ISSN 1110-0419

Annals Of Agric. Sc., Moshtohor,
Vol. 46(1): Ag. 45-53, (2008).

COMBINING ABILITY AND HETEROSIS IN SOME TOP CROSSES OF SOYBEAN [*Glycine max* L. Merrill]

BY

El-Garhy, A.M.; Shaaban, M.; Ola A.El-Galaly,; Omran, M.M.; El-Harty, E.H. and Ragheb, S.B.
Food legumes, Res. Sec., Field Crops Res. Inst., ARC.

ABSTRACT

Four lines or varieties of soybean were top crosses to each of the three different genetic base testers, PI416937, Huch and Giza 83. All entries were grown in a randomized complete block design with three replications. The data under investigation were; number of days to flowering, number of days to maturity, maturity period, plant height, number of branches per plant, number of pods per plant, number of seeds per pod, number of seeds per plant, 100-seed weight and seed yield per plant. Significant mean squares due to males x females were detected for all the studied traits. Relative estimates of the variance due to general combining ability (σ^2GCA) and specific combining ability (σ^2SCA) indicated that (σ^2SCA) was the dominance component for all traits except number of days to flowering and number of days to maturity.

The parental line PI416937 (male) gave the highest positive ($\hat{g}_i$) effect among all over the testers under tested for plant height, number of pods per plant, and number of seeds per plant, it was the second for number of branches per plant and seed yield per plant.

The female variety Giza 111 behaved as good a combiner for seed yield per plant, 100-seed weight, number of seeds per plot, number of pods per plant, number of branches and plant height.

Significant positive SCA effects were detected for seed yield per plant in the four top crosses PI416937 Giza 111, Huch x H154Z, Giza 83 x Giza 111 and Giza 83 x Giza 83 X H47ZL$_2$.

The desirable heterotic effects were detected by 12 crosses for seed yield per plant.

All crosses showed highly significant positive heterotic effects relative to the mid parent for yield and its components.

Key words: Top cross, heterosis, specific and general combining ability, soybean.

INTRODUCTION

Soybean [*Glycine max* L. Merrill] is an important legume crop that was introduced into Egypt in the 1970 and gained local interest since then. Soybean has high nutritive value for both human and livestock. The combining ability analysis gives very useful information with regard to selection of parents based on the performance of their hybrids for the development of hybrids. Moreover, this analysis helps the breeder to identify the best combiners which may be hybridized either to exploit heterosis or two build up the favorable fixable genes. With regard to combining ability effects several authors found the significance of both general and specific combining ability effects for important agronomic traits, yield and its component. The performance of F1 hybrids in comparison with that of the parents provides the first opportunity in the sequence of events in hybrid populations to obtain information of gene action. Heterosis effects ranged from significantly positive to significantly negative values. These differentces in percent heterosis might be due to genetic differences of the parents used and or non-allelic interactions which can either increase or decrease the expression of heterosis Ma *et al.* (1983), Kunta *et al.* (1985), Cruz *et al.* (1987), El-Hosary *et al.* (1994), Bastawisy *et al.* (1997) and Mansour *et al.* (1983).

The objective of this study were: i) to determine the magnitude of heterosis for earliness, yield and its components and ii) to estimate the relative importance of general combining ability GCA and specific combining ability SCA in set of top crosses involving new local varieties and exotic parental strains.

MATERIALS AND METHODS

Four lines of soybean were crossed to each of three different male testers. The female lines were N92-8231, Giza 111, H154Z and H47ZL$_2$.

The male testers were PI416937, Huch and Giza 83. Table (1) demonstrates a brief description of these genotypes, i.e. maturity group, growth habit, flower color and origin.

Table (1): Maturity group, country of origin, growth habit and flower color of the studied soybean cultivars.

Cultivar	Maturity group	Country of Origin	Growth habit	Flower color
Testers				
PI416937	V	United states	Determinate	Purple
Huch	VI	United states	Indeterminate	White
Giza 83	I	Egypt	Indeterminate	White
Lines				
N92-8231	I	United states	Indeterminate	Purple
Giza 111	IV	Egypt	Indeterminate	Purple
H154Z	VI	Egypt	Indeterminate	Purple
H47ZL$_2$	V	Egypt	Indeterminate	Purple

In 2006 season, 12 top crosses were made at Ety El-Baroud Agricultural Research Station. In the following season 2007, seven parental lines and 12 top crosses were evaluated in a randomized complete block design with three replications. Each plot consisted of three ridges of 3 m length and 60 cm width. Hills were spaced 20 cm with one seed per hill in one side of the ridge.

Flowering time (in days) was recorded at 50% flowering of plants, maturity time (in days) was recorded at 95% pod maturity and maturity period (in days) At harvest, ten guarded plants were taken at random from each experimental plot to provide measurements for the following characteristics; plant height, number of branches per plant, number of pods per plant, number of seeds per pod, number of seeds per plant, 100-seed weight and seed yield per plant.

Combining ability analysis was conduced based on the procedure developed by Kempthorne (1957). This method was described in detail (Line x tester analysis) by Sing and Choulhary (1976). Heterosis effects were computed as the percentage deviation of F$_1$ mean performance from its mid and better parent.

RESULTS AND DISCUSSION

The analysis of variance in Table (2) showed that mean squares due to genotypes, parents and crosses were significant for all the studied character indicating the extance of genetic diversity in the material selection for this study.

F_1 means were significantly higher than parental means for all traits. Also, mean squares due to males and females were significant for all the studied traits, indicating greatest diversity among males interaction were obtained indicating that females did not express identical orders of ranking for the performance of their crosses with each tester.

The estimates of the variance due to general combining ability (σ^2GCA) and specific combining ability (σ^2SCA) presented in Table (2) showed that (σ^2SCA) laid a major contribution in the inheritance for all traits except number of days to flowering and number of days to maturity indicating that non-additive type of gene action was involved in determining the performance of top crosses progenies. These results support the findings of Cruz *et al.* (1987, Harer and Deshmukh (1991), El-Hosary *et al.* (1997) and Mansour *et al.* (2003).

Estimates of GCA effects ($\hat{g}_i$) for individual testers "males" and lines "females" in each trait are presented in Table (3). High positive values except flowering and maturity dates would be of interest under all the traits in question. The tester PI416937 gave the highest positive ($\hat{g}_i$) effect among all over the testers under test for plant height, number of pods per plant, number of seeds per plant and it was the second for seed yield per plant.

Therefore, the tester's (Huch) could be considered as an excellent tester for breeding number of branches per plant and seed yield per plant. While the tester 3 (Giza 83) expressed significant positive ($\hat{g}_i$) effects for number of seeds per plant and 100-seed weight and it was gave the lowest negative ($\hat{g}_i$) effect than other testers for number of days to flowering, number of days to maturity and maturity period.

The female lines Giza 111 and H154Z behaved as good combiners for plant height, number of branches per plant, number of pods per plant and number of seeds per plant. Also, the female line H154Z seemed to be the best combiner for seed weight and seed yield per plant. Female line N92-8231 gave a significant negative value of ($\hat{g}_i$) effects for earliness and it expressed significant positive ($\hat{g}_i$) effects for 100-seed weight and seed yield per plant. These results suggested that a greater opportunity for selection would be possible for yield and its components.

Specific combining ability effects of the top crosses were computed for all the studied traits Table (4). The desirable inter- and intra-allelic interactions were represented by two top crosses: PI416937x Giza 111 and Giza 83 x N92-8231 for number of days to maturity by three top crosses; PI416937 x Giza 111, PI416937 x $H47ZL_2$, and Giza 83 x $H47ZL_4$ for plant height, by two top crosses PI416937 x $H47ZL_2$ and Giza 83 x $H47ZL_2$ for number of branches per plant; by five top crosses PI416937 x Giza 111, PI416937 x $H47ZL_2$, Huch x H154Z, Giza83xGiza 111 and Giza 83 x $H47ZL_2$ for number of pods per plant, by two top crosses PI416937 x N92-8231 and Giza 83 x $H47ZL_2$ for number of seeds per pod; PI416937 and Giza 83 x $H47ZL_2$; by three top crosses PI416937 x Giza 111,

Huch x H154Z and Giza 83 x $H47ZL_2$ for number of seeds per plant by five crosses PI416937 x N92-8231, PI416937 x $H472L_2$, Huch x $H47ZL_2$, Giza 83 x N92-8231and Giza 83 x Giza 111 for 100-seed weight and by four top crosses PI416937 x Giza 111, Huch x $H47ZL_2$, Giza 83 x Giza 111, and Giza 83 x H154z2 for seed yield per plant. Three top crosses might be of interest in breeding programs to produce pure lines as most of them involve at least one good combiner for the trait in view. Similar results were obtained by El-Hosary *et al.* (1994), Bastawisy *et al.* (1997) and Mansour *et al.* (2002 and 2003).

Table (2): Analysis of variance for all traits studied.

S.O.V. \ Traits	d.f	No. of days to flowering	No. of days to maturity	Maturity period	Plant height (cm)	No. of branches/ plant	No. of pods/ plant	No. of seeds/ pod	100-seed weight (g)	Seed yield/ plant (g)	No. of seeds/ plant
Replication	2	1.39	0.54	8.21	3.80*	0.00	69.57**	0.004	0.002	3.092	92.4*
Genotypes	18	187.53**	551.97**	103.94**	947.55**	2.77**	8746.73**	0.062**	4.444**	954.22**	64734.16**
Parent	6	322.32**	932.50**	145.00**	1385.21**	2.16**	1573.73**	0.080**	6.760*	346.812**	1397.00**
Crosses	11	129.09**	390.50**	88.08**	656.55**	1.51**	2887.73**	0.023**	3.167**	324.42**	17892.00**
P. Vs. Cr	1	21.52**	46.73**	32.09**	1522.57**	20.28**	116229.32**	0.375**	4.603**	11526.46**	188.29
Male	2	380.33**	1092.36**	226.03**	632.86**	4.16**	6058.80**	0.021*	0.739**	394.73**	28245**
Female	3	210.99**	644.54**	120.10**	1650.99**	1.46**	2283.37**	0.033**	6.925**	705.25**	19958**
Male x female	6	4.41**	29.21**	26.10**	167.23**	0.66**	3132.88**	0.019	2.092**	110.57**	13407**
Error	36	1.20	1.14	5.47	0.98	0.05	7.15	0.006	0.027	1.686	18.29
Estimates											
σ^2 GCA		5.38	15.58	2.67	21.11	0.04	32.56	0.000	0.046	9.225	193.43
σ^2 SCA		1.07	9.36	6.88	55.41	0.20	708.59	0.0043	0.690	36.234	4406.24

Table (3): General combining ability effect for all characters studied.

S.O.V. \ Traits	No. of days to flowering	No. of days to maturity	Maturity period	Plant height (cm)	No. of branches/ plant	No. of pods/ plant	No. of seeds/ pod	100-seed weight (g)	Seed yield/ plant (g)	No. of seeds/ plant
Tester										
PI416937	3.333**	3.056**	-0.2778	8.336**	0.116	17.975**	-0.0411**	-0.2686**	3.111**	35.207**
Huch	3.166**	7.6389**	4.472	-3.381	0.522**	7.217**	-0.0011	0.0481	3.508**	20.134**
Giza 83	-6.500**	-10.6944**	-4.194**	-4.956**	-0.638**	-25.192**	0.0422*	0.221**	-6.618**	-55.34**
L.S.D. (gi) 5% tester	**0.642**	**0.624**	**1.370**	**0.581**	**0.127**	**1.566**	**0.0408**	**0.0954**	**0.768**	**8.041**
L.S.D. (gi) 1% tester	**0.861**	**0.838**	**1.838**	**0.781**	**0.170**	**2.102**	**0.0615**	**0.128**	**1.021**	**10.79**
Female										
N92-823	-6.0278**	-11.027**	-5.00**	-9.769**	-0.1978**	-4.942**	0.0611*	0.5692**	3.604**	1.5081
Giza 1...	-1.8056**	-2.250**	-0.444	2.031**	0.2867**	19.158**	-0.010	0.7547**	10.311**	46.113**
H1547	3.750**	6.528**	2.778**	18.37**	0.3811**	4.481**	0.0289	-1.181**	-3.878**	17.361**
H47...	4.083**	6.750**	2.667**	-10.636*	-0.470**	-18.697**	-0.080**	-0.1431*	-10.0369**	-64.982
L.S.D. (gi) 5% lines	**0.737**	**0.721**	**1.583**	**0.671**	**0.1467**	**1.809**	**0.053**	**0.1110**	**0.878**	**9.285**
L.S.D. (gi) 1% lines	**0.995**	**0.967**	**2.124**	**0.828**	**0.1969**	**2.427**	**0.071**	**0.147**	**1.178**	**12.459**

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

The mean performance of the 19 genotypes is given in Table (5). Wide variations between parents and between their F_1 crosses were observed for all the studied traits. These variations might be primarily attributed to genetic diversity among parents for all studied traits. The parental line N92-8231 behaved as the earliest for number of days to flowering, number of days to maturity and maturity period and it gave high value for 100-seed weight. The parental variety Giza 111 gave the highest value for number of pods per plant, number of seeds per plant and seed yield per plant.

However, the parental line H154Z gave the highest values for number of branches per plant and plant height and it gave the lowest values for number of days to flowering, number of days to maturity and maturity period. Also, the top crosses were within the range of parental lines or testers for all traits except number of branches per plant, number of pods per plant, number of seeds per pod, number of seeds per plant, 100-seed weight and seed yield perplant.

The obtained results indicated that top cross (Giza 83 x N92-8231) gave the highest value for plant height and it had earliest for number of days to flowering, number of days to maturity and maturity period.

Also, for number of branches per plant, the top crosses were within the range of parental lines or testers except top crosses PI416937 x Giza 111, Huch x N92-8231, Huch x Giza 111, Huch x H154Z and Giza 83 x H154Z, which were characterized by its high stature. The top crosses PI416937 x N92-8231, PI416937 x Giza 111, Huch x N92-8231, Huch x Giza 111 and Giza 83 x Giza 111 gave the high significant values for number of pods per plant, number of seeds per plant and seed yield per plant

Heterosis values measured of top crosses from mid-parent are presented in Table (6).

For number of days to flowering; three top crosses exceeded significantly negative heterotic effects. The cross Giza 83 x H154Z gave the lowest heterosis for this trait.

For number of days to maturity, the four top crosses expressed significant negative heterotic effects. The top crosses PI416937 x H154Z and Giza 83 x H154Z gave the lowest heterosis for this trait.

For maturity period two crosses Huch x N92-8231 and Giza 83 x H154Z exhibited significantly negative heterotic effect. For plant height ten crosses expressed significantly positive heterotic effects relative to mid-parent. It was clear that the top cross Huch x N92-8231 gave the highest heterosis for this trait.

Concerning number of branches per plant twelve top crosses showed significant positive heterotic effects relative to mid-parent.

For number of pods per plant eleven top crosses exhibited significantly positive heterotic effects relative to mid parent. The best top crosses Huch x N92-8231, PI416937 x H154Z and PI416937 x H47Z for this trait.

Considering number of seeds per pod ten top crosses showed significant positive heterotic effects relative to mid parent. The highest heterotic effect for this trait was detected in top crosses PI416937 x N92-8231, Giza 83 x N92-8231and Giza 83 x $H47ZL_2$.

Regarding 100-seed weight eight top crosses showed significant positive heterotic effect relative to mid parent. The best top crosses Giza 83xN92-8231 and Giza 83x $H47zL_2$ were detected for this trait.

Concerning seed yield per plant all top crosses showed significant positive heterotic effects relative to mid-parent. The top cross Giza 83 x H154Z showed significant positive for yield and its components. Also, it gave significant negative for earliness traits. Similar results were obtained by Weber *et al.* (1970), Paschal and Wilcox (1975), Halvankar and Patil (1992), Bastawisy *et al.* (1997), Habeeb (1998) and Mansour *et al.* (2002). The

Table ([illegible]): Specific combining ability effects for all the studied traits.

Crosses \ Traits	No. of days to flowering	No. of days to maturity	Maturity period	Plant height (cm)	No. of branches/ plant	No. of pods/ plant	No. of seeds/ pod	100-seed weight (g)	Seed yield/ plant (g)	No. of seeds/ plant
PI416937 X N92-8231	0.1111	2.2778**	2.166	-9.0139**	-0.0272	-37.04**	0.0988*	0.4275**	-5.418**	-74.15**
PI416937 X Giza 111	-0.3888	-2.9722**	-2.583	8.469**	0.2003	39.38**	0.00889	-0.2392*	10.087**	103.51**
PI416937 X H154Z	0.27778	0.6944	0.4166	0.5444	-0.1731	-2.342	-0.1078*	-0.188	-4.669**	-29.36**
PI416937 X H47ZL$_2$	-1.1111	-0.8333	0.2773	10.153**	0.4883**	3.958**	0.040	0.2986**	0.725	0.5608
Huch X N92-8231	1.0556	-1.4167*	-2.472	-5.731**	-0.0925	-6.38**	0.01662	-0.05806	-0.983	-13.453
Huch X Giza 111	0.05556	2.250**	2.194	-4.422**	-0.391**	2.425	0.0233	-0.24058*	0.2575	12.892
Huch X H154Z	1.000	-1.611*	-2.611	0.942	-0.5061**	24.303**	0.0011	-1.4225**	1.913*	63.722**
Huch X H47ZL$_2$	0.5000	4.805**	4.305**	-0.808	-0.2086	-19.605**	0.000778	0.70083**	-3.3469**	-49.548**
Giza 83 X N92-8231	-1.5000*	-3.1949**	-1.6944	-0.1333	0.7147**	-4.692**	0.0089	0.7217**	1.4351	-14.17
Giza 83 X Giza 111	0.0000	0.1667	0.1662	-2.081**	0.045	8.781**	-0.0600	0.6964**	2.779**	9.865
Giza 83 X H154Z	-1.1667	-0.4166	0.750	-1.931*	0.1058	-13.34**	-0.0333	-0.40306**	-5.758**	-40.51**
Giza 83 X H47ZL$_2$	1.16662	0.2500	-0.4167	4.0111**	-0.151	4.614**	0.0933*	-0.2927**	2.978**	30.644**
L.S.D. (Sij) 5%	1.284	1.249	2.741	1.163	0.254	3.134	0.0919	0.1908	1.521	16.08
L.S.D. (Sij) 1%	1.723	1.676	3.678	1.560	0.341	3.133	0.1234	0.2560	2.042	21.158
L.S.D. (gi-gj) 5%	1.816	1.766	3.826	1.644	0.359	5.947	0.129	0.269	2.15	22.74
L.S.D. (gi-gj) 1%	2.437	2.370	5.163	2.206	0.482	5.977	0.174	0.362	2.880	30.52

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

Table (5): The genotypes mean performance for the studied traits.

Genotypes \ Traits	No. of days to flowering	No. of days to maturity	Maturity period	Plant height (cm)	No. of branches/ plant	No. of pods/ plant	No. of seeds/ pod	100-seed weight (g)	Seed yield/ plant (g)	No. of seeds/ plant
T_1 PI416937	49.67	130.00	80.33	68.92	4.02	124.47	2.16	13.16	39.22	269.02
T_2 Huch	48.67	144.00	95.33	45.51	4.88	123.53	2.30	11.91	90.85	284.12
T_3 Giza 83	30.00	104.67	78.0	64.32	3.27	114.94	2.50	12.50	40.40	287.27
L_1 N92-8231	29.67	100.67	78.33	53.90	2.98	112.80	2.50	13.43	39.73	282.19
L_2 Giza 111	38.67	119.33	80.62	92.20	3.97	168.07	2.52	13.03	64.43	423.59
L_3 H154Z	55.00	145.0	90.0	107.5	4.98	141.03	2.54	9.03	38.45	359.0
L_4 H47ZL$_2$	50.67	140.67	90.0	73.90	2.97	96.90	2.20	12.20	29.29	231.14
PI416937 X N92-8231	39.33	119.33	80.0	72.60	5.00	195.57	2.68	13.49	72.55	523.45
PI416937 X Giza 111	42.33	125.0	82.67	103.57	6.00	260.67	2.47	13.55	85.40	642.76
PI416937 X H154Z	50.00	133.0	83.0	110.70	5.100	266.37	2.55	9.89	72.40	677.17
PI416937 X H47ZL$_2$	49.33	135.0	85.67	78.67	4.80	227.63	2.38	13.05	67.11	540.97
Huch X N92-8231	38.67	118.67	80.0	78.37	5.63	261.23	2.63	13.14	88.45	686.03
Huch X Giza 111	44.33	129.0	84.67	75.97	5.82	239.57	2.56	13.51	84.09	613.67
Huch X H154Z	49.33	144.0	94.62	97.23	5.80	211.67	2.59	12.33	67.54	548.83
Huch X H47ZL$_2$	48.00	139.0	91.0	67.10	5.27	194.70	2.44	12.22	58.97	475.52
Giza 83 X N92-8231	29.67	104.0	74.33	68.82	4.10	187.1	2.55	13.37	63.57	477.68
Giza 83 X Giza 111	33.62	114.33	80.62	75.70	4.37	215.95	2.61	13.50	75.70	564.54
Giza 83 X H154Z	37.67	117.67	80.00	96.33	5.52	194.17	2.62	12.53	62.19	508.73
Giza 83 X H47ZL$_2$	40.67	121.33	80.67	71.47	3.85	180.30	2.61	12.55	57.58	471.20
LSD 5%	2.22	1.766	3.876	1.644	0.359	4.43	0.128	0.355	5.034	22.74
LSD 1%	2.98	2.37	5.201	2.021	0.482	5.94	0.172	0.477	6.755	30.51

Table (6): Percentage of heterosis effects relative to mid parent for all studied traits.

Crosses \ Traits	No. of days to flowering	No. of days to maturity	Maturity period	Plant height (cm)	No. of branches/ plant	No. of pods/ plant	No. of seeds/ pod	100-seed weight (g)	Seed yield/ plant (g)	No. of seeds/ plant
PI416937 X N92-8231	-0.851	1.70*	0.84	18.22**	42.04**	64.85**	15.02**	1.46	83.67**	89.92*
PI416937 X Giza 111	-4.165*	0.268	2.69	28.56**	49.25**	78.21**	5.555*	3.47*	64.70**	85.59**
PI416937 X H154Z	-4.462*	-3.27**	0.593	25.46**	12.70**	100.62**	8.5**	-10.74**	86.30**	115.6**
PI416937 X H47ZL$_2$	-1.67	-0.247	1.335	10.16**	36.36**	105.65**	9.17**	7.88*	95.77**	124.32**
Huch X N92-8231	-1.276	4.556**	-7.867**	57.62*	43.44**	121.15**	9.58**	3.71*	119.53**	142.25**
Huch X Giza 111	1.51	-2.024**	-3.78	10.33**	31.52**	64.28**	6.22*	8.34**	59.79**	73.34**
Huch X H154Z	-4.83	-0.346	2.163	27.0**	17.64**	60.01**	7.02*	17.93**	70.34**	70.79**
Huch X H47ZL$_2$	-3.36	-2.329*	-1.79	12.38**	34.26**	76.62**	8.44**	1.78	68.15**	91.23**
Giza 83 X N92-8231	-0.553	-0.640	-4.906	16.46**	31.41**	64.31**	20.0**	3.125*	58.66**	67.78**
Giza 83 X Giza 111	-1.93	2.08*	1.682	-3.29**	20.72**	52.47**	3.98	5.75**	43.47*	58.83**
Giza 83 X H154Z	-11.36**	-5.76**	-4.76*	12.08**	35.03**	51.72**	3.99	16.55**	57.74**	57.43**
Giza 83 X H47ZL$_2$	0.831	-1.090	-3.96	-6.89**	23.33**	-29.92**	11.06**	1.619	65.25**	88.30**

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

top crosses Huch x N92-8231, PI416937 x $H47ZL_2$ and PI416937 x HI54Z showed almost the more pronounced heterotic effect for yield and its components. The relatively large magnitude observed in seed yield per plant of heterosis in most top-crosses might have resulted from heterosis in one or more of its components. It worth-mentioning that heterosis in seed yield per plant was largely manifested in hybrids showing pronounced heterosis in number of pods per plant. Hence, it could be concluded that the previous top crosses offer possibility for improving seed yield in soybean. These findings revealed that a hybrid program based on these materials would be useful.

REFERENCES

Bastawisy, M.H.; Ibrahim, H.M. and Mansour, S.H. (1997): Combining ability and heterosis studies for yield and its components in some top crosses of soybean [*Glycine max* L. Merrill]. Annals of Agric. Sci Moshtohor, 35(1): 1053-1065.

Cruz, C.D.; Sediyama, C.D. and Sediyama, T. (1987): Combining ability and reciprocal effects for some characters in soybean [*Glycine max* L. Merrill]. Revista Ceres, 34: 432-439. (C.F. plant Breed. Abst. 58: 9965,1988).

El-Hosary, A.A.; Habeeb, M.B. and El-Shamarka, S.A. (1997): Combining ability and heterosis in some top crosses of faba beans (*Vicia faba* L.). Egypt. J. Appl. Sci., 9(21): 111-122.

Habeeb, M.B. (1998): Heterosis and combining ability in F_2 diallel crosses of soybean [*Glycine max* L. Merrill]. Minufiya J. Agric. Res., 23(2): 261-271.

Halvankar, G.B. and Patil, V.P. (1992): Heterosis in soybean. J. Maharashtra Agric. Univ.,17(3): 368-370 (C.F. Plant Breed. Abst. 64: 6137, 1994).

Harer, P.N. and Deshamukh, R.B. (1991): Components of genetic variation in soybean [*Glycine max* L. Merrill]. J. Oil seeds Res., 8(2): 220-225.

Kempthorne, O. (1957): An introduction to genetic statisties. John Wiley and Sons Inc., New York.

Kunta, T.; Edwards, L.H.; McNew, R.W. and Dinkis, R. (1985): Heterosis performance and combining ability in soybeans. Soybean Genetics Newsletter. 12: 97-99.

Ma, R.H.; Gai, J.Y. and Hu, Y.Z. (1983): Study on genetic variation in hybrid generations of soybean. 1. Heterosis and inbreeding depression. Scientia Agricultural Sinica, 5: 1-6 (C.F. Plant Breed. Abst.54: 4157, 1994).

Mansour, S.H.; Al-Assily, Kh.A.; Mahamed, M.S.A.; Abdel- Mohsen, M.I. and Bastawisy, M.H. (2002): Evaluation of soybean top crosses for seed yield and other agronomic characters. J. Agric. Sci. Mansoura Univ., 27(5): 2799 - 2809.

Mansour, S.H.; Zakia M. Ezzat; El-Lithy, R.E.; Mohamed, M.S.A. and Shaaban, M. (2006): Top crosses analysis for yield and its components in soybean [*Glycine max* L. Merrill]. Minfiya J. Agric. Res. Vol. 28(2): 419-431.

Paschal, T.H. and Wilcox, J.R. (1975. Heterosis and combining ability in exotic soybean germplasm. Crop Sci., 15: 344-349.

Singh, R.K. and Choudhary, B.D. (1976): Biometrical techniques in genetics and breeding. International Bioscience Publishers Hissar (India), pp. 145-153.

Tawar, M.L.; Halvankar, G.B.; Raut, V.M. and Patia, V.P. (1990): Hybrid vigour in soybean [*Glycine max* L. Merrill]. India J. Agric. Sci., 60: 545-546.

Weber, C.R.; Empig, L.T. and Thorne, J.C. (1970): Heterotic performance and combining ability of two-way F_1 soybean hybrids. Crop Sci., 10: 159-160.

القدرة علي التآلف و قوة الهجين فى بعض الهجن القمية لفول الصويا

عادل الجارحى محمد، محمد شعبان العيسوى، علا احمد مختار الجلالى، محمود محمد عمران،
ايهاب حلمى الحارتى، صموئيل برتى راغب
قسم بحوث المحاصيل البقولية – معهد بحوث المحاصيل الحقلية – مركز البحوث الزراعية

اجرى هذا البحث بمحطة البحوث الزراعية بايتاى البارود عامى ٢٠٠٦ و ٢٠٠٧ بهدف دراسة قوة الهجين و القدرة على التآلف لمجموعة من الهجن القمية فى فول الصويا بين ثلاث كشافات هم PI416937, Huch, Giza 83 و اصناف و سلالات هم HI54Z, H47ZL2, N92-8231, Giza 111 استخدمت كأمهات فى الموسم الاول تم عمل التهجينات القمية و فى الموسم الثانى تم مقارنة الهجن القمية و الاباء.

وشملت الدراسة صفات ميعاد التزهير، ميعاد النضج، طول النبات، عدد الفروع للنبات، عدد القرون فى النبات. عدد البذور فى القرن، عدد البذور فى النبات، وزن ١٠٠ بذرة و وزن البذور للنبات.

و يمكن ايجاز النتائج المتحصل عليها كالاتى:

١- كان تباين الاباء و تباين الهجن القمية و تباين التفاعل بين الكشافات و السلالات معنويا لكل الصفات المدروسة.

٢- ساهم تباين القدرة الخاصة على التآلف بدور كبير فى وراثة كل الصفات المدروسة مما يعنى ان التباين الراجع للعوامل غير المضيفة هى الاهم فى وراثة الصفات عدا صفتى ميعاد التزهير و ميعاد النضج.

٣- أوضحت قيم القدرة العامة للتآلف ان الكشاف PI416937 أفضل الكشافات بالنسبة لصفة المحصول و معظم مكوناته.

٤- كما كان الصنف Giza 111 افضل الامهات فى المحصول و مكوناته.

٥- كما اعطت الهجن Giza 83 x Giza 111, H47ZL2 x Giza 83, HI54Z x Huch, PI416937 x Giza 111 افضل الهجن فى المحصول و معظم مكوناته.

٦- كما أعطت الهجن HI54Z x Huch, Giza 111 x PI416937 تفوقا فى المحصول ومعظم مكوناته و التبكير فى النضج