Arab Univ. J. Agric. Sci., Ain Shams Univ., Cairo, 13(3), 741-753, 2005

HETEROSIS AND COMBINING ABILITY FOR FIBER-TO-SEED ATTACHMENT FORCE, EARLINESS, YIELD AND YIELD COMPONENTS IN A HALF DIALLEL CROSS OF COTTON

[49]

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ABSTRACT

Seven cotton genotypes involving cvs. Giza 70, Giza, 77, Giza 86 and Giza 83 and the exotic varieties; Pima S7 and Sea Island, as well as, the American Upland variety Tamcot C.E., were crossed in a diallel pattern, excluding reciprocals, in 2000 season to produce 21 F_1 hybrids. Parents and F_1's were evaluated in 2001 season for eight economic traits. Mean squares due to genotypes were highly significant for all traits, revealing the presence of sufficient variability in the population. Significant desired negative mid and better parent heterosis were found for fiber-to-seed attachment force and days to flowering. Significant positive heterosis was also observed for yield and its components. The variances due to general combining ability (GCA) and specific combining ability, (SCA) were significant for all studied traits, indicating the importance of both additive and non additive gene action in the inheritance of these characters. The GCA/SCA ratio was found to be greater than unity, indicating predominance of additive and additive x additive types of gene action in the inheritance of these traits. Based on GCA effects, the Upland variety Tamcot C.E. proved to be the best general combiner for earliness, boll weight, seed index, seed cotton yield and lint cotton yield/ plant. Giza 83 seemed to be good combiner for fiber-to-seed attachment force, Giza 86 for lint percentage and Pima S_7 for number of bolls per plant.

Key words: Cotton, Diallel cross, Combining ability, Fiber-to-seed attachment, Yield components

INTRODUCTION

The selection of parents and the crosses either for heterosis breeding or for pedigree breeding is based on knowledge of the nature and magnitude of the genetic variances present in the base population. The diallel-cross technique provides information about general (GCA) and specific combining ability (SCA) effects of parents and is helpful in estimating various types of gene action. In addition, the diallel analysis is a systematic method for

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(Received May 14, 2005)
(Accepted May 23, 2005)

Arab Univ. J. Agric. Sci., Ain Shams Univ., Cairo, 13(3), 741-753, 2005

identifying those parents and hybrids that have superior combinations of the characters of interest. General combining ability (GCA) involves mostly additive and additive x additive gene effects. Specific combining ability (SCA), on the other hand, depends upon non-additive gene effects, which involves dominance and epistatic components of genetic variation. Knowledge of the relative magnitude of additive and non-additive effects would be very useful in designing an efficient breeding program.

Fiber-to-seed attachment force plays an important role in ginning. Studies on this trait have revealed that varieties of lower attachment strength require less force to pull fibers from the seed, so fiber separation at ginning is easier and faster than varieties of higher attachment strength. Consequently, this should reduce the number of broken fibers and neps and produce ginned lint of higher quality. Differences in attachment strength between cotton species and varieties within each species were reported by **Fransen *et al* (1984); Awad (1989); Wahba & Ewida (1990); Al-Tantawy *et al* (1992) and Awaad *et al* (1992).** On the other hand, **El-Feki and Abd El-Gelil (2001)** found small and insignificant heterosis for this trait in a diallel cross of cotton and added that the additive part of genetic variance was more important than dominance for fiber-to-seed attachment force. Heterosis effects tended to be negative and significant for days to first flower opening **(Awad *et al* 1986; Awad, 2001 and El-Helw, 2002),** whereas, heterosis was in the positive direction for yield components **(El-Kilany and Al-Mazar, 1985; Singh *et al* 1987 and Soomro *et al* 1995).**

Also, several workers reported contradicting results with respect to the role and importance of GCA and SCA effects in the inheritance of earliness and yield components **(El-Gohary *et al* 1981; El-Banna, 1987; Meredith, 1990; Tang *et al* 1993; Hendawy, 1994; Nadeem *et al* 1998 and Ismail *et al* 2005).**

The present study was designed to determine heterosis and general and specific combining ability for fiber-to-seed attachment force, earliness and yield component traits in a diallel cross of cotton.

MATERIAL AND METHODS

The present investigation was carried out during the two successive seasons 2000 and 2001. In the first season, all possible crosses were made, excluding reciprocals, in a diallel mating design involving seven divergent parental cotton genotypes at Giza Agric. Res. Station, Agricultural Research Center. The genotypes used included four Egyptian commercial cultivars, namely; Giza 70 and Giza 77 (extra-long staple), Giza 86 and 83 (long-staple), beside three exotic varieties, namely; Pima S_7 (American-Egyptian Cotton), Sea Island variety and an American Upland variety named Tamcot Camd E. All genotypes belong to *G. barbadense* L. except Tamcot which

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(Received May 14, 2005)
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belongs to *G. hirsutum* L. The pure seed of these genotypes were supplied by Cotton Breeding Section, Cotton Res. Institute, ARC. In the second season 2001, the seven parents along with their 21 F_1's (28 entries) were sown at 25th March, in complete randomized block design with three replications. The experimental plot consisted of two rows, 2 m long and 60 cm apart. Hills were spaced at 25 cm within rows and seedlings were later thinned to two plants per hill. Ordinary cultural practices for cotton production were followed during the growing seasons.

Measurements were recorded for parents and F_1 hybrids on 10 guarded plants from each plot to study the following traits:

1. Fiber-to-seed attachment force (cN. cm/mg), was determined using the L.D.M. Cotton Seed Attachment Tester of Shirley Developments Ltd., as described by **Fransen *et al* (1984)**.
2. Earliness, expressed as days from planting to the first flower opening.
3. Number of bolls per plant
4. Boll weight (gm).
5. Lint percentage
6. Seed index (gm)
7. Seed cotton yield per plant (gm)
8. Lint cotton yield per plant (gm).

The obtained data were statistically analyzed based on plot means basis. Heterosis was determined as percentage of increase over both mid-parent (MP) and better parent (BP) values of each cross as follows:

Heterosis (%) over mid-parent =
$$[(\overline{F_1} - \overline{MP}) / \overline{MP}] \times 100$$
Heterosis (%) over better-parent =
$$[(\overline{F_1} - \overline{BP}) / \overline{BP}] \times 100$$

General and specific combining ability estimates were obtained by employing **Griffing's (1956)** diallel cross analysis designated as method 2 model 1.

RESULTS AND DISCUSSION

1. Mean performance

Analysis of variance presented in Table (1) indicated that mean squares due to all 28 genotypes, as well as mean squares due to parents and crosses were highly significant for the eight traits studied, revealing the presence of sufficient genetic variability in the population. Also, mean squares of parents vs. crosses as an indication of average heterosis over all crosses were highly significant for all studied traits, except for days to first flowering and lint percentage.

Table 1. Mean squares of fiber - to - seed attachment force, earliness, yield and yield component traits in a seven-parents half diallel cross of cotton.

Source Of Variation	d.f	Fiber to seed attachment cN cm/mg	Days to flowering	Number of bolls/plant	Boll weight (gm)	Lint percentage %	Seed index (gm)	Seed cotton yield/plant (gm)	Lint yield/plant (gm)
Replicates	2	5.25	2.02	0.07	0.01	0.24	0.012	2.83	0.07
Genotypes	27	540.11^{**}	27.95^{**}	22.91^{**}	0.69^{**}	2.66^{**}	0.249^{**}	317.55^{**}	32.19^{**}

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Parents (p)	6	1074.71**	53.75**	17.25**	2.04**	2.16**	0.284**	862.59**	103.36**
crosses (c)	20	336.02**	21.69**	7.19**	0.17**	2.94**	0.212**	167.25**	12.35**
P vs.C	1	1414.31**	2.5	371.09**	2.87**	0.05	0.757**	53.63**	1.92*
Error	54	2.39	1.11	0.18	0.01	0.20	0.016	6.23	0.333

* and ** denote significance at 5% and 1% levels of probability , respectively.

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(Received May 14, 2005)
(Accepted May 23, 2005)

Arab Univ. J. Agric. Sci., Ain Shams Univ., Cairo, 13(3), 741-753, 2005

The mean performance of parents and hybrids for all traits are presented in Table (2). Concerning fiber-to-seed attachment force, Giza 83 showed the least desirable attachment force being 73.0 cN. cm/mg, while the Upland variety Tamcot C.E. exhibited the highest value of 122.0. Within the F_1 hybrids, Pima S_7 x Giza 86 showed the least desirable attachment of 69.33, while Tamcot C.E. x Giza 70 showed the highest value of 108.0 cN. cm/mg. With regard to days to first flower appearance, the Upland variety Tamcot C.E. proved to be the earliest and averaged 60.67 days to first flower, while Giza 77 proved to be the latest one (73.0 days). On the other hand, the F_1 hybrid Tamcot C.E. x Sea Island was the earliest recording 65.67 days to first flower, whereas Pima S_7 x Giza 83 was the latest F_1 with an average of 74.67 days.

Concerning yield and its component traits, The American Upland variety Tamcot C.E possessed the highest desirable values of boll weight (4.80 gm), seed index (10.17 gm), seed cotton yield per plant (94.6 gm) and lint cotton yield per plant (33.73 gm), while Giza 77 attained the lowest values of boll weight (2.33 gm), seed index (9.27 gm), seed cotton yield per plant (47.57 gm) and lint cotton yield per plant (16.83 gm). Regarding number of bolls / plant, Pima S_7 gave the highest number (24.27) while Giza 86 gave the lowest (16.87).

On the other hand, Giza 86 surpassed the other varieties in lint percentage (35.9%) while Pima S_7 gave the lowest (33.53%). The best performing F_1 in number of bolls / plant was Pima S_7 x Giza 70 with a mean of 27.17. bolls while Giza 83 x Giza 77 produced the lowest number (21.9) bolls / plant. Giza 70 x Giza 83 gave the heaviest boll of 3.17 gm, while the lowest weight of 2.3 gm was recorded by Pima S_7 x Sea Island and two other F_1's. Comparing lint % of F_1's revealed that Giza 86 x Giza 83 showed the highest value of 37.07% while Pima S_7 x Sea Island gave least value of 33.63%. Tamcot C.E. x Giza 86 gave the heaviest 100-seed weight of 10.439 gm and Giza 86 x Giza 83 produced the lowest value of 9.33 gm. The best performing F_1 for seed cotton yield was Pima S_7 x Tamcot C.E. giving 83.13 gm per plant, while Tamcot C.E. x Sea. Island gave the highest lint yield of 26.33 gm / plant. On the other hand, Giza 83 x Giza 77 produced the lowest values of seed cotton and lint yields of 49.5 and 18.17 gm / plant, respectively.

II. Expression of heterosis

Analysis of variance presented in Table (1) showed that parents vs. crosses mean squares, as an indication to average heterosis over all hybrids, was highly significant for fiber-to-seed attachment force, number of bolls per plant, boll weight, seed index and both seed cotton and lint yield per plant, indicating that average heterosis overall crosses was existed for these traits, while parents vs. crosses mean squares for days to first flower and lint percentage were

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insignificant, revealing that heterotic effect was not pronounced for both traits.

Mid and better parent heterotic values for all traits are presented in Table (3). Since low fiber-to-seed attachment force, as well as earliness are important objectives for cotton breeders, negative values of heterosis for both traits are desired. As for attachment force, all crosses exhibited significant negative heterosis relative to mid-parents ranging from -2.2% to –

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Table 2. Mean values of fiber-to- seed attachment force, earliness, yield and yield components, for seven parents and their F_1 diallel crosses of cotton

Parents & crosses	Fiber- to- seed attachment cN cm/mg	Days to flowering	Number of bolls/ plant	Boll weight (gm)	Lint percentage%	Seed index (gm)	Seed cotton yield/ plant (gm)	Lint cotton yield/ plant (gm)
(p_1)-PimaS7	88.0	66.33	24.27	2.77	33.53	9.30	66.77	22.43
(p_2)-Tamcot C.E	122.0	60.67	18.10	4.80	34.23	10.17	94.60	33.73
(p_3)-Sea Island	87.0	68.00	20.03	2.67	34.63	9.73	51.00	17.90
(p_4)-Giza 86	89.0	70.33	16.87	2.93	35.90	9.57	49.97	17.93
(p_5)-Giza 70	117.0	71.67	18.50	2.60	33.73	9.63	47.90	18.47
(p_6)-Giza 83	73.0	71.33	18.63	2.73	34.87	9.43	60.30	21.07
(p_7)-Giza 77	77.0	73.00	20.43	2.33	35.33	9.27	47.57	16.83
Mean	93.3	68.76	19.55	2.97	34.60	9.58	59.73	21.19
$P_1 \times P_2$	102.67	66.67	26.40	2.67	34.30	9.70	83.13	23.90
$P_1 \times P_3$	75.33	66.67	25.77	2.30	33.63	10.07	57.40	19.30
$P_1 \times P_4$	69.33	69.67	25.70	2.40	35.10	9.73	61.23	22.13
$P_1 \times P_5$	95.67	69.67	27.17	2.30	34.53	9.87	60.50	20.77
$P_1 \times P_6$	77.00	74.67	25.40	2.33	34.03	9.93	58.93	19.97
$P_1 \times P_7$	74.33	66.33	25.03	2.33	33.70	10.03	57.50	19.37
$P_2 \times P_3$	85.00	65.67	26.87	2.90	33.90	10.37	77.63	26.33
$P_2 \times P_4$	99.00	67.33	23.97	2.73	34.40	10.43	65.77	22.63
$P_2 \times P_5$	108.00	66.67	24.83	2.60	34.10	9.70	65.13	22.20
$P_2 \times P_6$	84.00	66.67	25.47	2.37	34.00	9.80	60.73	20.67
$P_2 \times P_7$	83.00	66.67	23.57	2.93	34.87	9.80	69.00	23.60
$P_3 \times P_4$	80.00	68.67	23.73	2.50	36.70	9.77	59.77	19.90
$P_3 \times P_5$	88.67	72.00	23.97	2.50	33.87	9.87	59.50	20.30
$P_3 \times P_6$	73.00	71.00	23.40	2.53	35.23	9.80	59.37	20.93
$P_3 \times P_7$	78.00	66.67	24.50	2.40	34.30	9.73	59.20	20.17
$P_4 \times P_5$	91.67	68.33	24.77	2.37	34.43	9.73	58.10	19.60
$P_4 \times P_6$	75.33	70.00	23.13	2.30	37.07	9.33	54.10	18.30
$P_4 \times P_7$	77.67	72.67	22.47	2.47	33.77	9.60	56.50	18.37
$P_5 \times P_6$	79.00	72.00	22.23	3.17	35.47	9.47	60.80	20.70
$P_5 \times P_7$	89.00	72.33	22.17	2.77	34.00	9.43	59.17	20.43
$P_6 \times P_7$	73.67	72.00	21.90	2.67	36.23	9.73	49.50	18.17
Mean	83.81	69.16	24.40	2.55	34.65	9.80	61.43	20.84
Average	88.55	68.91	21.93	2.76	34.63	9.69	60.58	21.02
LSD 0.05	2.53	1.72	0.69	0.12	0.73	0.21	4.08	0.94
LSD 0.01	3.37	2.30	0.92	0.16	0.97	0.275	5.44	1.25

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(Received May 14, 2005)
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21.7% for crosses Pima S_7 x Tamcot C.E and Pima S_7 x Giza 86, respectively, only insignificant value-1.8% was found for Giza 83 x Giza 77. Five crosses exhibited lower significant negative attachment force relative to their better parents ranging from -3.5 for Pima S_7 x Giza 77 to -21.2% for Pima S_7 x Giza 86. In this respect, **El-Feki and Abd El-Gelil (2001)** found small and insignificant heterosis for this trait in a diallel cross of cotton. With regard to days to first flower, four hybrids showed negative and significant mid-parent heterosis ranging from -2.65% for Sea Island x Giza 86 to -5.43% for Sea Island x Giza 77. As for better parent heterosis, only Giza 86 x Giza 70 exhibited a significant negative value of -2.8%. **Awad *et al* (1986) and El-Helw (2002)** also found that F_1 hybrids started to flower earlier than their mid and better parents.

With regard to number of bolls per plant positive and highly significant mid parent heterosis were found ranging from 12.0% for Pima S_7 x Giza 77 to 40.9% for Tamcot C.E x Sea Island. The same trend was observed for better parent heterosis which ranged from 3.2% for Pima S_7 x Giza 77 to 36.7% for Tamcot C.E x Giza 83. On the contrary, negative and significant heterosis effects were detected for boll weight relative to either mid or better parents. Only three and two crosses involving the three Egyptian cultivars, namely; Giza 70, Giza 83 and Giza 77 exhibited positive desirable heterosis relative to mid or better parents, respectively. Like boll weight, lint percentage showed undesirable negative heterosis relative to mid and better parents in the majority of F_1's. Only five and three F_1's showed positive and significant heterosis relative to mid and better parents, respectively, being small values but reached the level of significance. Concerning seed index, 12 and 8 heterotic effects relative to both mid and better parents, respectively were in the desired significant positive direction. With regard to seed cotton yield and lint cotton yield per plant, significant positive values were obtained relative to mid parent in 9 F_1's ranging from 6.6% to 23.9% in case of seed cotton yield and from 5.7% to 20.3% for lint cotton yield. The most important desirable positive and significant heterotic values versus better parent were detected in five F_1's which were stable in both seed cotton yield and lint cotton yield. The best F_1 hybrid is Giza 70 x Giza 77 which gave highest heterosis % relative to better parent of 23.5% and 19.3% for seed cotton yield and lint cotton yield per plant, respectively. Similar findings were reported by **El-Gohary *et al* (1981); El-Kilany & El-Mazar (1985); Singh *et al* (1987); Hendawy (1994); Soomro *et al* (1995) and El-Helw (2002)** who found positive and significant heterosis for yield and its components in some of their crosses.

III. Combining ability

Partitioning of genetic variance into general combining ability (GCA) and specific combining ability (SCA) shown in Table (4) revealed that both GCA and SCA were significant for days to first flower and highly significant for fiber-to-seed attachment force, number of bolls per plant, boll weight, lint percentage, seed index and both seed cotton and lint cotton yields / plant. This would indicate the importance of both additive and non-additive genetic variances in the inheritance of these characters. The GCA/SCA

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Table 4. Mean squares for general (GCA) and specific combining ability (SCA) in a half diallel cross of cotton

Source of variation	d.f	Fiber to seed attachment cN cm/mg	Days to flowering	Number of bolls/ plant	Boll weight (gm.)	Lint percentage %	Seed index (gm)	Seed cotton yield/ plant (gm)	Lint cotton yield/ plant (gm)
G.C.A	6	646.82**	29.69*	9.23**	0.482**	1.89**	0.160**	370.87**	36.39**
S.C.A	21	46.67**	3.50*	7.18**	0.164**	0.60**	0.060	30.13**	3.40**
Error	24	0.80	0.37	0.06	0.002	0.07	0.005	2.08	0.11
G.C.A / S.C.A		13.86	8.48	1.29	2.82	3.15	2.67	12.31	10.70

*, **: denote significant at 0.05 and 0.01% levels of probability, respectively

ratio was calculated to clarify the nature of the genetic variance involved and to determined the relative importance of both genetic portions. The GCA/SCA ratio was found to be greater than unity in all traits, indicating that additive and additive x additive types of gene action were of greater importance in the inheritance of these traits. Therefore, it could be concluded that selection procedures based on the accumulation of additive effect would be very successful in improving all traits studied. These results are in general agreement with those obtained by **El-Banna (1987); Meredith (1990); El-Feki & Abd El-Gelil (2001) and Ismail *et al* (2005).**

Estimates of general combining ability effects (gi) for individual parental varieties evaluated in F_1 crosses are presented in Table (5). Negative and significant GCA values are desirable in the case of fiber-to-seed attachment force and days to first flower opening, while positive and significant GCA values for yield and its components would be useful from the breeder's point of view. Giza 83 proved to be the best general combiner for fiber-to-seed attachment force followed by Giza 77, while low negative and highly significant GCA effects were detected for Sea Island, Pima S_7 and Giza 86.

With regard to earliness character, the Upland variety Tamcot C.E proved to be the best combiner for this trait, while the two exotic varieties Pima S_7 and Sea Island exhibited low negative but highly significant values for earliness. With regard to yield and its components, Pima S_7 recorded the highest significant positive effects of GCA followed by Sea Island for number of boll per plant. Among the seven parents studied, only

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Tamcot C.E could be considered the good combiner for boll weight. The three varieties Giza 86, Giza 83 and Giza 70 showed highly significant positive GCA effects for lint percentage. Both Tamcot C.E and Sea Island proved to be good combiners for seed index. Concerning seed cotton yield and lint yield per plant, the variety

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Table 5. Estimates of general combining ability effects for each parent from a half diallel cross of cotton

Parents	Fiber- to seed attachment cN cm/mg	Days to flowering	Number of bolls/ plant	Boll weight (gm)	Lint percent age %	Seed index (gm)	Seed cotton yield/ plant (gm)	Lint cotton yield/ plant (gm)
(P_1)-Pima S_7	-2.12**	-0.68**	2.06**	-0.15**	-0.53**	-0.007	2.50**	0.32**
(P_2)-Tamcot C.E	12.9**	-3.50**	0.20	0.51**	-0.34**	0.237**	13.52**	4.37**
(P_3)-Sea Island	-3.86**	-0.65**	0.31**	-0.09**	-0.02	0.119**	-1.56**	-0.52**
(P_4)-Giza86	-1.97**	0.54**	-0.89**	-0.07**	0.68**	-0.03	-3.72**	-1.18**
(P_5)-Giza70	10.73**	1.32**	-0.37**	-0.04**	0.36**	-0.074**	-3.32**	-0.72**
(P_6)-Giza83	-9.05**	1.84**	-0.75**	-0.05**	0.52**	-0.119**	-2.76**	-0.73
(P_7)-Giza77	-6.64**	1.13**	-0.56**	-0.11**	0.05	-0.126**	-4.76**	-1.52**
SE (gi)	0.28	0.19	0.08	0.01	0.08	0.023	0.44	0.10
SE (gi-gj)	0.42	0.29	0.12	0.02	0.12	0.040	0.68	0.16

*, **: denote significant at 0.05 and 0.01% levels of probability, respectively

Tamcot C.E followed by Pima S_7 proved to be good general combiners for both traits.

The effects of specific combining ability (Si) for the parental combinations in F_1 crosses are given in Table (6). Out of the 21 F_1's studied, 9 crosses exhibited highly significant negative SCA effects for fiber-to-seed attachment force. The highest negative SCA effects for this trait were given by Pima S_7 x Giza 86, Tamcot C.E. x Giza 77 and Giza 70 x Giza 83. Each of the three crosses contained at least one good combiner parent. Five F_1's showed significant negative SCA effects for days to first flower. The highest value was detected by Pima S_7 x Giza 77 and Sea Island x Giza 77. The two crosses involved the two good combiners; Pima S_7 and Sea Island for earliness. With regard to number of bolls / plant 15 F_1's showed highly significant positive SCA effects, however, the cross Tamcot C.E x Sea Island gave the highest positive SCA effect. With respect to boll weight, only two crosses; Giza 70 x Giza 77 and Giza 83 x Giza 77 showed highly significant positive SCA effects. For lint percentage, seven F_1s showed significant positive SCA effects with Sea Island x Giza 86 being the highest. Also, seven F_1's showed significant positive SCA values, with Tamcot C.E x Giza 86 being the highest. Concerning seed cotton yield, 10 F_1's exhibited significant positive SCA effects, the two F_1's Giza 70 x Giza 77

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followed by Pima S_7 x Tamcot C.E exhibited the highest effects. With respect to lint yield, 9 F_1's showed significant positive SCA values with Pima S_7 x Giza 86 being the highest.

The results obtained herein concerning GCA and SCA effects could indicate that most of the desirable hybrid

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(Accepted May 23, 2005)

Arab Univ. J. Agric. Sci., Ain Shams Univ., Cairo, 13(3), 741-753, 2005

Table 6. Estimates of specific combining ability effect from a seven parent diallel cross of cotton

Crosses	Fiber-to-seed attachment cN. cm/mg	Days to flowering	No. of bolls/ Plant	Boll weight (gm.)	Lint percentage %	Seed index (gm)	Seed cotton yield/ plant (gm)	Lint cotton yield/ plant (gm)
$P_1 \times P_2$	5.69**	1.79**	0.96**	-0.34**	0.53**	-0.28**	5.90**	-1.72**
$P_1 \times P_3$	-4.86**	-1.06*	0.21	-0.12**	-0.46**	0.21**	-4.75**	-1.42**
$P_1 \times P_4$	-12.75**	0.75	1.35**	-0.03	0.30	0.02	1.25	2.07**
$P_1 \times P_5$	0.88	-0.03	2.30**	-0.16**	0.78**	0.20**	0.11	0.24
$P_1 \times P_6$	1.99**	4.45**	0.90**	-0.12**	-0.60*	0.31**	-2.01	-0.55*
$P_1 \times P_7$	-3.08**	-3.18**	0.35	-0.06**	-0.46*	0.42**	-1.44	-0.36
$P_2 \times P_3$	10.23**	0.75	3.17**	-0.18**	-0.37	0.26**	4.56**	1.55**
$P_2 \times P_4$	1.88**	1.23*	1.47**	-0.36**	-0.58**	0.47**	-5.15**	-1.49**
$P_2 \times P_5$	-1.82**	-0.21	1.82**	-0.52**	0.16	-0.21**	-6.18**	-2.38**
$P_2 \times P_6$	-6.05**	-0.73	2.82**	-0.75**	-0.81**	-0.07	-11.14**	-3.90**
$P_2 \times P_7$	-9.45**	-0.03	0.74**	-0.12**	0.52*	-0.06	-0.87	-0.18
$P_3 \times P_4$	0.32	-0.29	1.12**	-0.01	1.40**	-0.07	3.93**	0.68**
$P_3 \times P_5$	-4.38**	2.27**	0.84**	-0.03	-0.39	0.07	3.27**	0.62*
$P_3 \times P_6$	-0.27	0.75	0.65	0.01	0.10	0.05	2.57*	1.26**
$P_3 \times P_7$	2.32**	-2.87**	1.56**	-0.06	-0.36	-0.01	4.41**	1.28**
$P_4 \times P_5$	-3.27**	-2.58**	2.84**	-0.18**	-0.53*	0.09	4.03**	0.58*
$P_4 \times P_6$	0.18	-1.43**	1.58**	-0.24**	1.22**	-0.27**	-0.53	-0.72**
$P_4 \times P_7$	0.10	1.93**	0.72**	-0.01	-1.60**	0.01	3.87**	0.14
$P_5 \times P_6$	-8.86**	-0.21	0.16	0.60	0.67**	-0.09	5.77**	1.23**
$P_5 \times P_7$	-1.27	0.82	-0.09	0.26**	-0.33	-0.12*	6.14**	1.75**
$P_6 \times P_7$	3.18**	-0.03	0.01	0.17**	1.03**	0.23**	-4.09**	-0.51*
SE(SIJ)	0.68	0.46	0.19	0.03	0.23	0.06	1.10	0.25
SE(SIJ-S1K)	1.19	0.81	0.33	0.06	0.34	0.10	1.92	0.44

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(Received May 14, 2005)
(Accepted May 23, 2005)

*, **: denote significant at 0.05 and 0.01% levels of probability, respectively
P_1= Pima S_7 - P_2 = Tamcot C.E – P_3 = Sea Island – P_4 = Giza86 – P_5 = Giza70 – P_6 = Giza83 – P_7 = Giza77.

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combinations were obtained from crossing high x high, high x low or low x low general combiners, suggesting that GCA effects of the parental varieties were generally unrelated to the specific combining ability effects of their respective crosses. These results are generally in agreement with those obtained by **El-Banna (1987); Meredith (1990); Tang *et al* (1993); Hendawy (1994); Nadeem *et al* (1998) and Ismail *et al* (2005).**

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قوة الهجين والقدرة على الائتلاف لقوة تماسك الشعر بالبذرة والتبكير والمحصول ومكوناته في أحد هجن القطن الدائرية

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أجري هذا البحث بمحطة بحوث الجيزة الـ موسمي 2000 ، 2001 لدراسة قوة الهجين والقدرة على الائتلاف لهجن الدائرية بين سبعة أصناف من القطن أربعة أصناف محلية هي جيزة 70، جيزة 83 (طويلة) ، جيزة 86 وجيزة 77 (فائقة الطول) ، Sea Island ، التيلة (ثلاثة أصناف أجنبية

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القطن التابعة لـ Tamcot C.E وصنف Pima S7، الأبوين الأمريكيين تحمل كافة الهجن التبادلية 21 للحصول على ... بدون هجين فردي وقد قيم الآباء والهجن من حيث الصفات التبكير وتبات البذرة ... متانة الشعر مقدرة من التبكير – الزهر عدد اللوز على النبات ومعامل الشعر ونسبة التيلة والوزن البذرة ومحصول النبات من القطن الزهر أو الشعر.

وفي أهم النتائج

1- كان التباين الوراثي عالي لكل التراكيب الوراثية الأبوية وهجنها الفردية لمعظم الصفات.

2- كانت معظم الهجن أفضل من الآباء في صفة متانة الشعر بالنسبة للبذرة وتفوق ... على ... في معظم الهجن مقارنة بمتوسط الآباء والمرغوب ... كما كانت الأفضل ... في متوسط معظم الهجن لصفات محصول ومكوناته.

3- أظهرت نتائج تحليل القدرة العامة والخاصة على الائتلاف أن ... للفعل الجيني المضيف ... أهمية في وراثة الصفات المدروسة.

4- كانت النسبة بين التباين القدرة العامة والخاصة على الائتلاف أعلى من الواحد لمعظم الصفات.

5- كان الصنف الأمريكي طويل التيلة Tamcot C.E من أحسن الأصناف في القدرة العامة على الائتلاف لصفات التبكير ووزن اللوزة ومعامل البذرة ومحصول النبات من كل القطن الزهر والشعر وأظهر الصنف جيزا 83 قدرة ائتلافية عالية لنقاوة الخف ومتانة الشعر والبذرة. أما صنف جيزا 86 فأظهر قدرة ائتلافية عالية لصفات نسبة التيلة وطول الشعر النسبي والصنف Sea Island والصنف Pima S7 فأظهرا قدرة ائتلافية عالية لصفة عدد اللوز على النبات. مما يشير إلى أهمية استخدام كل الأصناف الآباء في برامج التربية لتحسين هذه الصفات في القطن.

6- على عكس ما سبق فقد أمكن تحديد بعض الهجن التي تميزت بكفاءة عالية في تحسين الأصناف ... هذه الهجن بقدرة عالية على الائتلاف الخاص على ... واحد على الأقل ... مما يزيد من فرص الحصول على بعض الطرز المتميزة للصفة المدروسة.

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(Received May 14, 2005)
(Accepted May 23, 2005)