Determination of Superior Parents and Hybrid Combinations for Yield and Fiber Traits in Cotton (*Gossypium barbadense* L.)

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ABSTRACT

The purpose of this study was to determine estimates of the general combining ability of parents and the specific combining ability of hybrids needed to develop high yielding cotton cultivars. Thirteen cotton lines [Kar. G 89, G. 87, G. 70, Pima 62, G 85, (G. 84 x (G. 74 x G. 68)), G. 76, (G. 89 x Pima S_6), G 86, (G 77 x Pima S_6), G. 45 and G. 88) as females and three testers (G. 75, Suvin and Pima S_6) as males were crossed in a line x tester mating system at Sakha Agric. Res. Sta. in 2006 season. Sixteen genotypes and 39 F_1 hybrids were sown in a randomized complete block design with three replications at the same station in 2007 season. The results indicated that the mean squares of genotypes, parents and crosses were significant for all the studied traits. Also, the results cleared that no one of parents was superior good general combiner for all the studied traits. However, the testers of G. 75 and Suvin were good combiner for yield and its components only, while Pima S_6 was good combiner for fiber traits. Also, the lines Kar. G. 85 and G. 89 were good combiner for yield and yield components and G 77 x Pima S_6, G. 45 and G. 88 were good combiners for fiber traits.

The results also showed that no one of 39 hybrids was good specific and superior for all the studied traits. Also, the results indicated that the most desirable combinations were [G. 77 x Pima S_6, Kar. x G. 75, G. 88 x Pima S_6 and [(G. 84 x (G. 74 x G. 68) x Pima S_6)] for yield and yield components and (G. 85 x Suvin, Pima 62 x Pima S_6, G. 86 x Suvin and G. 88 x Pima S_6) for fiber traits. Meanwhile, line x tester interaction contributions were higher than each of line or tester for all studied traits with a few exceptions. The obtained values for heterosis of the mid-parents ($H_{.MP.}$ %) and the better parent ($H_{.B.P}$%) was significant and exhibited desirable estimates for all studied traits.

INTRODUCTION

The concept of combining ability is important in designing plant breeding programmes. It is especially useful in testing procedures, where it is desired to study and compare the performance of lines in hybrid combinations. Two types of combining ability, general and specific, have been recognized in quantitative genetics. Specific combining ability is defined as the deviation in the performance of hybrids from the expected productivity based upon the average performance of lines involved in the hybrid combination, whereas general combining ability is defined as average performance of a line in a series of crosses. According to Sprague and Tatum (1942), general combining ability is due to genes which are largely additive in their effects and specific combining ability is due to the genes with dominance or epistatic effect. Rawlings and Thompson (1962) used line x tester analysis to estimate GCA and SCA of inbred parents. Since the development of new cultivars through hybridization is a continuous process, information on combining ability of new cultivars remains important. Desphande and Baig (2003) noted that through GCA and SCA variances were important, the magnitude of SCA was higher than GCA, indicating the preponderance of dominant genes controlling number of bolls seed index, lint percentage, lint index and seed cotton yield. Contrary to the above findings, Rokaya *et al.* (2005) found significant of GCA and SCA suggesting the importance of additive as well as dominant genes, nevertheless the ratio GCA/SCA was rather than the unity further indicating the preponderance of additive genes in the inheritance of seed cotton yield, seed index and lint %.

Thus, keeping in view the importance of combining ability of the parents for various plant characters in cotton, the line x tester analysis was carried out. The estimates of various genetic parameters would provide guidelines to the cotton breeders to launch effective breeding strategies.

MATERIALS AND METHODS

The eleven Egyptian cotton varieties, i.e. Giza 89, G. 87, G. 70, G. 85 (G. 84 x (G. 74 x G. 68)), G. 76, (G. 89 x Pima S_6), G. 86, (G. 77 x Pima S_6), G. 45, G. 88 as well as, two varieties Karshenky (Russian variety and Pima 62 (American variety). All thirteen varieties were used as lines. In addition three testers, G. 75, Suvin (Indian variety) and Pima S_6 (American variety) were used to establish the genetic materials used in this study. Both lines and testers are belonging to (*Gossypium barbadense* L.). Sixteen (13 x 3) parents and thirty nine crosses were grown in a randomized complete blocks design with three replications in 2007 season at the Experimental farm of Sakha Agricultural Research Station. Each plot was one ridge of 4 m long and 60 cm in width. Hills were spaced at 40 cm, with one plant per each hill. Cultural practices were done as recommended. A representative random sample of eight individual guarded plants per plot were recorded for estimating the following traits.

A. Yield and yield component traits:

1. Boll weight (B.W).
2. Seed cotton yield per plant (S.C.Y./P.).
3. Lint cotton yield per plant (L.C.Y./P).
4. Lint percentage (L. %).
5. Seed index (S.I).
6. Lint index (L.I).
7. Number of bolls per plant (No.B./P.).
8. Number of seeds per boll (No.S./B.).

B. Fiber traits:

1. Fiber fineness (F.F.).
2. Fiber strength (F.S.).
3. 50% span length (50% S.L.)
4. 2.5% span length (2.5% S.L.).
5. Uniformity ratio (U.R. %).

The analysis of variance was carried out according to Gomez and Gomez (1984). The mean squares from line x tester design and general combining ability (GCA) and specific combining ability effect (SCA) were calculated according to the procedures developed by Kempthorne (1957) and adopted by Singh and Choudhary (1979).

RESULTS AND DISCUSSION

The analysis of variance for all studied traits are presented in Table (1). The results indicated that presence of significant amount of variability between all genotypes, parents and hybrids for all yield, yield components and fiber traits. Also, parents versus crosses (heterosis mean square) were significant for all studied traits except lint percentage, fiber strength, 50% S.L, 2.5% S.L. and uniformity ratio. Mean squares for testers, and lines, (variance of general combining ability) were much larger in all the studied traits and significant for all the studied traits with except fiber strength in lines. These results are in agreement with those of Liu and Han (1998), Meredith and Brown (1998), Banumathy and Patel (2001), El-Oraby (2003) and Laxmen and Ganesh (2003).

Mean performance for parents (lines and tester) are presented in Table 2. The results showed that the lines G. 86 showed the highest mean performances for boll weight, seed cotton yield per plant, lint cotton yield per plant and number of seeds per boll. Also, the lines G. 89 x Pima S_6 had the highest values for seed index, line index, 50% S.L. and 2.5% S.L., on the other hand, the lines G. 85 and G. 70 were the lowest mean performances for most of studied traits. Also, the tester Suvin was the highest mean performances for all the studied traits with a few exception and the tester Pima S_6 was the lowest in mean values for most of the studied traits.

Mean performances for crosses are presented in Table 3. The results indicated that the F_1 hybrid G. 89 x G. 75 was the highest mean values for seed cotton yield per plant and lint cotton yield per plant with the mean values of 88.27 and 35.12 g. respectively., G. 87 x G. 75 was the lowest mean value for fiber fineness. Also, G. 76 x Pima S_6, G. 88 x G. 75, G. 76 x Pima S_6, G. 85 x G. 75 produced the highest mean performances for boll weight, lint percentage, seed index and lint index, respectively, with the mean values of 2.90, 40.71%, 10.20 and 6.42, respectively. On the other hand, for 50% span length and uniformity ratio it was found that F_1 hybrid G. 88 x Pima S_6 gave the highest mean performances with the mean values of 29.59 and 86.27%, respectively.

For 2.5% span length and number of seeds per bolls the results showed that the F_1 hybrids G. 45 x Pima S_6 and G. 76 x Pima S_6 recorded the highest mean values with the mean values 34.60 and 18.85, respectively. In addition for number of bolls per plant and fiber strength it could be noticed the F_1 hybrid [(G. 84 x (G. 74 x G. 68)] x Suvin was the highest mean performances, with the mean values of 11.57 and 34.7, respectively.

These results indicated that these crosses could be used for improving these traits.

The estimates of general combining ability (GCA) effects for lines and testers are presented in Table 4. Combining ability analysis is useful for the evaluation of genotypes and the selection of suitable parents to be incorporated in hybridization programs. It also helps in identification of superior hybrid combinations, which may be utilized for commercial exploitation of heterosis.

The data indicated that no one of lines or testers was the superior for all studied traits. Also, the results showed that for B.W. the lines G. 89, Kar. and G. 86 were good combiner for B.W. In addition, Kar., G. 89 and G. 85 were the good combiners and superior for seed cotton yield per plant, lint cotton yield per plant and lint percentage.

The lines G. 85 and G. 88 were good combiners for seed index and lint index, while, for number of bolls per plant, G. 85, [G. 84 x (G. 74 x G. 68)] and (G. 89 x Pima S_6) showed good GCA effects.

For, fiber traits it could be noticed that (G. 70, G. 77 x Pima S_6, G. 45), (G. 77 x Pima S_6, G. 45 and G. 8) and (G. 45 and G. 88) were good combiner lines and superior for 2.5% span length, 50% span length and uniformity ratio, respectively.

For testers, the results also cleared that no one of testers was superior and good combiner for all the studied traits, and the results showed that, the Pima S_6 tester was good combiner for boll weight, seed index, 2.5 and 50% span length, uniformity ratio and number of seeds per boll. On the other hand, G. 75 and Suvin testers were good combiner and superior for seed cotton yield per plant, lint cotton yield per plant, lint percentage and number of bolls per plant. Thus, it could be suggested that these parents could be utilized in breeding programs for improving those traits these results were in common agreement with those obtained by Hendawy (1994) and El-Disouqi and Zeina (2001).

Specific combining ability (SCA) effects are given in Table 5. Significant positive SCA effects were obtained for some crosses indicating the presence of a considerable non-allelic gene effects. On the other hand, the significant negative estimates of SCA revealed the presence of undeniable types of epistasis in these combinations.

The highest specific combining ability effects were found in the crosses of Kar. x G. 75 and G. 86 x Suvin for boll weight and fiber fineness, respectively. While, the cross (G. 77 x Pima S_6) x Suvin was the highest positive SCA effects for seed cotton yield per plant, lint yield per plant, seed index, lint index, number of bolls per plant and number of seeds per boll, Pima 62 x Pima S_6 for fiber strength, G. 85 x Suvin for 50% and 2.5% span length and G. 88 x Pima S_6 for uniformity ratio.

The relative contributions of lines (females), testers (males) and lines x testers (female x male) are shown in Table 6. Line x tester interactions were higher than lines and testers in the relative contributions for all studied traits with the except line percentage and fiber fineness. Females were higher than males for all the studied traits with except lint percentage, seed index and number of seeds per boll.

Heterosis has long been frequently observed in cotton especially in breeding program by hybridization, but to be of potential breeding value, a hybrid should be more profitable than the best available commercial varieties. Useful heterosis are expressed as the percentage of F_1 mean performance from mid-parent or better-parents was observed for all traits studied. Heterosis value relative to mid-parent are presented in Table 7.

For boll weight, the crosses Pima 62 x Pima S_6 and G. 76 x Pima S_6 were exhibited the highest and positive desirable heterosis relative to mid-parents with the mean heterosis values of 16.17 and 12.17%, respectively.

Regarding for seed cotton yield per plant and lint cotton yield per plant, 14 and 16 hybrids out of 39 F_1 hybrids exhibited significant and positive heterosis versus their mid-parents. In this respect, the crosses G. 76 x Pima S_6 and G. 85 x Pima S_6 showed the highest values versus mid-parents for the two traits with the mean values of heterosis 79.67, 63.07, 76.15 and 74.17%, respectively. On the other hand, the lowest positive heterosis were obtained by the crosses. G. 87 x Pima S_6 for seed cotton yield per plant and G. 88 x G. 75 for lint cotton yield per plant, with the mean values of heterosis 22.33 and 21.94%, respectively.

For lint percentage the results indicated that the cross G. 88 x G. 75 was exhibited the highest positive heterosis with the mean value of 10.31%. While, the cross G. 88 x Pima S_6 exhibited the highest heterosis versus mid-parent with heterosis value 11.80% for seed index. In addition the cross G. 85 x Pima S_6 gave the highest positive heterosis for lint index with the mean value 24.43%, while, the lowest positive heterosis was obtained by the cross G. 88 x G. 75 (13.34%).

Concerning number of bolls per plant and number of seeds per plant it could be noticed that the cross G. 76 x Pima S_6 exhibited the highest positive heterosis versus mid-parents with the mean values of 60.45 and 24.23% for the two traits, respectively.

For fiber traits, the results of heterosis versus mid-parents indicated that the crosses G. 89 x G. 75, [G. 84 x (G. 74 x G. 68)] x G. 75 and G. 88 x Pima S_6 were exhibited the highest positive heterosis for, fiber strength, 50% S.L. and uniformity ratio %, respectively with the mean values of 15.40, 11.56 and 5.18%, respectively, while, the cross G. 87 x G. 75 recorded the lowest negative heterosis and a desirable heterosis for fiber fineness with the mean values of heterosis versus mid-parent of -24.23%.

These results are in agreement with those results obtained by El-Akhedar (2001), El-Helw *et al.* (2002), Laxman and Ganesh (2003), Tuteja *et al.* (2004) and Panhwar *et al.* (2008).

The results of heterosis versus the better parent are presented in Table 8. The results cleared that the crosses G. 76 x Pima S_6 for boll weight, G. 89 x G. 75 for seed cotton yield per plant, G. 85 x Pima S_6 for lint yield per plant and G. 88 x G. 75 were exhibited the highest positive heterosis for the above traits with the mean values of heterosis, 11.38, 42.54, 51.13 and 8.04%, respectively.

For seed index the results showed that the cross G. 88 x Pima S_6 exhibited the highest positive heterosis value versus the better parent with the mean of value of 11.67%, while the cross G. 85 x Pima S_6 gave the lowest positive heterosis with the values 9.32%.

Concerning lint index and number of bolls per plant, the cross G. 85 x Pima S_6 gave the positive heterosis (desirable) versus better parent with the mean values of 20.26 and 42.95%, respectively. On the other hand, the cross G. 76 x Pima S_6 gave the highest positive heterosis for number of seeds per boll with the mean value of heterosis 23.04%.

The results also revealed that for fiber traits the crosses, Kar. x G. 75, G. 89 x G. 75 and G. 88 x Pima S_6 exhibited the desirable heterosis versus better parent for fiber fineness, fiber strength and uniformity ratio with the mean values of heterosis -21.95, 12.91 and 4.65%, respectively. Also, the cross [G. 84 x (G. 74 x G. 68)] x G. 75 gave the highest positive heterosis (desirable) for 50% S.L. and 2.5% S.L. with the mean values of heterosis 10.98 and 8.55%,. respectively.

These results are in agreement with the results obtained by Laxman and Ganesh (2003); Tuteja *et al.* (2004); Samreen (2007) and Panhwar *et al.* (2008).

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Table (1): Mean squares of yield, yield components and fiber traits

S.O.V	d.F	Yield and yield components traits									Fiber traits			
		B.W	S.C.Y./P.	L.C.Y./P	L%	S.I.	L.I.	No. B/P.	No. S./B	F.F	F.S	50% S.L	2.5% S.L	U.R. %
Replications	2	0.040	92.84	14.20*	0.353	1.079**	0.319	39.18**	6.868**	0.053	0.243	2.217	2.255	0.816
Genotypes	54	0.109**	587.02**	96.40**	7.640**	1.205**	0.859**	88.43**	9.473**	0.455**	0.978*	5.950**	6.168**	2.993**
Parents	15	0.075**	430.96**	62.46**	2.838**	0.747**	1.050**	53.64**	5.473**	0.688**	0.958	3.090	3.981*	0.921
Crosses	38	0.121**	532.30**	91.22**	9.681**	1.042**	0.666**	78.21**	9.518*	0.355**	1.001*	7.218**	7.173**	3.889**
Parents vs crosses	1	0.124*	5007.2**	802.34**	2.111	14.268**	5.332**	998.42**	67.768**	0.724*	0.408	0.646	0.736	0.004
Lines	12	0.119**	596.07**	107.56**	10.324*	0.377*	0.902**	84.12**	2.830**	0.537**	0.573*	7.303**	7.532**	4.261**
Testers	2	0.500**	443.07**	157.58**	64.695**	2.305**	0.872**	204.80**	61.870**	0.949**	2.863*	31.554**	33.940**	6.813**
Line x tester	24	0.091**	507.85**	77.52**	4.775**	1.270**	0.530**	64.70**	8.499**	0.214*	1.059*	5.147**	4.764*	3.460**
Error	108	0.020	30.57	4.52	0.694	0.163	0.179	4.87	1.166	0.124	0.627	2.082	2.174	1.206

*, ** significant at 0.05 and 0.01 levels of probability, respectively.

Table (2): The mean performance of 13 parental lines and three testers for yield and yield components and fiber traits.

Parents	Yield and yield components traits									Fiber traits			
	B.W	S.C.Y./P.	L.C.Y./P	L%	S.I.	L.I.	No. B/P.	No. S./B	F.F	F.S	50% S.L.	2.5% S.L	U.R. %
Lines													
Kar.	2.52	50.76	18.95	37.31	9.94	5.91	20.16	15.72	4.10	9.70	25.40	30.67	82.77
G. 89	2.65	46.59	15.98	36.83	8.78	5.12	18.25	14.69	4.07	9.63	26.81	32.23	83.17
G. 87	2.68	48.04	18.09	37.71	10.07	6.10	17.86	16.81	3.43	10.73	26.59	32.10	83.17
G. 70	2.37	29.69	11.62	39.15	9.79	6.30	12.55	14.10	3.80	11.00	26.58	32.23	82.43
Pima 62	2.24	31.37	11.94	38.06	9.66	5.94	13.75	13.36	2.67	10.00	25.11	30.43	82.47
G. 85	2.27	43.78	15.71	35.90	8.69	4.87	19.27	12.63	3.63	10.67	24.47	29.67	82.50
G. 84 x (G. 74 x G. 68)	2.61	53.12	19.57	36.85	9.96	5.82	20.48	16.39	3.63	10.67	25.23	30.80	81.90
G. 76	2.57	33.22	12.67	38.13	9.62	5.93	12.91	15.32	3.77	11.53	28.88	32.37	83.03
G. 89 x Pima S_6	2.56	54.92	20.99	38.21	10.51	6.50	21.58	16.62	4.13	10.67	27.27	33.30	83.40
G. 86	2.79	61.26	23.80	38.86	10.08	6.40	21.94	17.21	4.57	10.03	27.19	32.60	83.40
G. 77 x Pima S_6	2.72	51.45	18.88	36.70	9.79	5.68	18.93	16.83	4.10	9.70	27.05	32.40	83.50
G. 45	2.67	60.98	22.45	36.82	9.55	5.57	22.84	16.11	3.07	9.83	27.49	33.07	83.13
G. 88	2.42	58.62	21.22	36.13	9.05	5.12	24.59	13.98	3.37	10.27	26.50	32.13	82.43
Testers													
G. 75	2.66	61.94	23.33	37.68	9.73	5.88	23.29	16.16	4.13	10.07	24.97	30.30	82.40
Suvin	2.61	72.43	27.86	38.46	9.86	7.15	27.85	15.85	3.27	10.40	26.38	31.73	83.10
Pima S_6	2.61	58.53	21.36	36.50	9.08	5.22	22.45	15.03	3.67	9.53	27.42	33.60	81.60
L.S.D 0.05	0.229	8.94	3.44	1.35	0.65	0.68	3.57	1.75	0.570	1.28	2.33	2.37	1.780
0.01	0.273	10.65	4.10	1.61	0.78	0.82	4.25	2.08	0.680	1.53	2.78	2.82	2.120

*, ** significant at 0.05 and 0.01 levels of probability, respectively

Table (3): The mean performance of F_1 crosses for yield, yield components and fiber traits

Crosses	Yield and yield components traits									Fiber traits			
	B.W.	S.C.Y./P.	L.C.Y./P.	L.%	S.I.	L.I.	No. B/P	No. S/B	F.F.	F.S.	50% S.L.	2.5% S.L.	U.R. %
Kar. x G. 75	2.84	87.30	33.72	38.69	8.73	5.54	29.92	15.25	3.20	10.23	24.78	29.87	82.90
G. 89 x G. 75	2.78	88.27	35.12	39.77	[illegible]	5.68	31.70	14.38	3.40	11.37	28.69	32.10	83.13
G. 87 x G. 75	2.22	58.35	20.21	34.69	9.08	4.84	25.37	13.13	2.87	10.87	25.32	30.93	81.83
G. 70 x G. 75	2.33	50.98	15.71	39.61	8.66	5.45	21.90	12.40	3.73	10.43	27.23	32.93	82.67
Pima 62 x G. 75	2.34	66.27	25.19	38.01	8.70	5.33	28.32	12.62	3.37	10.20	23.81	29.13	81.53
G. 85 x G. 75	2.30	71.30	28.86	[illegible]	9.45	6.42	30.97	12.94	3.63	10.20	24.15	29.57	81.63
(G. 84 x (G. 74 x G. 68)) x G. 75	2.18	71.71	26.54	[illegible]	[illegible]	5.71	32.97	13.32	3.20	10.63	28.00	33.43	83.70
G. 76 x G. 75	2.25	44.38	17.72	[illegible]	7.10	[illegible]	19.82	9.57	3.90	9.83	23.84	29.20	81.57
(G. 89 x Pima S_6) x G. 75	2.33	66.84	27.13	[illegible]	9.12	5.94	29.63	12.85	3.70	10.43	25.22	30.50	82.70
G. 86 x G. 75	2.70	64.67	24.39	37.91	[illegible]	5.51	[illegible]	15.16	4.23	10.93	26.18	31.67	82.87
(G. 77 x Pima S_6) x G. 75	2.31	62.01	23.89	38.53	9.09	5.70	[illegible]	12.91	3.10	11.27	27.43	32.93	83.27
G. 45 x G. 75	2.12	46.68	17.59	37.68	8.55	5.23	22.07	11.40	3.17	10.60	27.45	33.00	83.17
G. 88 x G. 75	2.25	66.71	27.16	40.71	9.07	6.23	29.68	12.11	3.53	10.93	27.71	33.00	83.97
Kar. x Suvin	2.50	76.30	30.61	40.54	8.54	5.89	30.68	12.83	3.93	10.47	26.48	31.87	83.07
G. 89 x Suvin	2.57	65.16	24.79	38.95	8.86	5.44	25.44	14.11	4.00	9.70	25.83	31.40	82.27
G. 87 x Suvin	2.37	60.82	23.20	38.18	9.05	5.59	25.68	13.24	3.10	9.60	25.37	31.27	81.13
G. 70 x Suvin	2.31	45.31	17.42	38.41	8.35	5.21	19.63	11.86	3.53	11.17	28.10	33.60	83.63
Pima 62 x Suvin	2.61	76.73	28.37	36.96	8.99	5.27	29.43	14.77	3.13	10.37	27.28	32.67	83.50
G. 85 x Suvin	2.56	76.23	28.80	37.75	8.88	5.39	29.88	14.16	3.30	11.33	23.32	28.53	81.77
((G. 84 x (G. 74 x G. 68)) x Suvin	2.35	81.52	32.72	40.15	7.89	5.29	34.70	11.09	3.47	11.57	26.24	31.67	82.83
G. 76 x Suvin	2.53	60.52	23.15	38.26	8.75	5.42	23.71	13.72	3.17	10.67	25.24	30.93	81.60
(G. 89 x Pima S_6) x Suvin	2.51	61.80	24.59	39.62	8.91	5.91	24.56	13.52	3.90	10.13	24.91	30.73	81.03
G. 86 x Suvin	2.67	68.19	26.12	38.31	9.39	5.84	25.88	15.47	4.03	10.80	26.37	31.87	82.77
(G. 77 x Pima S_6) x Suvin	2.67	52.43	19.96	38.36	9.35	5.83	19.52	15.42	2.90	9.33	27.40	33.10	82.70
G. 45 x Suvin	2.46	72.87	25.29	36.19	9.17	5.21	29.68	14.37	3.33	10.40	26.10	31.43	82.97
G. 88 x Suvin	2.53	47.73	17.79	37.37	8.75	5.24	18.86	13.83	3.57	10.50	25.13	30.67	81.93
Kar. x Pima S_6	2.45	49.16	17.82	36.24	9.27	5.27	20.04	14.49	3.60	10.23	28.05	33.30	84.23
G. 89 x Pima S_6	2.66	61.22	23.06	37.64	9.62	5.81	23.08	15.96	3.57	9.63	28.11	33.70	83.40
G. 87 x Pima S_6	2.54	65.18	21.90	33.61	6.02	4.56	25.74	15.19	3.67	10.27	27.48	33.13	82.93
G. 70 x Pima S_6	2.32	43.92	15.60	35.52	9.65	5.31	18.98	14.40	3.87	9.37	26.56	32.50	81.73
Pima 62 x Pima S_6	2.81	52.03	18.79	36.10	8.91	5.00	18.53	15.89	3.53	10.11	27.83	33.80	82.33
G. 85 x Pima S_6	2.60	83.42	32.28	38.71	9.93	6.27	32.10	15.84	3.93	10.07	26.11	31.17	83.77
(G. 84 x (G. 74 x G. 68)) x Pima S_6	2.61	43.70	14.77	33.83	9.22	4.72	16.75	15.91	4.10	10.50	25.16	30.90	81.37
G. 76 x Pima S_6	2.90	82.42	29.97	36.37	10.20	5.83	28.37	18.85	3.90	10.30	28.16	33.87	83.07
(G. 89 x Pima S_6) x Pima S_6	2.28	70.43	25.90	36.77	9.12	5.30	30.89	13.16	3.80	9.70	27.91	33.73	82.77
G. 86 x Pima S_6	2.57	51.86	19.27	37.13	7.85	4.53	20.22	12.69	4.00	9.43	25.38	31.33	80.87
(G. 77 x Pima S_6) x Pima S_6	2.66	40.33	15.03	37.29	8.66	5.17	15.24	14.45	3.67	9.73	28.15	33.83	83.87
G. 45 x Pima S_6	2.68	51.21	17.42	34.01	8.88	4.58	19.11	15.70	3.50	10.77	29.57	34.80	85.47
G. 88 x Pima S_6	2.78	75.76	28.54	37.69	10.14	6.14	27.30	17.55	3.57	11.00	29.59	34.30	86.27
L.S.D. 0.05	0.229	8.94	3.44	1.35	0.65	0.68	3.57	1.75	0.57	1.28	2.33	2.37	1.78
0.01	0.273	10.65	4.10	1.61	0.78	0.82	4.25	2.08	0.68	1.53	2.78	2.82	2.12

Table (4): General combining ability effects of the parental genotypes (lines and testers) for yield, yield components and fiber traits.

Parents		Yield and yield components traits								Fiber traits				
		B W	S C Y /P	L C Y /P	L%	S I	L I	No B/P	No S /B	F F	F S	50% S L	2 5% S L	U R %
Lines														
Kar.		0 099*	7 746**	3 502**	0 785**	0 087	0 119	1 541*	0 177	0 011	-0 078	-0 087	-0 321	0 836
G 89		0 170**	8 378**	3 775**	0 781**	0 039	0 195	1 404	0 803*	0 089	-0 153	0 373	0 401	0 169
G 87		-0 124**	-1 721	-2 111**	-2 213**	0 064	0 449**	0 591	-0 161	-0 356**	-0 142	-0 448	-0 221	-0 797*
G 70		-0.160**	-16 436**	-6 306**	-0 194	-0 100	0 124	5 167**	1 127**	0 144	-0 064	0 796	1 012*	-0 086
Pima 62		0 089	1 838	0 234	-0 685**	-0 121	0 247	0 089	0 412	0 222	-0 161	-0 197	-0 133	-0 309
G 85		-0 011	13 809**	6 098**	1 276**	0 434**	0 584**	5 648**	0 301	0 056	0 147	-1 974**	2 244**	-0 375
G 84 x (G 74 x G 68)		-0 119**	2 472	0 795	-0 709**	0 043	0 207	2 805**	-0 572	0 022	0 513	-0 039	0 001	-0 131
G 76		0 063	-0 731	-0 270	0 480	0 305*	0 123	-1 370	0 036	0 089	-0 120	-0 756	-0 666	-0 666
G 89 x Pima S_6		-0 123**	3 852*	1 992**	0 898**	0 062	0 270	3 022**	-0 834*	0 233*	-0 298	-0 490	-0 344	-0 597
G 86		0.148**	-1 599	-0 623	0 086	0 238	0 119	-1 977**	0 429	0 522**	0 002	-0 531	0 377	0 664
G 77 x Pima S_6		0 049	-11 583**	-4 255**	0 357	0 048	0 120	-4 809**	0 249	-0 344**	-0 276	1 155**	1 223**	0 447
G 45		-0.080	-6 252**	-3 449**	-1 746**	0 087	-0 442**	1 718*	-0 190	-0 233*	0 202	1 205**	1 012*	1 103**
G. 88		0.020	0.227	0 618	0 885**	0 334**	0 424**	-0 058	0 480	-0 011	0 425	0 972*	0 656	1 292**
L S.D.	0.05	0 093	3.649	1 403	0 550	0 268	0 279	1 456	0 713	0 232	0 523	0 952	0 973	0 725
	0.01	0.111	4 350	1 672	0 655	0 317	0 333	1 736	0 850	0 277	0.623	1 135	1 160	0 864
Testers														
G 75		- 118**	2 017*	1 289**	0 865**	0 138*	0 114**	1 907**	089**	0 103	0 224*	-0 519*	- 594**	-0 092
Suvin		0 011	1 874*	1 027**	0 615**	0 143*	0 055	0 636*	0 291	-0 077	0 078	0 520*	-0 481*	-0 364*
Pima S_6		0.107**	-3.891**	- 316**	- 480**	0 281**	189**	- 542**	1 380**	0 180**	- 301**	1 039**	1 075**	1 456**
L.S D.	0 05	0.045	1 753	0 674	0 264	0 128	0 134	0 700	0 342	0 111	0 251	0 458	0 467	0 348
	0 01	0 053	2 090	0.803	0 315	0 152	0 160	0 834	0.408	0 133	0 299	0 545	0 557	0 415

*, ** significant at 0.05 and 0.01 levels of probability, respectively

Table (5): Estimates of specific combining ability for yield, yield components and fiber traits.

Crosses	Yield and yield components traits										Fiber traits		
	B.W	S.C.Y./P	L.C.Y./P	L%	S.I.	L.I	No. B/P	No. S/B	F.F	F.S	50% S.L	2.5% S.L	U.R %
Kar. x G. 75	0.358**	14.36**	5.05**	0.669	0.028	-0.143	1.14	2.145**	-0.275	-0.301	-1.140	-1.217	-0.408
G. 89 x G. 75	-0.108	3.50	2.50**	1.438**	-0.117	0.269	3.16**	-1.069	0.432*	0.078	0.568	0.870	0.031
G. 87 x G. 75	-0.251**	-17.87**	-7.24**	-0.770	0.089	-0.126	-4.30**	1.076	-0.157	0.223	0.527	0.547	0.377
G. 70 x G. 75	0.227**	14.70**	6.18**	0.415	0.291	-0.078	3.06	0.649	-0.153	0.910*	0.330	0.294	0.292
Pima 62 x G. 75	-0.112	-8.26*	-3.89**	-1.048**	-0.026	-0.260	1.93	-0.416	0.421	-0.811	-0.522	0.519	-0.303
G. 85 x G. 75	-0.115	-6.44*	-2.28	0.634	0.317	0.338	1.12	-0.233	-0.268	-0.299	0.192	0.225	0.010
(G. 84 x (G. 74 x G. 68)) x G 75	-0.038	-5.12	-2.85*	-1.671**	0.168	-0.272	[illegible]	0.363	-0.242	0.399	-0.219	-0.255	-0.041
G. 76 x G. 75	-0.018	-2.50	0.40	2.073**	0.143	0.537*	-0.88	-0.318	-0.034	-0.722	-0.164	-0.030	-0.469
(G. 89 x Pima S_6) x G. 75	0.056	7.62**	2.45*	-0.402	-0.311	-0.265	2.35	-0.045	0.276	0.323	0.384	0.280	0.510
G. 86 x G. 75	0.131	2.23	0.84	0.230	-0.089	0.010	-0.17	0.599	0.125	-0.113	0.447	0.516	0.081
(G. 77 x Pima S_6) x G. 75	-0.022	-3.30	-1.18	0.281	-0.394	-0.171	-1.18	0.733	-0.101	0.767	1.326	1.070	1.320*
G. 45 x G. 75	-0.108	1.08	0.34	[illegible]	0.483*	[illegible]	1.35	0.134	-0.024	-0.854	-1.773*	-1.586	-1.401*
G. 88 x G. 75	-0.128	-0.76	-0.22	0.121	-0.028	0.016	0.99	-0.717	0.125	-0.249	1.980**	-2.139	-0.830
Kar. x Suvin	0.009	9.85*	3.23**	-0.678	0.264	0.011	3.37**	0.632	-0.134	0.064	1.490	1.281	1.409*
G. 89 x Suvin	0.119	-9.09**	-3.01**	0.557	-0.236	-0.027	-4.35**	0.085	0.009	0.186	0.469	0.858	-0.579
G. 87 x Suvin	-0.068	-7.70**	-2.41**	0.620	0.168	0.279	-1.92	-0.286	0.114	-0.557	0.144	0.405	-0.663
G. 70 x Suvin	0.095	-2.63	-2.20	-1.833**	-0.397	-0.692**	-1.74	0.136	-0.245	0.722	-0.688	-0.741	-0.258
Pima 62 x Suvin	0.009	10.33**	4.62**	1.212**	0.229	0.413	3.66**	0.149	0.132	-0.165	0.544	0.336	0.921
G. 85 x Suvin	-0.084	4.05	0.58	-0.855	0.921**	0.359	2.92*	0.964	-0.286	-0.490	2.052**	2.027**	1.159
((G. 84 x (G. 74 x G. 68)) x Suvin	-0.040	14.00**	7.02**	2.538**	-0.914**	-0.005	5.92**	2.057**	0.045	0.589	0.293	0.148	0.564
G. 76 x Suvin	0.124	-18.05**	-7.59**	-1.683**	-0.007	-0.354	-8.85**	1.093	0.322	-0.099	2.345*	-2.175**	-1.723**
(G. 89 x Pima S_6) x Suvin	-0.193**	-20.08**	-7.18**	0.873	-1.497**	-0.721**	-6.06**	3.387**	0.347	-0.657	-1.388	-1.539	-0.419
G. 86 x Suvin	-0.042	-3.80	-1.49	-0.541	0.209	0.041	-0.89	-0.038	-0.412*	0.322	0.013	0.081	-0.114
(G. 77 x Pima S_6) x Suvin	0.235**	23.87**	8.67**	-0.331	1.238**	0.679**	6.95**	3.425**	0.065	0.335	1.375	1.458	0.532
G. 45 x Suvin	0.074	-0.20	-0.03	-0.049	0.209	0.106	-0.64	0.759	0.003	0.121	-0.274	-0.562	0.826
G. 88 x Suvin	0.125	-7.10*	-2.31	0.398	0.004	0.138	-4.44**	0.834	0.177	-0.033	-0.585	-0.441	-0.789
Kar. x Pima S_6	-0.198*	7.30*	2.34	-0.350	-0.213	-0.244	5.07*	-1.393*	0.179	-0.088	0.859	1.003	0.144
G. 89 x Pima S_6	0.173*	1.80	-0.16	-0.726	0.395	0.072	-1.28	1.807**	0.247	0.321	0.727	0.638	0.859
G. 87 x Pima S_6	0.010	4.74	1.84	-0.093	0.784**	0.454	1.88	1.322*	0.021	0.334	0.922	0.726	1.031
G. 70 x Pima S_6	-0.183*	-5.82	-1.67	0.819	-1.180**	-0.525*	-0.60	-3.128**	-0.268	-0.654	-1.650*	-1.364	-1.690**
Pima 62 x Pima S_6	-0.118	8.40**	2.97**	-0.394	0.193	0.016	4.39**	-0.260	-0.020	0.932*	0.289	0.305	0.148
G. 85 x Pima S_6	0.112	-1.03	-0.69	-0.317	0.459	0.211	-1.65	1.449**	-0.245	-0.855	0.260	0.359	-0.147
(G. 84 x (G. 74 x G. 68)) x Pima S_6	0.006	-7.37*	-2.28	0.711	-0.652**	-0.227	-2.75*	-1.188	0.265	-0.077	-0.549	-0.664	-0.001
G. 76 x Pima S_6	-0.183*	-12.26**	-4.13**	0.853	-0.112	0.108	-3.45**	1.338*	-0.064	-0.213	0.262	0.583	-0.608
(G. 89 x Pima S_6) x Pima S_6	0.028	14.08**	4.83**	-0.387	0.413	0.150	5.42**	0.841	0.077	-0.266	-1.090	-1.097	-0.539
G. 86 x Pima S_6	0.155	-1.82	-0.70	-0.465	-0.301	-0.258	-1.97	0.497	-0.013	0.479	0.828	0.514	1.144
(G. 77 x Pima S_6) x Pima S_6	-0.149	1.29	1.37	1.251**	-0.112	0.247	2.49	-1.298*	0.080	-0.101	0.751	0.938	0.003
G. 45 x Pima S_6	-0.002	-17.55**	-7.73**	-1.832**	-0.430	0.684**	-7.05**	-0.383	0.088	-0.389	1.824*	-1.508	-1.758**
G. 88 x Pima S_6	0.152	16.26**	8.36**	0.580	0.543*	0.437	4.56**	1.681**	-0.168	0.490	1.071	0.569	1.755**
L.S.D 0.05	0.161	6.321	2.430	0.952	0.461	0.484	2.523	1.235	0.402	0.905	1.650	1.885	1.255
0.01	0.192	7.534	2.896	1.135	0.549	0.577	3.007	1.471	0.479	1.079	1.966	2.009	1.498

*, ** significant at 0.05 and 0.01 levels of probability, respectively

Table (6): Proportion contributions of lines, testers and their interaction for yield, yield components and fiber traits.

Proportional contributions	Yield and yield components traits								Fiber traits				
	B.W	S.C.Y./P.	L.C.Y./P.	L%	S.I.	L.I.	No. B/P.	No. S./B	F.F	F.S	50% S.L.	2.5% S.L	U.R. %
Lines	31.06	35.36	37.24	33.68	11.41	42.79	33.97	9.39	47.79	18.10	31.95	33.16	34.60
Testers	21.70	4.38	9.09	35.17	11.64	6.89	13.78	34.21	14.06	15.05	23.01	24.90	9.22
Lines x testers	47.24	60.26	53.67	31.15	76.95	50.31	52.25	56.40	38.14	66.85	45.04	41.94	56.18

Table (7): Heterosis relative to the mid-parents for yield, yield components and fiber traits.

Crosses	Yield and yield components traits									Fiber traits			
	B W	S C Y /P	L C Y /P	L%	S.I	L I	No. B/P.	No. S /B	F F	F.S	50% S L	2.5% S L	U R %
Kar. x G. 75	9.52	54.93**	59.51**	3.81	-10.63**	-6.08	37.70**	-4.35	-22.27*	3.54	-1.81	-2.02	0.38
G 89 x G 75	4.58	62.66**	78.71**	6.74**	-7.11	3.28	52.62**	-6.80	-17.07*	15.40	3.08	2.67	0.42
G 87 x G 75	-16.98**	6.10	2.42	-7.98**	-8.28*	-19.15**	28.13**	-20.38**	-24.23**	4.49	1.79	0.88	-1.15
G 70 x G 75	-7.29	11.27	12.78	0.50	-11.26**	-10.54	22.23*	-18.07**	-5.88	-0.95	5.64	5.33	0.30
Pima 62 x G 75	-4.43	42.05**	42.85**	0.37	-10.25**	-9.78	52.89**	-14.50*	-0.98	1.66	-4.91	-4.06	-1.09
G 85 x G. 75	-6.69	34.88**	47.86**	9.99**	2.61	19.58**	45.54**	-10.11	-8.44	-1.81	-2.29	1.39	-0.99
(G 84 x (G. 74 x G 68)) x G 75	-17.34**	24.65**	23.75**	-0.69	-1.20	-2.28	50.66**	-18.19**	-17.60	2.57	11.56**	9.44	1.89
G. 76 x G. 75	-13.96**	6.72	-1.56	5.33**	-26.64**	-20.08**	9.46	-39.19**	-1.27	-8.95	-8.03	-6.81	-1.39
(G 89 x Pima S_6) x G 75	-10.67	17.82	22.44*	3.90	-9.88**	-4.04	32.06**	-21.62**	-10.48	0.64	-4.36	-4.09	-0.24
G 88 x G. 75	-0.98	4.98	3.49	-0.86	9.05*	-10.21**	8.04	-9.14	-2.68	8.79	0.39	0.89	-0.28
(G 77 x Pima S_6) x G 75	-14.07**	9.38	13.20	3.61	6.87	-1.39	27.06**	-21.71**	-24.70**	13.99	5.45	5.05	0.38
G 45 x G 75	-20.58**	-24.05**	-23.16**	1.15	-10.27**	-8.65	-4.31	-29.38**	-12.04	8.53	4.66	4.15	0.48
G 88 x G 75	-11.42*	10.66	21.94*	10.31**	[illegible]	13.34**	[illegible]	-19.67**	-5.78	7.54	7.66	5.71	1.88
Kar x Suvin	-2.47	23.87**	30.76**	7.02**	-12.71**	-9.82**	27.78**	-18.70**	6.79	4.15	2.31	2.14	0.18
G 89 x Suvin	-3.35	9.49	13.09	1.08	-4.95	-11.36**	10.37	-7.57	9.09	-3.18	-2.86	-1.82	-1.04
G 87 x Suvin	-10.47	0.97	0.96	0.25	-9.17*	-15.60**	12.34	-18.89**	-7.48	-9.15	-4.20	-2.04	-2.41
G 70 x Suvin	-7.24	-11.27	11.76	-1.03	-14.98**	22.58**	-2.82	-20.76**	0.00	4.36	6.14	5.06	1.05
Pima 62 x Suvin	7.64	47.85**	42.56**	-3.41	-7.89	-19.51**	41.45**	1.13	5.62	1.63	5.96	5.09	0.87
G 85 x Suvin	4.85	31.19**	32.20**	1.57	-4.24	-10.24**	26.83**	-0.54	-4.35	7.60	-8.27	-7.06	-1.25
((G 84 x (G. 74 x G 68)) x Suvin	-9.85	29.86**	37.97**	6.82**	-20.40**	-18.41**	43.59**	-31.18**	0.48	9.81	1.69	1.28	0.40
G 76 x Suvin	-2.25	14.57	14.22	-0.09	-10.17**	-17.10**	18.32	-11.97	-9.95	-2.74	-5.21	-3.48	-1.77
(G 89 x Pima S_6) x Suvin	-2.78	-2.95	0.66	3.35	-12.50**	-13.39**	-0.85	-16.71**	5.41	-3.80	-8.01	-5.48	-2.68*
G 88 x Suvin	-1.24	2.01	1.11	-0.89	-5.79	-13.87**	3.95	-8.37	2.98	5.71	-1.53	-0.93	-0.58
(G 77 x Pima S_6) x Suvin	0.31	-15.35	-14.59	2.07	-4.82	-9.04**	-18.57	-5.81	-21.27*	-7.13	2.55	3.22	-0.72
G 45 x Suvin	-8.89	9.24	4.51	-3.86	-5.50	-18.06**	17.08	-10.06	5.26	2.80	-3.11	-2.98	-0.18
G 88 x Suvin	0.53	-27.16**	-27.51**	0.22	-7.46	-14.57*	-28.07**	-7.33	7.54	1.61	-4.96	-3.97	-1.01
Kar x Pima S_6	-4.29	-10.03	-11.56	-1.80	-2.54	-5.30	-5.97	-5.72	-7.30	6.41	6.21	3.63	2.49
G 89 x Pima S_6	1.21	16.48	23.52**	2.66	7.74	12.45	13.38	7.44	-7.78	0.52	3.66	2.38	1.23
G 87 x Pima S_6	-4.04	22.33**	11.05	-9.42**	-5.82	-19.33**	27.67**	-4.61	3.29	1.32	1.75	0.86	0.87
G. 70 x Pima S_6	-6.64	-0.44	-5.41	-8.09**	2.28	-7.73**	8.44	-1.12	3.57	-8.77	-1.61	-1.27	-0.35
Pima 62 x Pima S_6	16.17**	15.75	12.86	-3.17	-4.91	-10.28**	2.36	11.95	11.58	3.52	5.99	5.57	0.37
G 85 x Pima S_6	6.77	63.07**	74.17**	6.94**	11.74**	24.13**	53.86**	14.57	7.76	-0.33	0.64	-1.48	2.09
(G. 84 x (G. 74 x G. 68)) x Pima S_6	0.13	-21.72**	-27.83**	-7.75**	-3.20	-14.50**	-21.96*	1.29	12.33	3.96	-4.43	-4.04	-0.47
G 76 x Pima S_6	12.17*	79.67**	76.15**	-2.53	9.09*	4.50	60.45**	24.23**	4.93	-2.22	3.71	2.68	0.91
(G 89 x Pima S_6) x Pima S_6	-11.56*	24.16**	22.32*	-1.55	-6.94	-9.45**	40.30**	-16.81**	-2.56	-3.96	1.14	0.85	0.32
G 86 x Pima S_6	-4.82	-13.42	-14.67	-1.46	-18.06**	-20.25**	-8.92	-21.29**	-2.83	-3.58	-7.19	-5.34	-1.98
(G 77 x Pima S_6) x Pima S_6	-0.06	-26.42**	-25.26**	1.88	-8.20	-5.08	-26.35**	-9.26	-5.58	1.22	3.35	1.92	1.35
G 45 x Pima S_6	1.58	-14.30	-20.46*	-7.22**	-4.69	-15.12**	-15.64	0.82	3.96	11.19	7.72	3.80	3.76**
G 88 x Pima S_6	10.48	29.34**	34.08**	3.79	11.90**	18.77**	16.04	21.02**	1.42	11.11	9.74**	4.36	5.18**
L.S.D 0.05	0.280	10.947	4.209	1.649	0.800	0.838	4.370	2.140	0.697	1.568	2.857	2.919	2.174
0.01	0.334	13.048	5.017	1.966	0.953	0.998	5.209	2.550	0.631	1.869	3.405	3.479	2.891

*, ** significant at 0.05 and 0.01 levels of probability, respectively.

Table (8): Heterosis relative to the better parent for yield, yield components and fiber traits.

Crosses	Yield and yield components traits									Fiber traits			
	B.W	S.C.Y./P.	L.C.Y./P.	L%	S.I	L.I.	No. B/P.	No. S/B	F.F	F.S	50% S.L.	2.5% S.L.	U.R %
Kar. x G. 75	6.64**	40.94**	44.54**	2.88	-11.57**	-6.37	28.45**	-5.67	-21.95**	1.66	-2.44	-2.61	0.16
G. 89 x G. 75	4.39	42.540**	50.58**	5.55**	-11.65**	-3.40	38.11**	-11.05**	-18.39**	12.91**	-0.47	-0.41	-0.04
G. 87 x G. 75	-17.29**	-5.80	-13.38	-6.03**	-9.63**	-20.61**	13.19	-21.91**	-16.51*	1.24	-4.79	-3.63	-1.60
G. 70 x G. 75	-12.41*	-17.70**	-15.52*	-1.89	-11.51**	-13.54**	-5.97	-23.30**	-1.75	-5.15	2.43	2.17	0.28
Pima 62 x G. 75	-12.03**	6.99	7.97	-0.14	-10.59**	-16.21	21.58**	-21.92**	26.25**	1.33	-5.18	-4.27	-1.13
G. 65 x G. 75	-13.53**	15.11*	23.71**	7.41**	-2.88	9.30	32.97**	-19.94**	0.00	-4.38	-3.26	-2.42	-1.05
(G. 84 x (G. 74 x G. 68)) x G.75	-18.17**	15.77*	13.76	-1.78	-2.34	-2.78	41.56**	-16.75**	-11.93	-0.31	10.98**	8.55*	1.58
G. 76 x G. 75	-15.41**	-28.35**	-24.05**	4.69**	-27.06**	-20.42**	-14.92	-40.77**	3.54	-14.74**	-11.30**	-9.78**	-1.77
(G. 89 x Pima S_6) x G. 75	-12.41**	[illegible]	16.31*	3.18	-13.23**	-8.62	27.20**	-22.89**	-10.48	-2.19	-9.19	-8.41*	-0.84
G. 66 x G. 75	-3.34	4.41	2.45	-2.39	-10.62*	-13.90**	2.98	-11.90**	2.42	6.61	-3.72	-2.86	-0.88
(G. 77 x Pima S_6) x G. 75	-14.97**	0.11	2.40	2.29	-7.15*	-3.06	15.17	-23.26**	-24.39**	11.91	1.38	1.65	-0.28
G. 45 x G. 75	-20.72**	-24.64**	-24.61**	0.00	-11.10**	-11.06	-5.24	-29.49**	3.26	5.30	-0.15	-0.20	0.04
G. 88 x G. 75	-15.41**	7.70	16.43*	8.04**	-8.78*	6.01	27.40**	25.10**	4.95	6.49	4.54	2.70	1.86
Kar. x Suvin	-4.09	5.34	9.85	5.42**	-13.08**	-17.62**	10.14	-19.04**	20.41*	0.64	0.40	0.42	-0.04
G. 89 x Suvin	-3.15	-10.04	-11.03	-1.06	-10.15**	-23.96**	-8.85	-10.96	22.45**	-8.73	-3.66	-2.59	-1.08
G. 87 x Suvin	-11.69**	-16.03**	-16.75**	-0.73	-10.13**	-21.62**	-7.80	-21.22**	-5.10	-10.56	-4.59	-2.60	-2.45*
G. 70 x Suvin	-11.51**	-37.45**	-37.48**	-1.80	-15.29**	-27.18**	-29.52**	-25.14**	6.16	1.52	5.73	4.24	0.64
Pima 62 x Suvin	0.0	5.94	1.82	-3.91*	-8.83**	-26.34**	5.65	-8.82	17.50	-0.32	3.41	2.94	0.48
G. 65 x Suvin	-1.92	5.24	3.36	-1.61	-9.91**	-24.57**	7.29	-10.64	1.02	6.25	-11.59**	-10.08	-1.60
((G. 84 x (G. 74 x G. 68)) x Suvin	-9.85**	12.55**	17.43**	4.39**	-20.82**	-26.01**	24.58**	-32.32**	8.12	6.44	-0.53	-0.21	-0.32
G. 76 x Suvin	-2.94	-16.44**	-16.93**	-0.52	-11.26**	24.20**	-14.88**	-13.42**	-3.06	-7.51	-6.09	-4.43	-1.81
(G. 89 x Pima S_6) x Suvin	-3.71	-14.68**	-11.76	3.01	-15.22**	-17.34**	-11.84	-18.64**	19.39*	-5.00	-10.32**	-7.71*	-2.84**
G. 66 x Suvin	-4.54	-5.85	-6.26	-1.40	-6.81*	-18.37**	-7.09	-10.07	23.47**	3.85	-3.00	-2.25	-0.76
(G. 77 x Pima S_6) x Suvin	-1.72	-27.61**	-28.37**	-0.26	-5.14	-18.42**	-29.93**	-8.36	-11.22	-10.26	1.27	2.18	-0.96
G. 45 x Suvin	-7.99*	0.61	-5.65	-5.91**	-6.97*	-27.13**	6.55	-10.80	8.70	0.00	-5.07	-4.94	-0.20
G. 88 x Suvin	-3.07	-34.11**	-36.15**	-2.83	-11.26**	-26.71**	-32.28**	-12.79*	9.18	0.96	-5.18	-4.56	-1.40
Kar. x Pima S_6	-5.86**	-16.01*	-16.54**	-2.87	-8.74*	-10.88	-10.76	-7.78	-1.62	5.50	2.30	-0.69	1.77
G. 89 x Pima S_6	0.36	4.60	7.96	2.19	5.95	11.37	2.78	6.21	-2.73	0.00	2.52	0.30	0.28
G. 87 x Pima S_6	-5.35	11.36	2.56	-10.88**	-10.43**	-25.15**	14.62	-9.66	6.80	-4.35	0.22	-1.39	-0.28
G. 70 x Pima S_6	-11.13**	-24.97**	-26.97**	-9.27**	-1.40	-15.66**	-15.48	-4.19	5.46	-14.65**	-3.11	-3.27	-0.65
Pima 62 x Pima S_6	7.93**	-11.11	-12.03	-5.16**	-7.73*	-15.72**	-17.47**	5.72	32.50**	1.10	1.52	0.60	-0.16
G. 65 x Pima S_6	-0.13	42.52**	51.13**	6.06**	9.32**	20.26**	42.95**	5.41	8.26	-5.63	-4.79	-7.24*	1.54
(G. 84 x (G. 74 x G. 68)) x Pima S_6	0.13	-25.34**	-30.86**	-8.20**	-7.46*	-18.91**	-25.39**	-2.91	12.84	-1.56	-8.24	-8.04**	-0.65
G. 76 x Pima S_6	11.36**	40.61**	40.32**	-4.62**	6.07	-1.58	26.37**	23.04**	6.36	-10.69	2.71	0.79	0.040
(G. 89 x Pima S_6) x Pima S_6	-12.48**	20.33**	21.27**	-3.75*	-13.26**	-18.37**	37.57**	-20.78**	3.84	-9.06	0.49	0.40	-0.76
G. 66 x Pima S_6	-7.99**	-15.35*	-19.06**	-4.44**	-22.10**	-27.64**	-9.96	-26.23**	9.09	-5.98	-7.50	-6.75	-3.04**
(G. 77 x Pima S_6) x Pima S_6	-2.09	-31.11**	-29.62**	1.61	-11.51**	-8.93	-32.13**	-14.11**	0.00	0.34	2.66	0.10	0.20
G. 45 x Pima S_6	0.38	-16.02*	-22.42**	-7.61**	-7.02*	-17.78**	-16.38*	-2.57	14.13	9.49	7.67	2.98	2.61**
G. 88 x Pima S_6	6.52	29.25**	33.65**	3.28	11.67**	17.64**	10.99	16.79**	5.94	7.14	7.92	2.08	4.65**
L.S.D. 0.05	0.132	8.936	3.437	1.346	0.653	0.683	3.568	1.750	0.570	1.281	2.332	2.384	1.776
0.01	0.157	10.653	4.097	1.605	0.779	0.814	4.253	2.080	0.680	1.527	2.760	2.841	2.117

*, ** significant at 0.05 and 0.01 levels of probability, respectively.

الملخص العربى

الاستدلال على تفوق الأباء والهجن لصفات المحصول والتيلة فى القطن المصرى

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أجريت هذه الدراسة بهدف التحسين فى صفات المحصول ومكوناته وأيضا التحسين فى خصائص التيلة بغرض الحصول على تراكيب وراثية جديدة متميزة فى صفات المحصول وذلك من خلال تقدير القدرة العامة على التآلف للأباء وكذلك القدرة الخاصة على التآلف للهجين. ولذلك استخدم فى هذه الدراسة ثلاثة عشر صنفا استخدمت كسلالات وهى: (كارشنكى جيزه ٨٩ ، جيزه ٨٧ ، جيزه ٧٠ ، بيما ٦٢ ، جيزه ٨٥ ، (جـ٨٤ × جـ٧٤ × جـ٦٨) ، جيزه ٧٦ ، (جـ٨٩ × بيماس ٦) ، جيزه ٨٦ ، (جـ٧٧ × بيماس٦) ، جيزه ٤٥ ، جيزه ٨٨. وثلاثة أصناف استخدمت ككشافات وهى: جيزه ٧٥ ، سيوفين ،بيماس ٦ ، وكل هذه الأصناف تتبع النوع باربادنس. وفى الموسم الزراعى ٢٠٠٦ تم التهجين بين الأباء بطريقة التهجين القمى فأعطت تسعة وثلاثون هجينا فى الجيل الأول (F_1). وفى موسم ٢٠٠٧ تم تقييم الأباء مع الأنسال وذلك باستخدام تصميم القطاعات كاملة العشوائية فى ثلاث مكررات ويمكن تلخيص أهم النتائج فيما يلى:

- أظهرت جميع التراكيب الوراثية المستخدمة تباينات عالية المعنوية فى جميع الصفات تحت الدراسة.
- بالنسبه للقدرة العامة على التآلف لم يظهر أى من الأباء المستخدمة سواء السلالات أو الكشافات قدرة عامة على التآلف لكل الصفات الموجودة تحت الدراسة مجتمعة ولكن وجد ان الاصناف جيزه ٧٥ ، سيوفين كان ذات قدرة عامة على التآلف بالنسبة المحصول ومكوناته فى حين أن الكشاف بيماس ٦ ، كان ذو قدرة عامة على التآلف لصفات جودة التيلة. وبالنسبه للسلالات أظهرت النتائج أن الأصناف جيزه ٨٥ ، جيزه ٨٩ كان ذا قدرة عامة على التآلف لصفات المحصول ومكوناته فى حين أن الأصناف (جيزه ٧٧ × بيماس ٦) ، جيزه ٤٥ ، جيزه ٨٨ كانوا ذو قدرة عامة على التآلف لصفات جودة التيلة.

- بالنسبه للقدرة الخاصة على التآلف أيضا لم تظهر النتائج أن أى من الهجن الناتجة كان منفردا ذو مقدرة خاصة على التآلف لكل الصفات تحت الدراسة ولكن الهجين جيزه ٧٧ × بيماس ٦ ، كارشنسكى × جيزه ٧٥ ، جيزه ٨٨ × بيماس ٦ والهجين (جيزه ٨٤ × (جيزه ٧٤ × جيزه ٦٨)) × بيماس ٦ كانوا ذو قدرة خاصة على التآلف لصفات المحصول ومكوناته فى حين أن التراكيب جيزه ٨٠ × سيوفين ،بيما ٦٢ × بيماس ٦ ، جيزه ٨٦ × سيوفين ، بالإضافة للهجين جيزه ٨٨ × بيماس ٦ كانوا ذو قدرة خاصة على التآلف لصفات جودة الألياف.
- بالنسبه لمساهمة السلالات والكشافات والتفاعل بينهم أظهرت النتائج أن مساهمة التفاعل بين السلالات × الكشافات كان أعلى من مساهمة السلالات ومساهمة الكشافات لكل الصفات تحت الدراسة فيما عدا صفتى التصافى والنعومة إلى جانب أن نسبة مساهمة السلالات. كانت أعلى من مساهمة الكشافات لمعظم الصفات تحت الدراسة.
- تم تقدير قوة الهجين على أساس متوسط الأباء وأفضل الأباء وكانت قياسات قوة الهجين مرتفعة سواء بالنسبه لمتوسط الأباء أو أفضل الأباء ويمكن الاستفادة من الهجن ذات قوة الهجين المرتفعة لصفات المحصول ومكوناته وصفات التيلة فى برامج التربية سواء كأصناف جديدة أو من خلال برامج الانتخاب والتحسين.