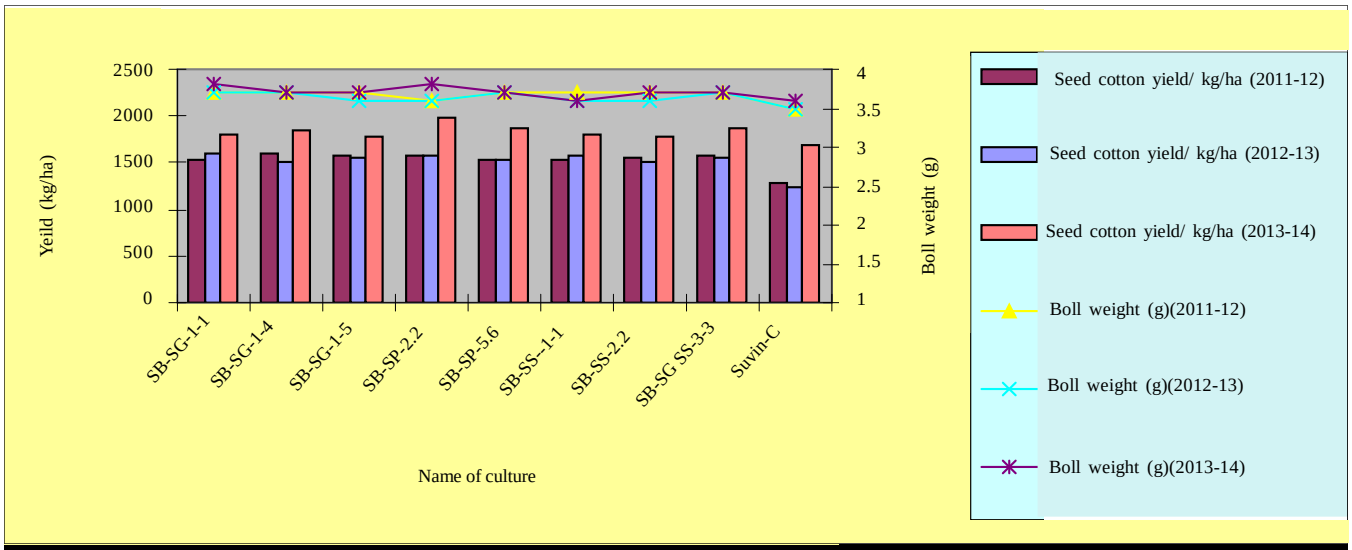

Fig. 1 : Seed cotton yield (kg) and boll weight (g)

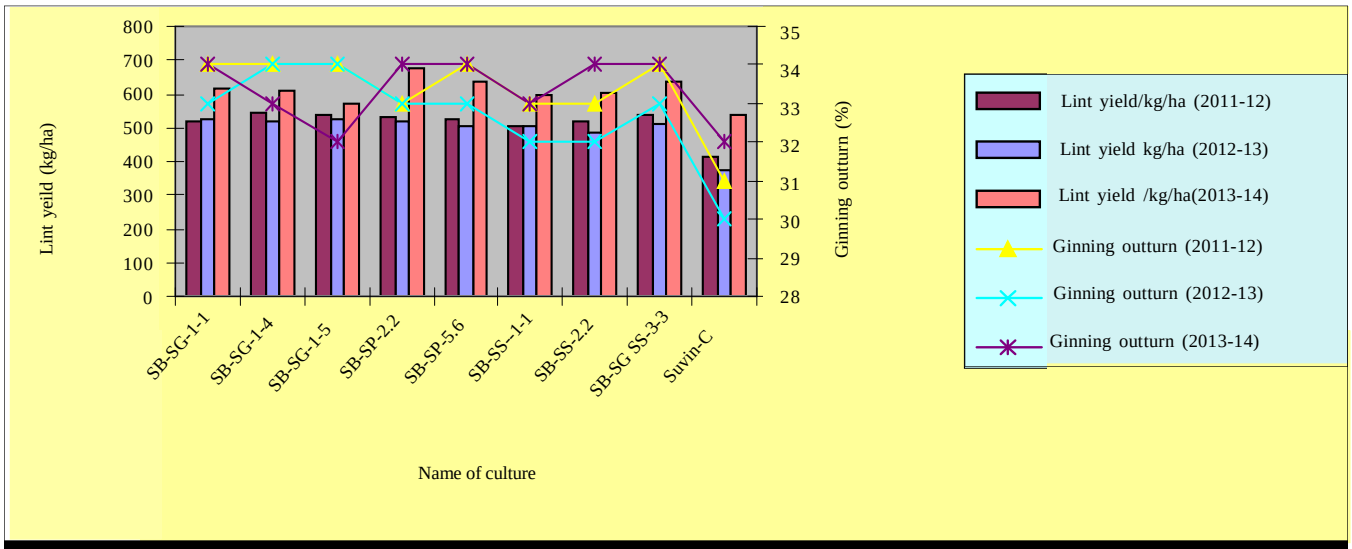

Fig. 2 : Lint yield and ginning percentage

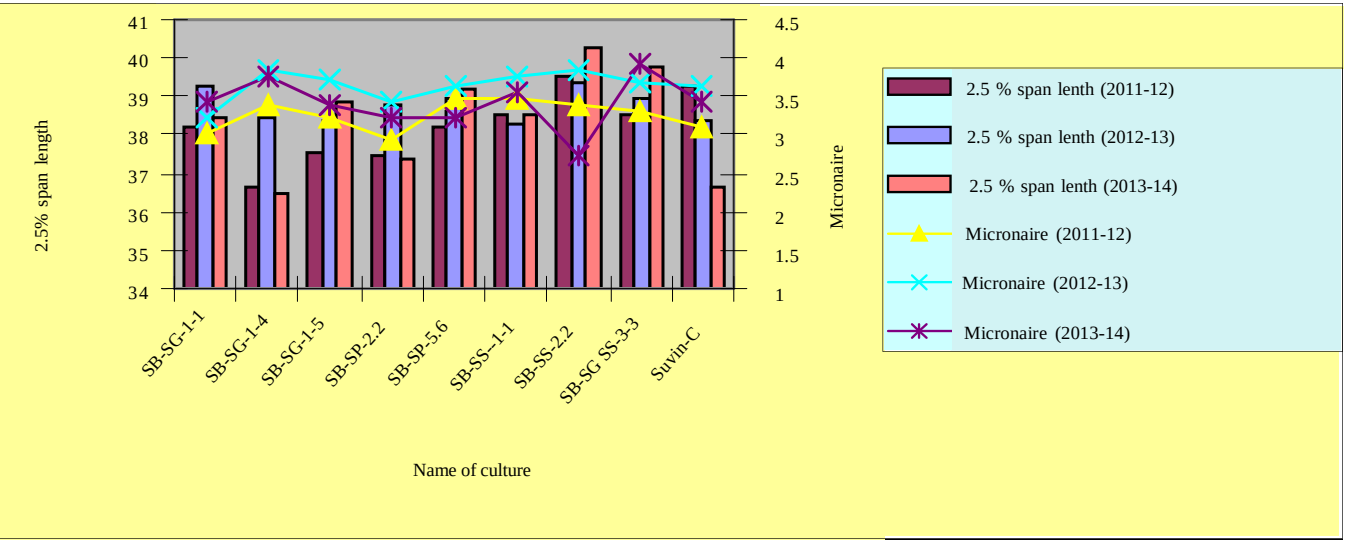

Fig. 3 : 2.5 per cent span length and micronaire

over control for all the above characters except boll weight, micronaire value and elongation. The lines SB-SG-1-5 (Suvin x Giza), SB-SP-2.2 (Suvin x Pima) and SB-SS-1-1 (Suvin x Sudan) were also found promising for five characters each as shown in Table 1. These results are in agreement with the findings of Vaman *et al.* (1985).

The range of mean value between 7.10 -28.4; 6.12 – 41.4; 00 – 13.3; 2.31-8.94; 0.00-5.71;2.80 -5.71; -6.03-8.81; -4.99-11.89 and -1.39-20.0 for the traits seed cotton yield, lint yield, ginning outturn, 100 seed weight, boll weight, 2.5 per cent span length, fibre strength, micronaire value and fibre elongation were registered by the progenies SB-SS-1-1, SB-SG-1-5,SB-SG-1-5,SB-SG-1-5,SB-SS-1-1,SB-SGSS-3-3,SB-SG-1-4, SB-SP-5-6 and SB-SP-2-2, respectively.

However, in general, cross derivatives of all the eight progenies evaluated during the years 2011-2013 have exhibited increased mean value over control for the traits boll weight (g), seed cotton yield (kg/ha), lint yield (kg/ha) and ginning outturn (in percentage) consistently, but in regard to quality parameters *viz*., 100 seed weight, 2.5 per cent span length, strength (g/tex), micronaire value and elongation, the lines showed both positive and negative shift of mean value over control (Fig.1-3).

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