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EFFECT OF GENOTYPES BY LOCATIONS INTERACTION ON ECONOMICAL TRAITS OF SQUASH

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ABSTRACT

This study was carried out to investigate the nature of genetic behavior of economical traits in squash at two locations. These locations were El-Bramoun Research Station (ARC) and Kalabsho Research Station, Fac. of Agric. Mans. University.

Complete diallel cross mating design was used to obtain 12 F_1 hybrids among four parental varieties. The results cleared the presence of significant genetic variability among evaluated genotypes as well as among genotypes by locations interactions. The results also indicated that the means of most studied traits of the F_1 hybrids significantly exceeded the mid-parents. Thus, significant values of heterosis versus the mid-parents were obtained.

The highest values of heterosis were 135.4% for white buch x Giado in F.Y./Pt (kg) from the combined data and 167.0% for Eskandrani x Zucchino 544-005 at the second location for the same trait.

The results also revealed the presence of some promising F_1 hybrids which exceeded the better parent and showed desirable heterosis values against the better parent (B.P). The highest value of heterosis (B.P.) was 194.6% for F.Y./Pt.(kg) at the second location for the F_1 hybrid (Giado x Zucchino 544-005).

The results of the analysis of variance of diallel crosses mating design indicated that the mean squares of GCA, SCA, GCA x L and SCA x L showed highly significance for most studied traits at each location and over both locations.

Concerning genetic parameters, the results illustrated the importance of both additive and non- additive genetic variances including dominance in the inheritance of studied traits. The obtained heritability values in broad sense were larger than their corresponding values in narrow sense for all studied traits.

The results also investigated that the Eskandrani and White buch were the best combiners in the second location and the first location, respectively for most studied traits.

INTRODUCTION

The estimation of genetic parameters of quantitative traits provides important information about the suitable breeding program to improve these traits. If the additive genetic variances (σ^2A) appear to be of sizeable magnitude, maximum improvement could be expected through selection program. On the other hand, the presence of heigh non-additive genetic variance including dominance (σ^2D) suggest the possibility of increasing production of squash through hybridization program.

Thus, the present study was conducted to investigate the nature of heterosis and evaluate the importance of gene action through diallel crosses mating design in two locations.

Concerning heterosis, El-Gazar (1981) evaluated five varieties of squash and their F_1 hybrids. He obtained significant amounts of heterosis for fruit length, while fruit diameter showed negative heterosis value. In this respect, Abd El-Maksoud (1986) indicated that heterosis values in the F_1

hybrids of squash were highly significant for total number of fruits (27.58%) and total weight of fruit (42.03%). Similarly, Dogra *et al.* (1997) evaluated different cucumber lines in addition to F_1 hybrids among them. They recorded that the cross k 75 x Gymt showed the highest heterosis values estimated from the (B.p) (51.35%). In the mean time, El-Gendy (1999) and Abd El-Hadi *et al.* (2001) indicated that fruit length and fruit diameter traits showed heterosis values (17.47and 6.1%) and (13.74 and 8.02%), respectively. Sadek (2003) evaluated 12 F_1 hybrids of squash and their parental varieties. She claimed that amounts of heterosis (M.P.) were desirable and ranged from 5.59 to 101.51% for fruit weight and early yield respectivily. She also added that some F_1 hybrids exceeded the (B.P) for plant height, total number of fruits and total weight of fruits.

El-Diasty and Kash (1989) and El-Adl *et al.* (1996) investigated the magnitudes of additive genetic variance (σ^2A) which were more important for most of the studied traits. In this respect, El-Gendy (1999) indicated that σ^2A was more important for 1st F.F, no. F./P. , W.F./P and T.F.N/P . On the other hand, Metwally (1985), El-Gazar and Gamil (1983), Doijode and Sulladmath (1988) , Abd El-Raheem and Mighawry (1991) cleared that the magnitudes of non-additive genetic variances including dominance (σ^2D) were more important than those of additive genetic variance (σ^2A) for all studied traits.

Concerning heritability, several authors recorded relatively high estimates of heritability among them, Ragab (1984) who recorded high heritability in narrow sense values for fruit length (83.78%), Kosba and El-Diasty (1991) illustrated that the values of heritability were 14.1, 6.66 and 4.03% for fruit length , fruit diameter and fruit weight, respectively. In agoor, El-Adl *et al* (1996) obtained high estimates of heritability which ranged from 94.7 to 82.7% for fruit weight and fruit thickness, respectively.

Moderate value of heritability (52.4%) was obtained by El-Mighawry *et al.* (2001) for fruit weight. Abd El-Maksoud *et al.* (2003) recorded that the highest value of heritability in broad sense was 87.93% for fruit diameter.

MATERIALS AND METHODS

Four squash varieties belong to *Cucurbita pepo*, L were used in this investigation. These varieties were Eskandrani (P_1), Giado (P_2), Zucchino 544 - 005 (P_3) and White Buch Scallop (P_4). The seeds of these varieties were obtained from different countries i.e., P_1 from Egypt, P_2 and P_3 from Italy and P_4 from U.S.A.

In the growing season of 2002, all crosses were made according to complete diallel cross mating design to obtain six F_1 hybrids and their six reciprocal hybrids (F_{1r}). The parental varieties were also selfed to obtain sufficient seeds. In the second growing season of 2003, all 16 genotypes which included four parental varieties, six F_1 and their F_{1r} hybrids were evaluated in a field trial experiment at two locations. These locations were El-Bramoun vegetable research station (L_1) and Kalabsho Research Station, Fac. Agric., Mansoura University (L_2).

The experimental design used was a randomized complete blocks design with three replications. Each replicate contained 16 entries. Each plot was one ridge of 5.0 m. long and 0.9 m. wide. Hills were spaced at 0.35 m.

apart. All Agricultural practices were carried as recommended for squash. Data were recorded on the following traits:-

Days to first female flower (D 1^{st} . F.F.),
Days to first male flower (D 1^{st} . M.F.),
Number of fruits per plant (N.F./P.),
Fruit yield per plot in kilograms [F.Y./Pt (k.g)],
Fruit length in centimeters [F.L.(cm)],
Fruit diameter in centimeters [F.D.(cm)],
Fruit shape index (F.Sh.I.),
Fruit weight in grams (F.W.g.) and
Fruit size [F.S.$(cm)^3$].

Different analyses of variance were made to estimate heterosis values and determine the different genetic parameters. Tests of significance were made using L.S.D. according to Steel and Torrie (1960).

The procedures of the analysis of diallel crosses were described by Griffing's (1956) method III and outlined by Singh and Chaudhary (1985). General combining ability variances (σ^2g), specific combining ability variances (σ^2s) and reciprocal effect variance (σ^2r) were obtained and translated into appropriate genetic variance components according to Hallaur and Miranda (1988), Matzinger and Kempthorne (1956) and Cockerham (1963). In addition, heritability values were also calculated.

RESULTS AND DISCUSSION

The analyses of variances for parental varieties and their 12 F_1 hybrids were made for the data derived from each location in addition to the combined analysis of the data combined over both locations and the obtained results are presented in Table1.The results indicated that the genotypes mean squares were highly significant at each location as well as at the combined analysis for all studied traits. This finding illustrated the presence of genetic variability which could be estimated through the analysis of diallel crosses. In addition, the mean squares of (GxL) interaction of genotypes x locations also showed highly significant for all studied traits , although the mean squares of locations were insignificant. Thus, the main effect was due to genotypes effect.

The means of all entries (four parental varieties, six F_1 hybrids and six F_{1r} reciprocal hybrids) were calculated for all studied traits from each location and from the combined data and the results are shown in Table 2.

The results indicated that the mean performances of the varieties P_1, P_2 and P_3 were larger in the first location than their means in the second location for most studied traits. On the other hand, the means of the variety P_4 were larger in the second location (desirable) for all studied traits except D.1^{st} F.F. (ealier), D. 1^{st} M.F. (earlier) and F.D.cm. Thus, it could be recommended that P_1, P_2 and P_3 were more suitable for L_1 and P_4 for L_2.

The results of the combined data revealed that the magnitudes of means cleared that the variety (P_4) was the highest for fruit diameter F.D., F.W.(g) and F.S.(cm^3) traits, while it was the lowest for the other studied traits.

Table 1: Analysis of variance and mean squares for all genotypes from each location and their combined data for all studied traits.

S.O.V	d.f	D. 1st F.F			D. 1st M.F			N.F.P.			F.Y./Pt (kg)			F.L.(cm)		
		L_1	L_2	Comb.	L_1	L_2	Comb.	L_1	L_2	Comb.	L_1	L_2	Comb.	L_1	L_2	Comb.
Location(L)	1	-	-	607.5	-	-	33.01	-	-	612.9	-	-	889	-	-	52.36
Replications(r)	2	4.91	0.071	2.49	6.95	0.07	3.51	0.685	0.551	0.618	2.00	1.289	1.65	0.058	0.057	0.057
Genotypes(G)	15	19.40**	25.06**	33.85**	11.87**	26.07**	28.69**	36.78**	66.54**	73.79**	90.89**	101.2**	145.1**	16.68**	27.13**	39.06**
G x L	15	-	-	10.62**	-	-	9.25**	-	-	29.53**	-	-	46.9**	-	-	4.75**
Error	60	3.97	0.643	2.31	5.54	1.23	3.39	1.53	1.25	1.39	4.73	3.02	3.88	0.614	0.634	0.624

S.O.V	d.f	F.D.(cm)			F.Sh.I			F.W. (g)			F.S. (cm³)		
		L_1	L_2	Comb.	L_1	L_2	Comb.	L_1	L_2	Comb.	L_1	L_2	Comb.
Locations	1	-	-	0.374	-	-	3.04	-	-	10.94	-	-	3536
Replications	2	0.006	0.031	0.018	0.007	0.002	0.005	9.368	1.609	5.488	15.38	11.42	13.40
Genotypes	15	8.74**	5.34**	13.14**	6.83**	5.41**	10.75**	5050**	331.5**	2792**	6512**	1614**	6451**
G x L	15	-	-	1.94**	-	-	1.49**	-	-	2590**	-	-	1674**
Error	60	0.02	0.051	0.035	0.114	0.040	0.077	46.57	43.19	44.87	52.28	21.44	36.86

*,** Significant at 0.05 and 0.01 levels of probability, respectively.
L_1, L_2 and comb. are : El-Bramoun Horticultural Research Station, Kalabsho Research Station and their combined data, respectively.

Table 2: The mean performances of four parental varieties and their F_1 hybrids for all studied traits from each location and their combined data.

Genotypes	Locations	D. 1st F.F	D. 1st M.F.	N.F./P.	F.Y./Pt (kg)	F.L. (cm)	F.D.(cm)	F.Sh. I	F.W.(g)	F.S(cm^3)
P_1	L_1	49.8	46.7	18.3	22.7	12.8	2.77	4.62	123.8	77.2
	L_2	47.8	44.1	11.2	9.6	11.7	2.58	4.54	85.7	54.5
	Comb.	48.8	45.4+	14.8+	16.2+	12.3	2.68	4.58	104.8	65.9
P_2	L_1	51.8	48.5	14.7	16.5	12.7	2.77	4.59	112.5	86.4
	L_2	45.6	48.8	8.50	5.75	11.1	2.42	4.59	67.4	52.3
	Comb.	48.7	48.7	11.6	11.1	11.9	2.60	4.59	90.0-	69.4
P_3	L_1	47.2	46.4	16.3	19.2	14.3	2.48	5.76	117.6	74.7
	L_2	44.3	45.1	9.43	7.4	11.9	2.07	5.75	78.1	50.4
	Comb.	45.8 +	45.8	12.9	13.3	13.1+	2.28-	5.76+	97.9	62.6-
P_4	L_1	53.2	53.5	5.20	4.6	3.50	8.60	0.41	87.3	111.9
	L_2	48.2	49.3	8.20	11.44	3.60	7.88	0.46	137.9	167.1
	Comb.	50.7-	51.4-	6.70-	8.02-	3.55-	8.24+	0.44-	112.6+	139.5+
$P_1 \times P_2$	L_1	48.6	47.3	20.4	26.1	13.1	2.86	4.58	127.7	115.6
	L_2	40.7	43.6	18.3	17.9	11.2	2.32	4.84	98.7	93.2
	Comb.	44.7	45.5	19.4	22.0	12.2	2.59	4.71	113.2	104.4
$P_1 \times P_3$	L_1	47.4	45.8	21.6	26.0	14.7	3.17	4.64	120.4	119.5
	L_2	39.8	43.4	21.2	22.7	13.3	2.35	5.65	106.7	106.5
	Comb.	43.6+	44.6	21.4+	24.4+	14.0+	2.76-	5.15+	113.6	113.0+
$P_1 \times P_4$	L_1	48.6	47.2	19.2	25.3	10.4	3.80	2.74	132.1	86.8
	L_2	43.9	46.3	13.1	23.1	9.4	4.82	1.95	176.2	119.7
	Comb.	46.3-	46.8-	16.2	24.2	9.9-	4.31+	2.35-	154.2+	103.3
$P_2 \times P_3$	L_1	49.3	46.7	14.7	17.4	16.4	3.06	5.36	118.3	57.4
	L_2	40.2	42.3	11.6	21.8	10.9	2.70	4.05	62.4	70.8
	Comb.	44.8	44.5+	13.2-	19.6	13.7	2.88	4.71	90.4-	64.1-

Table 2: Cont.

Genotypes	Locations	D. 1st F.F	D. 1st M.F.	N.F./P.	F.Y./Pt (kg)	F.L. (cm)	F.D. (cm)	F.Sh. I	F.W.(g)	F.S(cm^3)
$P_2 \times P_4$	L_1	47.4	46.4	17.9	18.3	12.1	3.55	3.41	102.2	85.1
	L_2	43.4	44.7	12.7	10.1	10.6	2.58	4.11	79.4	103.2
	Comb.	45.4	45.6	15.3	14.2-	11.4	3.07	3.76	90.8	94.2
$P_3 \times P_4$	L_1	47.2	46.1	17.7	19.9	12.7	2.91	4.36	112.1	68.3
	L_2	42.7	46.4	14.7	15.7	12.5	3.03	4.14	106.5	95.3
	Comb.	45.0	46.3	16.2	17.8	12.6	2.97	4.25	109.3	81.8
$P_2 \times P_1$	L_1	52.2	48.4	14.4	17.5	14.2	3.18	4.46	121.1	111.2
	L_2	44.3	45.6	13.7	17.2	11.3	3.04	3.81	125.6	119.7
	Comb.	48.3	47.0	14.1	17.4	12.8	3.11-	4.14	123.4	115.5
$P_3 \times P_1$	L_1	48.1	45.3	26.1	28.0	13.5	3.43	3.93	107.2	108.9
	L_2	41.8	43.5	12.9	13.0	13.7	3.11	4.4	100.6	105.0
	Comb.	45.0	44.4	19.5+	20.5	13.6	3.27	4.17+	103.9-	107.0
$P_4 \times P_1$	L_1	43.6	45.7	22.6	26.6	12.2	2.96	4.12	117.7	103.4
	L_2	40.5	46.5	9.8	18.3	12.4	6.60	1.88	186.4	164.2
	Comb.	42.1	46.1	16.2	22.5+	12.3	4.78	3.00	152.1+	133.8
$P_3 \times P_2$	L_1	41.9	38.2	14.5	16.9	16.3	3.16	5.16	116.8	74.7
	L_2	42.3	44.0	9.3	14.2	11.4	4.60	2.47	152.4	99.8
	Comb.	42.1+	41.1+	11.9-	15.6-	13.9+	3.88	3.82	134.6	87.3-
$P_4 \times P_2$	L_1	47.1	47.6	21.4	24.0	9.7	4.88	1.97	113.3	147.2
	L_2	44.9	47.1	11.2	21.0	9.2	5.39	1.70	187.4	226.6
	Comb.	46.0-	47.4-	16.3	22.5	9.45-	5.14+	1.84-	150.4	186.9+
$P_4 \times P_3$	L_1	49.3	46.5	16.1	19.3	12.3	3.23	3.81	120.4	95.5
	L_2	41.7	46.8	14.6	16.0	13.1	3.32	3.96	109.9	88.1
	Comb.	45.5	46.7	15.4	17.7	12.7	3.28	3.89	115.2	91.8
L.S.D 0.05	L_1	3.32	3.92	2.05	3.62	1.305	0.23	0.56	11.36	12.04
	L_2	1.33	1.85	1.86	2.89	1.32	0.37	0.33	10.94	7.71
	Comb.	1.75	2.12	1.36	2.27	0.912	0.216	0.32	7.73	7.0
L.S.D 0.01	L_1	4.48	5.30	2.78	4.9	1.765	0.318	0.76	15.37	16.29
	L_2	1.80	2.50	2.51	3.91	1.78	0.49	0.45	14.8	10.43
	Comb.	2.33	2.88	1.80	3.02	1.213	0.28	0.42	10.28	9.32

P_1, P_2, P_3 and P_4 are the parental varieties Eskandrani, Giado, Zucchino 544-005 and White Buch Scallop.

The variety Eskandrani (P_1) appeared to be the highest parent for (N.F./P.) , D1st F.M.F. (Latest) and F.Y./Pt (kg) traits. In the same time , the variety Zucchino 544-005 (P_3) showed the highest means for F.L. (cm) and F.Sh.I and the lowest for F.D. (cm), F.S. (cm^3) and D.1st F.F. (desirable). It could be concluded that the parent White Buch Scallop (P_4) was the lowest in the mean performances for most studied traits.Thus it could be expected that all hybrids involving P_4 variety as one of its parents cleared lowest means.This finding might be due to small general combining ability effect of this variety.

The results cleared that the mean performances of all F_1 hybrids in the first location (L_1) were larger than those means in the second location (L_2) for most of the studied traits. These results were expected and were in agreement with the results of the means of parental varieties which were described earlier. Whereas the means of P_1, P_2 and P_3 showed highly performances in the first location (L_1), the performances of their F_1 hybrids and F_{1r} (reciprocal) hybrids of the combined data showed variable magnitudes for the means of different studied traits. The results also cleared that the F_1 hybrid (P_1 x P_3) appeared to be the best F_1 hybrid for all studied traits expect for F.W. (g) and F.D (cm). These two traits were at their highest performances of the hybrid (P_1x P_4). Generally, the results cleared that the hybrids which included the highest variety showed the highest mean and vice versa. Similar results were obtained for the magnitudes of the reciprocal hybrids (F_{1r}). It could be noticed that F_1 hybrids which showed high mean performances included at least one variety showing high mean performances. It could be also regarded that the means of hybrids were close or as good as the means of the highest variety with respect to most studied traits. However, few hybrids exceeded the highest variety for some traits.

The amounts of heterosis versus the mid-parents (M.P.) for each F_1 hybrid and reciprocal hybrid (F_{1r}) were determined from each location and over the two locations and the results are presented in Table 3. The results revealed that the means of F_1 and F_1 reciprocal hybrids significantly exceeded the mid- parents for most studied traits at each location. The obtained heterosis values cleared the manifestations of heterosis in the L_2 which were larger than those values obtained in L_1 for most studied traits. The highest value of heterosis was recorded in the combination P_2 x P_3 at L_2 with value of 231.3% for fruit yield per plot Kg, whereas, the reciprocal F_1 hybrid P_3 x P_2 showed the highest value 115.8% for the same obvious trait. These results cleared that the combinations of parental varieties were affected by environment and illustrated that the nature of soil in the second location (L_2) was more suitable for these hybrids.

The results of the combined data indicated that the F_1 hybrid P_2 x P_4 cleared highly significant values of heterosis for all studied traits. In the mean time, the same F_1 hybrid cleared the best traits values of heterosis for D.1st .F.F (-8.65% ealier), N.F. /P. (67.2%) and F.Sh. I (49.2). Similarly, the F_1 hybrid P_2 x P_3 exhibited the highest heterosis values for D.1st M.F. (-5.92) and F.D.(cm) (18.0%) traits. Similarly, the F_1 hybrid P_1 x P_4 was the highest for F.Y./Pt (kg) (100%) and F.W(g) (41.9%) traits, while, the F_1 hybrid P_1 x P_3 for F.S (cm^3) (75.7%).

Furthermore, the results indicated that the F_{1r} hybrid P_4 x P_2 showed the highest values of heterosis for N.F./P (78.1%), F.Y./Pt (kg) (135.4%), F.W.(g) (48.5%) and F.S.(cm^3) (78.9%) traits. In the same time, the F_{1r} hybrid P_4 x P_1 showed the highest values for D.1st F.F. (-15.5%) and F.L. (cm)(55.1%), while the F1r P_3 x P_2 showed the highest value for F.D. (cm) (59%) and F_{1r} P_4 x P_3 for Sh.I (25.5%).

Table 3: Heterosis relative to mid-parents ($H_{M.P}$)% for all studied traits from each location and their combined data over the two locations

Hybrids	Locations	D. 1st F.F	D. 1st M.F.	N.F./P.	F.Y./Pt (kg)	F.L. (cm)	F.D. (cm)	F.Sh. I	F.W.(g)	F.S(cm^3)
$P_1 x P_2$	L_1	-4.33	0.63	23.6**	33.2**	2.34	3.25	-0.65	8.04*	**41.3****
	L_2	-12.8**	-6.24**	85.6**	133.1**	-1.75	-7.20	5.91*	28.9**	**74.5****
	Comb.	-8.21**	3.40	47.0**	60.6**	0.83	-1.89	2.61	16.2**	**54.2****
$P_1 x P_3$	L_1	-1.66	-1.72	24.9**	23.8**	8.09*	20.5**	-10.6*	-0.25	**57.2****
	L_2	-13.7**	-2.69	105.8**	167.0**	12.7**	0.86	9.71**	30.3**	**102.9****
	Comb.	-7.82**	-2.19	54.0**	64.9**	10.2**	11.3**	0.39	12.0**	**75.7****
$P_1 x P_4$	L_1	-5.63*	-5.79	62.7**	84.7**	27.6**	-33.3**	8.73	25.1**	**-8.25**
	L_2	-8.54**	-0.86	35.0**	120.0**	22.9**	7.84**	-22.0**	57.6**	**8.03**
	Comb.	-7.03**	-3.31	50.0**	100.0**	24.8**	-21.1**	-6.37	41.9**	**0.58**
$P_2 x P_3$	L_1	-0.40	-1.68	-5.16	-2.80	21.5**	16.3**	3.47	2.78	**-28.8****
	L_2	-10.7**	-10.0**	29.3**	231.3**	-5.22	20.0**	-21.7**	-14.3	**37.7****
	Comb.	-5.29**	-5.92**	7.32	60.7**	9.60**	18.0**	-9.07**	-3.83	**-2.88**
$P_2 x P_4$	L_1	-9.71**	-9.02**	79.9**	72.6**	49.4**	-37.6**	25.6**	2.30	**-14.2****
	L_2	-7.46**	-8.96**	52.1**	17.4	44.2**	-49.9**	62.5**	-22.7**	**-5.93****
	Comb.	-8.65**	-3.59*	67.2**	48.5**	47.50**	-43.4**	49.2**	-10.4**	**9.60****
$P_3 x P_4$	L_1	-5.98*	-7.8*	63.9**	67.2**	42.7**	-47.5**	41.1**	9.37*	**-26.8****
	L_2	-7.78**	-1.69	66.7**	66.7**	61.3**	-39.2**	33.1**	-1.39	**-12.4****
	Comb.	-6.83**	-4.73**	65.3**	66.4**	51.3**	-43.5**	37.1**	3.8	**-19.1****
$P_2 x P_1$	L_1	2.76	1.68	-12.7*	-10.7	10.9**	14.8**	-3.25	2.45	**35.9****
	L_2	-5.14**	-1.94	38.9**	124.0**	-0.88	21.6**	-16.6**	64.0**	**124.2****
	Comb.	-1.02	-0.21	6.82	27.0**	5.79	17.8**	-9.80**	26.7**	**70.6****
$P_3 x P_1$	L_1	-0.21	-2.36	50.9**	33.3**	-0.74	30.4**	-24.3**	-11.2**	**43.3****
	L_2	-9.33**	-2.47	25.2**	52.9**	16.1**	33.5**	-14.6**	22.8**	**100.0****
	Comb.	-4.86**	-2.63	40.3**	38.5**	7.09*	31.9**	-19.3**	2.47	**66.4****

Table 3: Cont.

Hybrids	Locations	D. 1st F.F	D. 1st M.F.	N.F./P.	F.Y./Pt (kg)	F.L. (cm)	F.D. (cm)	F.Sh. I	F.W.(g)	F.S(cm³)
$P_4 \times P_1$	L_1	-15.3**	-8.78**	91.5**	94.2**	49.7**	-48.0**	63.5**	11.5*	**9.30**
	L_2	-15.6**	0.43	0.93	74.3**	62.1**	26.2**	-24.8**	66.7**	**48.2****
	Comb.	-15.5**	-4.75**	50.0**	86.0**	55.1**	-12.5**	19.5**	40.0**	**30.3****
$P_3 \times P_2$	L_1	-15.4**	-19.6**	-6.45	-5.59	20.7**	20.2**	-0.39	1.48	**-7.32**
	L_2	-6.0**	-6.38**	3.68	115.8**	-0.87	104.4**	-52.2**	109.3**	**94.2****
	Comb.	-11.0**	-13.1**	-3.25	27.9**	11.2**	59.0**	-26.3**	43.2**	**32.3****
$P_4 \times P_2$	L_1	-10.3**	-6.67*	115.1**	126.4**	19.8**	-14.2**	-21.2*	13.4**	**48.4****
	L_2	-4.26**	-4.07**	34.1**	144.2**	25.2**	4.66	-32.8**	82.5**	**106.6****
	Comb.	-7.44**	0.21	78.1**	135.4**	22.3**	-5.17**	-27.0**	48.5**	**78.9****
$P_4 \times P_3$	L_1	-1.79	-7.00*	49.1**	62.2**	38.2**	-41.7**	23.3**	17.5**	**2.36**
	L_2	-9.93**	-0.85	65.5**	69.9**	69.0**	-33.3**	27.3**	1.76	**19.0****
	Comb.	-5.80**	-3.91*	57.1**	65.4**	52.5**	-37.6**	25.5**	9.40**	**-9.20****
L.S.D $_{0.05}$	L_1	2.62	3.09	1.62	2.86	1.03	0.18	0.44	8.98	**9.52**
	L_2	1.05	1.46	1.47	2.28	1.04	0.29	0.26	8.65	**6.09**
	Comb.	1.38	1.68	1.07	1.79	0.72	0.17	0.25	6.11	**5.54**
L.S.D $_{0.01}$	L_1	3.53	4.19	2.20	3.87	1.39	0.25	0.60	12.15	**12.88**
	L_2	1.42	1.97	1.99	3.09	1.41	0.40	0.35	11.70	**8.24**
	Comb.	1.84	2.23	1.43	2.39	0.95	0.23	0.33	8.13	**7.37**

***,** Significant and highly significant at 0.05 and 0.01 probability levels, respectively.**

Generally, the best values of heterosis for earliness traits (D.1st F.F. and D. 1st M.F), when exhibited the lowest negative significant values. In this respect, 11 and 6 out of the 12 F_1, F_{1r} hybrids exhibited desirable negative significant values for the same traits respectively. On the other hand, the favorable H.M.P% for N.F.P, F.Y./Pt(kg), F.W. (g) and F.S. (cm^3) which had the highest positive significant values. Therefor, 9,12,8 and 8 out of the F_1, F_{1r} hybrids showed desirable positive significant values of the same traits.

In general, it could be concluded that the hybrid P_2 x P_4 and its reciprocal P_4 x P_2 appeared to be the best for most studied traits. The results also indicated that the magnitudes of the means of F_1 hybrids and consequently the obtained heterosis from the mid-parents (H.M.P%) were higher in the second location. These results were in agreement with the obtained means of the F_1 hybrid, and F_{1r} hybrids which showed high magnitudes in the second location for most studied traits.

The obtained values of heterosis versus the better parent ($H_{B.P.}$%) were calculated from the F_1 hybrid, F_{1r} hybrids as well as from the combined data and the results are presented in Table 4. The results indicated that the estimated values of heterosis versus the better parent (B.P.) were larger in the second location for most studied traits. In the same time, the F_1 hybrid P_2 x P_3 significantly exceeded the B.p showing the highest value of heterosis 194.6% for F.Y./Pt (kg) followed by P_1 x P_3 hybrid 136.5% and P_1 x P_4 101.9% for the same previous trait. The results also showed that the F_{1r} hybrid P_2 x P_1 exceeded the highest values of heterosis estimated from the B.P. (119.6%) F.S.(cm^3). In the same time, the F_{1r} hybrid P_3 x P_2 showed highly significant values of heterosis for F.Y/Pt(kg) (19.9%), F.D(cm) (90.1%), F.W(g) (95.1%) and F.S (cm^3) (90.8%) traits. These findings indicated that P_1 was the best combiner followed by P_2 and P_3.The calculated heterosis values from the combined data revealed the absence of useful heterosis for many hybrids in most studied traits. Although, few specific F_1 hybrids cleared significant values of heterosis specially in the location two . Thus ,the hybrid vigor could not be obtained from these parental varieties. In this case ,the plant breeder should be careful in the choice of the parents to obtain vigorous F_1 hybrids. However, the promising F_1 hybrids which significantly exceed the better parent (B.P) could be used either directly or to select new inbred lines in their segregated generations. In this respect, it could be noticed that the F_1 hybrid (P_1 x P_3) cleared useful heterosis values (B.P). From the results, it could be also recommended that the F_1 (P_1 x P_3) was suitable to cultivate in second location (L_2),while the F_1 hybrid (p_1x p_2) for first location (L_1).

The obtained values of heterosis from the F_{1r} hybrids relative to better parent from the combined data indicated that the combination P_3 x P_2 showed useful heterosis for most studied traits followed by P_4 x P_2 and P_3 x P_1.The results also indicated that the second location was preferable to many F_1 hybrids .The better values of heterosis (B.P) were: -8.08 , -10.3 , 40.5 , 102.7 ,6.11 , 49.2 , 37.5 and 64.4% for D.1st F.F. , D.1st M.F. , N.F./P , F.Y./Pt(kg) , F.D(cm) , F.W(g) and F.S(cm^3) traits , respectively. Regarding the F_1,F_{1r} hybrids which had useful estimated values from the combined data, there were 7 and one from the 12 F_1, F_{1r} hybrids had negative significant values (desirable) for D.1st F.F. and D.1st M.F., respectively. On the other hand, there were 9,11,7 and 6 F1, F1r hybrids had positive significant values (desirable) for N.F./P, F.Y./Pt 9kg), F.W.(g) and F.S (cm^3).

Table 4: Heterosis relative to better parent ($H_{B.P}$)% for all studied traits from each location and their combined data over the two locations:

Hybrids	Locations	D. 1st F.F	D. 1st M.F.	N.F./P.	F.Y./Pt (kg)	F.L. (cm)	F.D.(cm)	F.Sh. I	F.W.(g)	F.S(cm^3)
$P_1 \times P_2$	L_1	-2.41	1.28	11.5*	15.0	2.34	3.25	-0.87	3.15	33.8**
	L_2	-10.7**	-1.13	63.4**	86.5**	-4.27	-10.1	5.45	15.2*	71.0**
	Comb.	-8.21**	0.22	31.1**	35.8**	-0.81	-3.36	2.61	8.02*	50.4**
$P_1 \times P_3$	L_1	0.42	-1.29	18.0**	14.5	2.80	14.4**	-19.4**	-2.75	54.8**
	L_2	-10.2**	-1.59	89.3**	136.5**	11.8*	-8.91	-1.74	24.5**	95.4**
	Comb.	-4.80*	-1.76	44.6**	50.6**	6.87	2.99	-10.6**	8.40*	71.5**
$P_1 \times P_4$	L_1	-2.41	1.07	4.92	11.5	-18.8**	-55.8**	-40.7**	6.70	-22.4**
	L_2	-8.16**	4.99*	17.0*	101.9**	-19.7**	-38.8**	-57.0**	27.8**	-28.7**
	Comb.	-5.12**	3.08	9.46*	49.4**	-19.5**	-47.7**	-48.7**	36.9**	-25.9**
$P_2 \times P_3$	L_1	4.45	0.65	-9.82	-9.38	14.7**	10.5*	-6.94	0.60	-33.6**
	L_2	-9.26**	-6.21**	23.0*	194.6**	-8.4	11.6	-29.6**	-20.1**	35.4**
	Comb.	-2.18	-2.84	2.33	47.4**	4.58	10.8**	-18.2**	-7.66	-7.64
$P_2 \times P_4$	L_1	-8.49*	-4.33	21.8**	10.9	-4.72	-58.7**	-25.7**	-9.2	-23.9**
	L_2	-4.82**	-8.46**	49.4**	-11.7	-4.50	-67.3**	-10.5**	-42.4**	-38.2**
	Comb.	-6.78**	0.44	31.9**	27.9**	-4.20	-62.7**	-18.1**	-19.4**	-32.5**
$P_3 \times P_4$	L_1	0.00	0.65	8.59	3.65	-11.2*	-66.2**	-24.3**	-4.68	-39.0**
	L_2	-3.61*	2.88	55.9**	37.2**	5.04	-61.5**	-28.0**	-22.8**	-43.0**
	Comb.	-1.75	1.09	25.6**	33.8**	-3.82	-64.0**	-26.2**	-2.93	-41.4**
$P_2 \times P_1$	L_1	4.82	3.64	-21.3**	-22.9**	10.9*	14.8**	-3.46	-2.18	28.7**
	L_2	-2.85	3.40	22.3*	79.2**	-3.42	17.8*	-17.0**	46.6**	119.6**
	Comb.	-0.82	3.52	4.73	7.41	4.07	16.0**	-9.80**	17.7**	66.4**
$P_3 \times P_1$	L_1	1.91	-2.37	42.6**	23.3**	-5.59	23.8**	-31.8**	-13.4**	41.1**
	L_2	-5.64**	-1.36	15.2	35.4*	15.1**	20.5**	-23.5**	17.4**	92.7**
	Comb.	-1.75	-2.20	31.8**	26.5**	3.82	22.0**	-27.6**	-0.86	62.4**

Table 4: Heterosis relative to better parent ($H_{B.P}$)% for all studied traits from each location and their combined data over the two locations:

Hybrids	Locations	D. 1st F.F	D. 1st M.F.	N.F./P.	F.Y./Pt (kg)	F.L. (cm)	F.D.(cm)	F.Sh. I	F.W.(g)	F.S(cm^3)
$P_1 \times P_2$	L_1	-2.41	1.28	11.5*	15.0	2.34	3.25	-0.87	3.15	33.8**
	L_2	-10.7**	-1.13	63.4**	86.5**	-4.27	-10.1	5.45	15.2*	71.0**
	Comb.	-8.21**	0.22	31.1**	35.8**	-0.81	-3.36	2.61	8.02*	50.4**
$P_1 \times P_3$	L_1	0.42	-1.29	18.0**	14.5	2.80	14.4**	-19.4**	-2.75	54.8**
	L_2	-10.2**	-1.59	89.3**	136.5**	11.8*	-8.91	-1.74	24.5**	95.4**
	Comb.	-4.80*	-1.76	44.6**	50.6**	6.87	2.99	-10.6**	8.40*	71.5**
$P_1 \times P_4$	L_1	-2.41	1.07	4.92	11.5	-18.8**	-55.8**	-40.7**	6.70	-22.4**
	L_2	-8.16**	4.99*	17.0*	101.9**	-19.7**	-38.8**	-57.0**	27.8**	-28.7**
	Comb.	-5.12**	3.08	9.46*	49.4**	-19.5**	-47.7**	-48.7**	36.9**	-25.9**
$P_2 \times P_3$	L_1	4.45	0.65	-9.82	-9.38	14.7**	10.5*	-6.94	0.60	-33.6**
	L_2	-9.26**	-6.21**	23.0*	194.6**	-8.4	11.6	-29.6**	-20.1**	35.4**
	Comb.	-2.18	-2.84	2.33	47.4**	4.58	10.8**	-18.2**	-7.66	-7.64
$P_2 \times P_4$	L_1	-8.49*	-4.33	21.8**	10.9	-4.72	-58.7**	-25.7**	-9.2	-23.9**
	L_2	-4.82**	-8.46**	49.4**	-11.7	-4.50	-67.3**	-10.5**	-42.4**	-38.2**
	Comb.	-6.78**	0.44	31.9**	27.9**	-4.20	-62.7**	-18.1**	-19.4**	-32.5**
$P_3 \times P_4$	L_1	0.00	0.65	8.59	3.65	-11.2*	-66.2**	-24.3**	-4.68	-39.0**
	L_2	-3.61*	2.88	55.9**	37.2**	5.04	-61.5**	-28.0**	-22.8**	-43.0**
	Comb.	-1.75	1.09	25.6**	33.8**	-3.82	-64.0**	-26.2**	-2.93	-41.4**
$P_2 \times P_1$	L_1	4.82	3.64	-21.3**	-22.9**	10.9*	14.8**	-3.46	-2.18	28.7**
	L_2	-2.85	3.40	22.3*	79.2**	-3.42	17.8*	-17.0**	46.6**	119.6**
	Comb.	-0.82	3.52	4.73	7.41	4.07	16.0**	-9.80**	17.7**	66.4**
$P_3 \times P_1$	L_1	1.91	-2.37	42.6**	23.3**	-5.59	23.8**	-31.8**	-13.4**	41.1**
	L_2	-5.64**	-1.36	15.2	35.4*	15.1**	20.5**	-23.5**	17.4**	92.7**
	Comb.	-1.75	-2.20	31.8**	26.5**	3.82	22.0**	-27.6**	-0.86	62.4**

The obtained results were in agreement with which were obtained by many authors among them, Abd-ElMaksoud (1986), Dogra *et al.* (1997), El-Gendy (1999) and Sadek (2003). The results of the analysis of variances and the mean squares of the diallel crosses were obtained for all studied traits and the results are shown in Table 5.

Tests of significance illustrated the significance of the mean squares of general combining ability (GCA) for all studied traits at each location and from the combined analysis. In the same time, the mean squares of specific combining ability SCA were significant for all studied traits except for D.1st F.F., D.1st M.F. and F.Y./Pt (kg). The presence of significant reciprocal effect indicated the role of maternal effect in the inheritance of most studied traits. The results also cleared the presence of significant interaction of general combining ability x location (GCA x L) , specific combining ability x location (SCA x L) and reciprocal effect x location (R.E x L) for all studied traits except D.1st F.F., (GCA x L) & (SCA x L) F.Y./Pt (kg) (GCA x L) and F.L.(cm) (R.E x L). This findings referred that these genetic components may be influenced by different environmental conditions. The results also indicated variable magnitudes of the mean squares of GCA , SCA and R.E and their interaction with locations for different studied traits. This finding revealed the importance of these components for different studied traits. The results of GCA/SCA and GCA x L / SCA.L were more than unit for most studied traits .These results indicated the importance of GCA , although SCA could not be ignored. Similar results were obtained by El-Gazar and Gamil (1983), El-Diasty and Kash (1989), El-Adl *et al.* (1996), Abd El-Raheem and Mighamry (1999) and El-Gendy (1999).

According to the expectations of mean squares, the variance components could be calculated and translated in terms of genetic variances components. Thus, the estimated values of additive(σ^2A), non-additive genetic variances including dominance (σ^2D), reciprocal effect (σ^2 r), additive variance x location (σ^2A x σ^2L) , non-additive variances x location (σ^2D x σ^2L) and reciprocal effect x location (σ^2r x σ^2L) were obtained and the results are presented in Table 6 . The combined data illustrated that the magnitudes of σ^2A were larger in magnitudes than corresponding values of σ^2D for D.1st M.F. , F.Y./Pt(kg) ,F.L.(cm) , F.D(cm). and Sh.I traits. On the other hand, the magnitudes of σ^2D were the larger for D.1st F.F., N.F./P , F.W.(g) and F.S.(cm^3) traits. The results also indicated that the magnitudes of σ^2D x L were larger than those of σ^2A x L for all studied traits except F.L.(cm) and F.W.(g) traits. It could be emphasized on the importance of σ^2A and σ^2D for the inheritance of the studied traits .The obtained results of σ^2A and σ^2D could explain the presence of heterosis which were described earlier .These values of heterosis could be due to σ^2D and σ^2A x A epistasis .The results also cleared the presence of σ^2r for all studied traits. All of genetic parameters played an important role in the inheritance of all studied traits .Similar results were obtained by values of heritability in narrow sense.

The values of heritability in broad (h^2_b%) and narrow (h^2_n%) senses were also estimated and the results are cleared in the same Table.

Table 5: Analysis of combining abilities and mean squares of F_1 hybrids for all studied traits.

S.O.V	d.f	D. 1st F.F			D. 1st M.F			N.F./P.			F.Y./Pt (kg)			F.L.(cm)		
		L_1	L_2	Comb.	L_1	L_2	Comb.	L_1	L_2	Comb.	L_1	L_2	Comb.	L_1	L_2	Comb.
Crosses (c)	11	8.586**	21.532**	17.91**	7.952**	20.11**	17.38**	33.93**	40.52**	44.34**	68.69**	54.0**	95.92**	6.37**	12.68**	13.08**
GCA	3	4.061*	1.692**	2.673*	6.890**	6.835**	11.36**	9.58**	19.15**	23.82**	35.95**	38.85**	72.4**	5.139**	12.35**	12.39**
SCA	2	0.661	12.26**	8.631**	1.022	7.240**	5.922**	21.3**	24.86**	28.5**	1.317	12.34**	7.90**	1.059*	1.766**	0.43
RE	6	2.996*	8.227**	6.732**	1.072	6.463**	2.967*	8.845**	6.897**	5.685**	23.56**	9.462**	19.78**	0.976*	0.985**	1.656**
C x L	11	-	-	12.21**	-	-	10.68**	-	-	30.11**	-	-	26.77**	-	-	5.986**
GCA x L	3	-	-	3.08*	-	-	2.356	-	-	4.916**	-	-	2.4	-	-	5.108**
SCA x L	2	-	-	4.287**	-	-	2.340	-	-	17.66**	-	-	5.757*	-	-	2.396**
RE x L	6	-	-	4.491**	-	-	4.568**	-	-	10.06**	-	-	13.24**	-	-	0.305
Pooled Error L/comb.	22/44	1.079	0.225	0.652	1.408	0.370	0.889	0.418	0.465	0.441	1.648	1.037	1.343	0.262	0.238	0.25
GCA/SCA		6.14	0.138	0.309	6.741	0.944	1.91	0.449	0.77	0.835	27.29	3.14	9.16	4.85	6.99	28.81
GCA x L/SCA x L		-	-	0.718	-	-	1.0	-	-	0.278	-	-	0.416	-	-	2.131

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

Table 5: Continued

S.O.V	d.f	F.D (cm)			F. Sh. I			F.W. (g)			F.S. (cm^3)		
		L_1	L_2	Comb.	L_1	L_2	Comb.	L_1	L_2	Comb.	L_1	L_2	Comb.
Crosses (c)	11	5.636**	0.919**	4.144**	4.854**	2.815**	5.72**	5242.2**	200.48**	3025**	5181**	1878**	5730**
GCA	3	2.021**	0.304**	1.739**	2.137**	2.024**	4.07**	2121**	53.35*	1218**	2316**	613.3**	2215**
SCA	2	3.337**	0.54**	1.925**	2.924**	0.925**	1.21**	1270**	134.1**	849.2**	1303**	1197**	2009**
RE	6	1.321**	0.23**	1.022**	0.922**	0.399**	1.06**	1720**	51.63**	956.5**	1574**	441.9**	1724**
C x L.	11	-	-	2.411**	-	-	1.95**	-	-	2418**	-	-	1329**
GCA x L	3	-	-	0.586**	-	-	0.09*	-	-	954.7**	-	-	713.9**
SCA x L	2	-	-	1.952**	-	-	2.64**	-	-	554.7**	-	-	491.4**
RE x L	6	-	-	0.529**	-	-	0.26**	-	-	815.2**	-	-	291.5**
Pooled Error L/comb.	22/44	0.007	0.004	0.005	0.041	0.018	0.029	14.88	12.7	13.79	19.36	8.724	14.04
GCA/SCA		0.60	0.56	0.903	0.730	2.188	3.36	1.67	0.397	1.434	1.77	0.512	1.102
GCA x L/SCA x L		-	-	0.300	-	-	0.034	-	-	1.721	-	-	1.452

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

Table 6: The relative magnitudes of different genetic parameters and heritability for all studied traits from each location and their combined data.

Genetic parameters	Locations	D. 1st F.F	D. 1st M.F.	N.F./P.	F.Y./Pt (kg)	F.L. (cm)	F.D. (cm)	F.Sh. I	F.W.(g)	F.S(cm^3)
σ^2A	L_1	1.70	2.93	-5.86	17.31	2.04	-0.658	-0.394	425.4	506.2
	L_2	-5.28	-0.203	-2.085	13.25	5.29	-0.118	0.549	-40.9	292.0
	Comb.	-1.19	1.358	2.02	16.96	2.31	0.295	1.352	-7.734	-4.13
σ^2D	L_1	-0.209	-0.193	10.44	-0.166	0.399	1.665	1.441	627.4	642.0
	L_2	6.02	3.435	12.20	5.654	0.764	0.268	0.454	60.73	594.3
	Comb.	1.09	0.895	2.71	0.537	-0.492	-0.007	-0.357	73.63	379.4
σ^2r	L_1	0.959	0.168	4.21	10.96	0.357	0.657	0.441	852.6	777.3
	L_2	4.00	3.046	3.22	4.21	0.374	0.113	0.191	19.46	216.6
	Comb.	0.560	0.400	-1.09	1.63	0.338	0.123	0.198	35.34	358.2
$\sigma^2A \times L$	Comb.	-0.604	0.008	-6.37	-1.68	1.36	-0.684	-1.274	200.0	111.3
$\sigma^2D \times L$	Comb.	1.818	0.726	8.61	2.21	1.073	0.974	1.305	270.4	238.7
$\sigma^2r \times L$	Comb.	1.920	1.839	4.81	5.95	0.028	0.262	0.118	400.7	138.8
	L_1	0.359	0.469	0.139	0.549	0.087	0.002	0.013	4.96	6.453
	L_2	0.075	0.123	0.155	0.345	0.079	0.001	0.006	4.233	2.906
σ^2E	Comb.	0.217	0.296	0.147	0.447	0.083	0.001	0.009	4.596	4.68
	L_1	56.3	82.14	70.59	60.06	84.59	71.64	76.04	55.11	59.43
	L_2	59.6	52.01	78.33	80.58	92.97	70.15	83.35	71.93	80.14
h^2_b%	Comb.	29.17	53.19	40.84	73.98	58.31	28.44	59.55	13.40	38.45
	L_1	56.3	82.14	0.00	60.06	70.75	0.00	0.00	22.26	26.20
	L_2	0.00	0.00	0.00	56.48	81.29	0.00	45.75	0.00	26.40
h^2_n%	Comb.	0.00	32.06	17.44	71.7	58.31	28.44	59.55	0.00	0.00

Concerning heritability values from the combined data ,the results indicated that the magnitudes of the values in broad sense (h^2_b%) were always larger than their corresponding h^2_n % for all studied traits. The values of heritability in broad sense ranged from 13.40% to 73.98% for F.W.(g) and F.W./Pt (kg) traits, respectively .In the same time, the highest value of h^2_n was 71.70% for F.Y/Pt(kg). These obtained values of heritability indicated the possibility of improving these studied traits through selection programs in the segregated generations. Many authors obtained similar results among them Ragab (1984), Kosba and El-Diasty (1991), El-Adl *et al.* (1996) and El-Mighawry (2001).

General combining ability effect (g_i) for each parental variety was calculated for all studied traits for each location and over all locations and the results are presented in Table 7.

The results indicated that the two parental varieties P_1 and P_4 proved to be the best combiner in the second location (L_2) and first location (L_1), respectively for most studied traits. The other parents showed different trends for all studied traits in both locations.

The results of the combined data cleared that the variety P_4 showed the highest and significant values of g_i for D.1st M.F (undesirable), F.D (cm) ,F.W (g) and F.S (cm^3) traits. In the same time,(P_1) showed positive and significant values of (g_i) for N.F/P., F.Y/Pt.(kg) , F.W. (g) and F.S.(cm^3), traits, while (P_3) was the best for, D1st F.F, D1st M.F (earlier and desirable), F.L (cm) and F.Sh.I traits. This finding suggested that P_4 was the best combiner for some traits followed by P_1 and P_3 for some traits among this set of varieties . This results were in agreement with the obtained values of the means of F_1 hybrids, where any hybrid included P_4 and/or P_1 and/or P_3 gave highly mean values .It could be noticed that no specific variety showed best combiner for all studied traits. Specific combining ability effects (S_{ij}) for all 12 hybrids were estimated and the results are shown in Table 8.

Concerning earliness traits, the combined analysis showed that 3 and 2 out of all studied hybrids exhibited negative significant and desirable values of SCA effects for D.1st F.F and D.1st M.F. traits, respectively. In contrast, there were 4,4,2 and 2 hybrids showed positive estimates of SCA effects for N.F./P., F.Y./Pt (kg), F.W. (g) and F.S.(cm^3) traits.

The combined data illustrated that some crosses showed positive values of S_{ij}. These crosses were P_2 x P_4 for N.F./P., F.Y./Pt (kg), F.D. (cm) and F.S (cm^3) and P_1 x P_3 for N.F./P, F.Y./Pt (kg), F.D (cm) and F.S (cm^3). The other combinations showed different values of S_{ij} for different studied traits. It could be noticed that the good expression of most combinations was noticed in the second location (Kalabsho). Thus, it could be recommended that the most of these genetic materials of squash are referable in such sandy land. On the other hand, due to the participation of additive and non-additive genetic factors in the inheritance of most studied traits, It could be concluded that the proper breeding program for improving these traits is recurrent selection procedure.

Table 7: General combining ability effects (gi) of the four parents for all studied traits from each location and their combined data.

Parents	Locations	D. 1st F.F	D. 1st M.F.	N.F./P.	F.Y./Pt (kg)	F.L. (cm)	F.D. (cm)	F.Sh. I	F.W.(g)	F.S(cm^3)
P_1	L_1	-.0529	-0.296	1.842**	3.495**	0.454	0.078*	0.247**	12.03**	3.279
	L_2	0.775**	1.025**	2.750**	4.212**	-0.175	-0.174**	0.049	5.388**	14.65**
	Comb.	0.123	0.365	2.296**	3.853**	0.140	-0.048	0.148	8.706**	8.965**
P_2	L_1	0.679	-0.704	-1.217**	-2.637**	-1.229**	-0.325**	-0.131	-10.05**	4.513*
	L_2	0.300	-0.250	-2.492**	-3.117**	0.750**	0.149**	0.170**	-1.313	1.100
	Comb.	0.490	-0.477	-1.854**	-2.877**	-0.240	-0.088**	0.020	-5.681**	2.806
P_3	L_1	-1.15*	-0.929	0.717*	-2.356**	1.346**	-0.705**	0.813**	-26.90**	-32.84**
	L_2	-0.525*	-1.75**	-0.658*	-1.285**	1.775**	-0.284**	0.746**	-2.360	-15.63**
	Comb.	-0.835*	-1.340**	0.029	-1.820	1.560**	-0.494**	0.780**	-14.63**	-24.23**
P_4	L_1	0.996*	1.929**	-1.342**	1.498*	-0.571*	0.953**	-0.929**	24.93**	25.05**
	L_2	-0.550*	0.975**	0.400	0.190	-2.350**	0.309**	-0.965**	-1.713	-0.125
	Comb.	0.223	1.452**	-0.471	0.844	-1.460**	0.631**	-0.947**	11.61**	12.46**
L.S.D $(gi)_{0.05}$	L_1	0.931	1.063	0.579	1.150	0.458	0.074	0.181	3.457	3.943
	L_2	0.425	0.545	0.611	0.912	0.437	0.056	0.12	3.194	2.647
	Comb.	0.706	0.825	0.581	1.014	0.437	0.061	0.149	3.249	3.279
L.S.D $(gi)_{0.01}$	L_1	1.263	1.44	0.786	1.562	0.622	0.100	0.246	4.693	5.353
	L_2	0.577	0.740	0.829	1.239	0.593	0.076	0.163	4.336	3.593
	Comb.	0.944	1.102	0.776	1.354	0.584	0.082	0.199	4.341	4.380

*,** Significant and highly significant at 0.05 and 0.01 probability levels, respectively.

Table 8: Specific combining ability effects of the 12 hybrids for all studied traits.

Hybrids	Locations	D. 1st F.F	D. 1st M.F.	N.F./P.	F.Y./Pt (kg)	F.L. (cm)	F.D. (cm)	F.Sh. I	F.W.(g)	F.S(cm³)
$P_1 \times P_2$	L_1	0.17	0.58	1.70**	0.34	0.44*	-0.73**	0.59**	-14.2**	-16.7**
	L_2	1.78**	1.14**	-1.73**	-1.41**	-0.06	-0.30**	0.26**	2.88	-0.15
	Comb.	0.97**	0.86*	-0.01	-0.53	0.19	-0.52**	0.42**	-5.65**	-8.4**
$P_1 \times P_3$	L_1	0.29	-0.34	0.93**	0.32	0.12	-0.30**	0.39**	-5.83**	19.2**
	L_2	-0.05	0.34	2.86**	1.97**	-0.63**	0.41**	-0.56**	-6.67**	17.4**
	Comb.	0.12	0.001	1.89**	1.15*	-0.26	0.06*	-0.08	-6.25**	18.3**
$P_1 \times P_4$	L_1	-0.46	-0.24	-2.63**	-0.66	-0.56*	1.03**	-0.98**	20.0**	-2.53
	L_2	-1.73**	-1.48**	-1.13**	-0.56	0.69**	-0.10**	0.30**	3.78*	-17.2**
	Comb.	-1.09**	-0.86*	-1.88**	-0.61	0.06	0.46**	-0.34**	11.9**	-9.88**
$P_2 \times P_3$	L_1	-0.46	-0.24	-2.63**	-0.66	-0.56*	1.03**	-0.98**	20.0**	-2.53
	L_2	-1.73**	-1.48**	-1.13**	-0.56	0.69**	-0.10**	0.30**	3.78*	-17.2**
	Comb.	-1.09**	-0.86*	-1.88**	-0.61	0.60**	0.46**	-0.34**	11.9**	-9.88**
$P_2 \times P_4$	L_1	0.29	-0.34	0.93**	0.32	0.12	-0.30**	0.39**	-5.82**	19.2**
	L_2	-0.05	0.34	2.86**	1.97**	-0.63**	0.41**	-0.55**	-6.67**	17.4**
	Comb.	0.12	0.001	1.89**	1.15*	-0.26	0.06*	-0.08	-6.25**	18.3**
$P_3 \times P_4$	L_1	0.17	0.58	1.70**	0.34	0.44	-0.73**	0.59**	-14.2**	-16.7**
	L_2	1.775**	1.14**	-1.73**	-1.40**	-0.058	-0.30**	0.26**	2.88	-0.15
	Comb.	0.97**	0.86*	-0.01	-0.53	0.19	-0.52**	0.42**	-5.65**	-8.4**
$P_2 \times P_1$	L_1	-1.80*	-1.00	2.20**	0.35	-0.05	-0.36**	0.56**	-13.5**	-14.1**
	L_2	-1.80**	-0.55	3.02**	4.34**	-0.55	-0.16**	0.06	3.30	2.2
	Comb.	-1.80**	-0.78	2.61**	2.35**	-0.30	-0.26**	0.31*	-5.08	-5.96*
$P_3 \times P_1$	L_1	-1.00	-0.05	4.13**	4.82**	-0.20	-0.38**	0.63**	3.05	0.77
	L_2	-0.35	0.25	-2.23**	-0.98	0.60	-0.13**	0.35**	6.06*	5.3*
	Comb.	-0.68	0.10	0.95*	1.92*	0.20	-0.26**	0.49**	4.83	3.03
$P_4 \times P_1$	L_1	1.68*	-0.12	1.65**	2.42*	-1.50**	-0.89**	0.04	-5.10	-22.2**
	L_2	2.55**	0.75	-1.7**	-0.61	-0.90*	0.42**	-0.69**	7.20**	-8.3**
	Comb.	2.12**	0.32	-0.03	0.90	-1.20**	-0.23**	-0.33**	1.05	-15.3**

Table 8: Cont.

Hybrids	Locations	D. 1st F.F	D. 1st M.F.	N.F./P.	F.Y./Pt (kg)	F.L. (cm)	F.D. (cm)	F.Sh. I	F.W.(g)	F.S(cm^3)
P_3 x P2	L_1	-1.05	-0.85	1.15*	-3.47**	-0.23	-0.95**	0.77**	-45.0**	-14.5**
	L_2	3.70**	4.25**	0.10	0.27	0.05	-0.05	0.10	0.75	-8.65**
	Comb.	1.33*	1.7*	0.63	-1.60	-0.09	-0.5**	0.43**	-22.13**	-11.6**
P_4 x P2	L_1	-0.75	-1.20	0.75	-5.43**	0.70	-1.41**	1.21**	-54.0**	-61.7**
	L_2	0.15	-0.60	-1.75**	-2.84**	1.20**	-0.67**	0.71**	-5.55*	-31.1**
	Comb.	-0.30	-0.90	-0.50	-4.14**	0.95*	-1.04**	0.96**	-29.8**	-46.4**
P_4 x P3	L_1	0.50	-0.20	0.05	-0.17	-0.30	-0.15*	0.09	-1.7	3.6
	L_2	-1.05**	-0.20	0.80	0.26	0.20	-0.16**	0.28**	-4.15	-13.6**
	Comb.	-0.27	-0.20	0.43	0.05	-0.05	-0.15**	0.18	-2.93	-5.0
L.S.D	L_1	0.877	1.0	0.546	1.084	0.432	0.070	0.171	3.259	3.718
$(sij)_{0.05}$	L_2	0.40	0.514	0.576	0.860	0.412	0.053	0.113	3.011	2.496
	Comb.	0.66	0.777	0.547	0.956	0.412	0.058	0.140	3.063	3.091
L.S.D	L_1	1.191	1.361	0.741	1.472	0.587	0.095	0.232	4.425	5.047
$(sij)_{0.01}$	L_2	0.544	0.697	0.781	1.185	0.559	0.072	0.153	4.088	3.388
	Comb.	0.890	1.039	0.731	1.277	0.551	0.077	0.187	4.093	4.130
L.S.D	L_1	1.520	1.736	0.946	1.879	0.749	0.122	0.296	5.646	6.440
$(rij)_{0.05}$	L_2	0.694	0.890	0.998	1.490	0.714	0.092	0.196	5.216	4.323
	Comb.	1.153	1.347	0.949	1.656	0.714	0.101	0.243	5.306	5.354
L.S.D	L_1	2.063	2.357	1.284	2.550	1.017	0.166	0.402	7.664	8.742
$(rij)_{0.01}$	L_2	0.942	1.208	1.354	2.023	0.969	0.123	0.266	7.080	5.868
	Comb.	1.54	1.80	1.267	2.212	0.954	0.135	0.325	7.089	7.153

*,** Significant and highly significant at 0.05 and 0.01 probability levels, respectively.

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تـأثير التفاعـل بـين التراكيـب الوراثيـة والمواقـع علـى الصـفات الإقتصـادية لقـرع الكوسة.

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- أجريت هذه الدراسة لإيضاح طبيعة السلوك الوراثى للصفات الاقتصادية فى قرع الكوسة فى موقعين مختلفين هما :- محطة بحوث البرامون (L_1) التابعة لمركز البحوث الزراعية ومزرعة مركز التجارب والبحوث الزراعية بقلابشو(L_2) التابعة لكلية الزراعة- جامعة المنصورة.
- استخدم فى هذا البحث أربعة أصناف من قرع الكوسة وتم التهجين بينها بنظام التزاوج الدورى الكامل للحصول على ستة هجن وستة هجن عكسية.
- أظهرت النتائج وجود إختلافات معنوية بين جميع التراكيب الوراثية وكذا التفاعل بين التراكيب الوراثية والمواقع.
- أوضحت النتائج ان متوسطات الهجن قد فاقت معنوياً متوسطات آبائها لمعظم الصفات محل الدراسة ، وبالتالى تم الحصول على قيم معنوية لقوة الهجين مقارنة بمتوسط الآباء. وكانت أعلى القيم التى تم الحصول عليها هى ١٣٥,٤% للهجين (الأب الرابع x الأب الثانى) وذلك لصفة محصول الثمار لكل وحدة تجريبية ،١٦٧% للهجين (الأب الأول x الأب الثالث) لنفس الصفة فى الموقع الثانى.
- أظهرت النتائج أيضاً وجود بعض هجن الجيل الأول المبشرة التى فاقت متوسطاتها أفضل الآباء. وبالتالى أظهرت قوة هجين مرغوبة. وكانت أعلى القيم التى تم الحصول عليها هى ١٩٤,٦% لصفة محصول الثمار فى الوحدة التجريبية وذلك للهجين (الأب الثانىx الأب الثالث) فى الموقع الثانى.
- أظهرت نتائج تحليل التباين أن متوسط مربعات القدرة العامة والقدرة الخاصة على التآلف وكذلك التفاعل بين كل منهما والمواقع وجود معنوية عالية لمعظم الصفات المدروسة فى كلا الموقعين.
- فيما يتعلق بالقياسات الوراثية فقد أظهرت النتائج أهمية كل من التباين الوراثى المضيف وغير المضيف (شاملاً السيادة) فى توارث الصفات محل الدراسة. كما أظهرت نتائج الدراسة أن قيم معامل التوريث المتحصل عليها فى المدى الواسع كانت أعلى منها فى المدى الضيق لجميع الصفات.
- كما أوضحت النتائج أن الأب الأول والرابع كانا الأفضل فى تعبيرهما. وقدرتهما على التآلف وذلك فى الموقع الثانى والموقع الأول على الترتيب لمعظم الصفات التى درست.