RESULTS AND DISCUSSION

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The present investigation was carried out to study the types of gene action and heterosis in some genotypes of soybean by means of diallel cross system in two planting dates. A half diallel cross set involving six parents namely; Clark (P_1), Giza 83 (P_2), Ware (P_3), Holladay (P_4), L 86-k-73 (P_5) and H_2L_{12} (P_6), were used in this concern. To evaluate the parents and their 21 F_1 crosses and the parents and their 21 F_2 crosses, two adjacent experiments were conducted at early and late planting dates in each generation. A randomized complete block design with three replications were carried out at the

Data were recorded on all genotypes for yield, yield components and some botanical characters. For better representation and discussion of the results obtained herein, it was performed to outline these results into five main parts, analysis of variance and mean performance, heterosis, combining ability, genetic components and graphical analysis.

1. Analysis of Variance and Mean Performance :

1.1. F_1 generation :

The analysis of variance for each experiment and the combined between them for agronomic attributes are presented in Table (7).

Planting date mean squares for all agronomic attributes under study were highly significant, with mean values in early planting date being higher than those in late planting one for all the studied traits (Table 7). The increase in these traits at early planting date may be due to the prevailing of favourable temperature and day length leading to greater of these attributes of soybean plants. These results are in harmony with those obtained by **Sweeney *et al.* (1995), Akram (1996), Steele and Grabau (1997), Kane *et al.* (1997 a&b), Board *et al.* (1999)** and **Popp *et al.* (2002).**

Genotypes mean squares reached the significance level of probability for all traits in both planting dates as well as the combined analysis (Table 7), indicating the wide diversity between the parental materials used in the present study. Significant genotypes by planting dates were detected for all the studied traits, indicating that the genotypes behaved somewhat differently from planting date to another.

Results also showed that mean squares due to parents were highly significant for all cases except number of branches/plant and seed yield/plant in the late of planting date. Significant mean squares due to interaction between parental genotypes and planting dates were obtained for all the studied traits except number of branches/plant. These results therefore, might reveal the performance of parental genotypes differed from one planting date to another.

The mean performance of the tested parental genotypes at each planting dates as well as the combined data are presented in Table (8). The parental line L 86-k-73 (P_5) and Giza 83 (P_2) gave the lowest values of number of days to flowering and maturity in the two planting dates and the combined data. Also, two previous parents and the Ware variety (P_3) had the lowest mean values of the first pod height. However, the two parents, Holladay (P_4) and H_2L_{12} (P_6) gave the latest with regard to flowering and maturity dates. For plant height, the three parents (P_1) Clark cv. (P_2) Giza 83 cv. and (P_6) H_2L_{12} gave the highest values in both planting dates as well as the combined data. However, the parental variety Ware gave the lowest one.

For number of branches/plant, the parental variety (P_4) Holladay gave the highest values of this trait followed by (P_6) H_2L_{12} in the early sowing date. However, the parental varieties Ware (P_3) and Holladay (P_4) had the highest values in the late of planting date. Holladay (P_4) gave the highest number of branches/plant at the combined data.

With respect to number of pods/plant, number of seeds and seed yield/plant, the two parents, Giza 83 (P_2) and H_2L_{12} (P_6) gave the highest values of these traits in both planting dates as well as the combined analysis. While, the parental variety Ware (P_3) gave the heavier seed index followed by variety Clark (P_1) in late planting date and the combined data.

Data presented in Table (7) showed that crosses mean squares were highly significant for all the studied traits in the separate planting dates as well as the combined data. Mean squares due to interaction between F_1 hybrids and planting dates was significant for all the studied traits, indicating that F_1 hybrids behaved somewhat differently from planting date to another.

The mean performance of the tested 21 crosses at each planting dates as well as the combined data are presented in Table (8). The cross (P_2xP_5) was the best for number of days to flowering, maturity and first pod height in the combined analysis. Also, it had the lowest seed yield, 100-seed weight and plant height. Meanwhile, the cross (P_2xP_5) had the earliest for number of days to flowering and maturity but without significant superiority over those of cross (P_1xP_5) for maturity date only. The crosses (P_2xP_4) and (P_1xP_6) gave the lowest values of first pod height in early and late planting dates, respectively. While, the cross

(P_2xP_5) showed the lowest value of first pod height in the combined data without significant superiority over those of crosses (P_1xP_2), (P_1xP_4), (P_1xP_5), (P_1xP_6), (P_2xP_6) and (P_4xP_5).

For plant height, the cross (P_3xP_6) gave the highest value at early planting date followed by cross (P_4xP_6) and then by cross (P_2xP_3). Meanwhile, the cross (P_2xP_6) had the highest value of plant height without significant differences with crosses (P_2xP_3) and (P_2xP_4) at the late of planting date. However, the three crosses (P_3xP_6), (P_4xP_6) and (P_2xP_3) showed the highest values in the combined analysis.

For number of branches per plant, the cross (P_2xP_4) gave the highest values in both sowing dates as well as the combined analysis. Also, the cross (P_2xP_3) followed by two crosses (P_1xP_3) and (P_1xP_4) exhibited significant higher number of branches/plant in the combined analysis.

For number of pods, number of seeds and grain yield per plant, the cross (P_2xP_4) significant surpassed the other hybrids for these traits in the late sowing dates as well as the combined analysis. The increase in seed yield/plant resulted from the increase in number of pods/plant and number of seeds/plant for the genotype of (P_2xP_4). Also, the second high hybrid in the combined data was (P_2xP_3) for grain yield followed by cross (P_1xP_3) and the both crosses were the earliest for maturity date. The high seed yield/plant in the previous crosses could be attributed to its high number of seeds and pods/plant. Also, the diversity between two parents gave the high seed yield, number of seeds and pods/plant.

For 100-seed weight, the cross (P_3xP_6) gave the highest mean value in the combined analysis but it did not deviate significantly from those for the crosses (P_3xP_5) and (P_2xP_3).

1.2. F_2-generation :

The analysis of variance for each experiment and the combined between them for agronomic attributes are presented in Table (9).

Highly significant planting date mean squares were detected for all the agronomic attributes, with mean values in early planting date being higher than those in late planting one for all the studied traits (Table 9). The increase in these traits at early planting date may be due to the prevailing of favourable temperature and day length leading to greater of these attributes of soybean plants. This finding is in harmony with that reached above in the F_1 data (Table 7). **Sweeny *et al.* (1995), Akram (1996), Steele and Grabau (1997), Kane *et al.* (1997 a&b), Board *et al.* (1999) and Popp *et al.* (2002).**

Highly significant genotypes mean squares were detected for all agronomic attributes in both planting dates as well as the combined data (Table 9). Significant genotypes by planting dates were detected for all traits except number of branches, and number of seeds/plant. Such results indicated that the tested genotypes varied from each other, and ranked differently from planting date to another. For two exceptional traits significant genotypes mean squares along with insignificant genotypes by planting dates interaction mean squares were detected. These findings, therefore, might revealed the high reputability of the tested genotypes under different planting dates. Also, it may reflect the minor role of the non-additive type of gene action on the exception of these traits.

Results showed that mean squares due to parents were significant for all the studied traits except first pod height and seed yield/plant at late of planting date and number of branches/plant at early planting date and the combined analysis. Significant mean squares due to interaction between parents and planting dates were detected for all the studied traits except number of branches, seeds and pods/plant. Also, it revealed that parental genotypes varied in their response to planting dates in these traits.

Also, the results showed that mean squares due to hybrids were significant for all the studied traits except for number of branches/plant at early planting date. Significant mean squares due to interaction between crosses and planting dates were obtained for all the studied traits except for first pod height, plant height, number of branches per plant and number of seeds/plant.

The mean performances of genotypes of soybean at separate of planting dates as well as the combined analysis are presented in Table (10). Results indicated that the two crosses (P_1xP_4) and (P_5xP_6) which were earlier in flowering date. Meanwhile, the cross (P_1xP_5) exhibited significantly differ than those other genotypes followed by cross (P_2xP_5) for maturity date and first pod height in the combined analysis.

For plant height, number of pods/plant, number of seeds, seed yield/plant and 100-seed weight, the hybrids were within range of parental genotypes.

For plant height, the cross (P_4xP_6) gave the highest mean value in the combined analysis but without significant superiority over those of crosses (P_1xP_4), (P_1xP_6), (P_2xP_3), (P_2xP_6) and (P_5xP_6) and parental line H_2L_{12}.

For number of branches/plant, the seven crosses (P_3xP_6), (P_1xP_4), (P_1xP_6), (P_2xP_4), (P_3xP_4), (P_3xP_5) and (P_4xP_5) had the highest mean values in the combined analysis. However, the parental variety Clark (P_1) gave the lowest one.

Results showed that the number of pods and seeds/plant, 100-seed weight and seed yield/plant, none of the hybrids surpassed the high parent (Table 10).

For number of pods/plant, the parental variety Giza 83 gave the highest value in the combined analysis, but without significant differences with crosses (P_1xP_4), (P_1xP_6), (P_2xP_3), (P_2xP_4), (P_3xP_5), (P_3xP_6), (P_4xP_5) and (P_4xP_6). However, the parental variety Ware gave the lowest one.

For number of seeds/plant, the parents (P_2) Giza 83, (P_5) L86-k-73 and (P_6) H_2L_{12} and the crosses (P_1xP_4), (P_3xP_5) and (P_3xP_6) at the early planting date, parental line (P_6) H_2L_{12} and crosses (P_1xP_6) and (P_2xP_4) at the late planting date, and four parents (P_2) Giza 83, (P_4) Holladay, (P_5) L86-k-73 and (P_6) H_2L_{12} and crosses (P_1xP_4), (P_1xP_6) and (P_2xP_4) in the combined analysis gave the highest values for this trait.

For 100-seed weight, the parental variety Ware (P_3) gave the highest value followed by cross (P_3xP_4) in the combined analysis.

Regarding seed yield/plant, the cross (P_1xP_4) gave the highest mean value but without significant superiority over those of parents (P_2) Giza 83, (P_4) Holladay and (P_6) H_2L_{12} and crosses (P_1xP_4), (P_1xP_6), (P_2xP_3), (P_2xP_4), (P_2xP_6), (P_3xP_4), (P_3xP_5), (P_3xP_6), (P_4xP_5) and (P_4xP_6) in the combined analysis. The increase in seed yield/plant resulted from the increase in number of pods/plant and number of seeds/plant for the genotype of (P_2) Giza 83.

Table (7): Observed mean squares for F1 crosses from analysis of variance for all studied traits in each planting dates as well as combined analysis.

Source of variance	d.f.		Flowering days			Maturity days			First pod height (cm)		
	Single	Comb.	S1	S2	comb	S1	S2	comb	S1	S2	Comb
Replication	2		4.63*	0.33		9.33*	0.21		0.39	0.36	
Sowing dates		1			373.72**			9291.46**			105.84**
Rep. with sowing dates		4			2.48			4.77			0.38
Genotypes	20	20	56.02**	60.34**	100.27**	660.60**	401.42**	1006.82**	16.47**	5.12**	11.29**
Parents	5	5	70.32**	131.33**	193.83**	536.22**	206.27**	605.91**	9.08**	1.27	5.44**
Crosses	14	14	48.21**	33.70**	61.75**	739.26**	499.51**	1213.38**	18.34**	6.81**	12.88**
P. vs. Crosses	1	1	93.73**	78.23**	171.61**	181.84**	3.97	119.48**	27.32**	0.68	18.31**
Genotype x Sowing		20			16.09**			55.21**			10.30**
Parents x Sowing		5			7.83**			136.58**			4.90**
Crosses x Sowing		14			20.16**			25.39**			12.26**
P. vs. Crosses x Sowing		1			0.35			65.83**			9.69**
Error	40	80	1.25	1.25	1.25	2.37	1.91	2.14	0.73	0.53	0.63

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

S1, S2 and Comb. Early, late planting dates and the combined analysis, respectively.

Table (7):cont.

Source of variance	d.f.		plant height (cm)			Number of branches/pl.			Number of pods/plant		
	Single	Comb.	S1	S2	Comb	S1	S2	Comb	S1	S2	Comb
Replication	2		0.44	13.36		0.06	0.20		64.87	8.33	
Sowing dates		1			11940.66**			70.94**			93606.48**
Rep. with sowing dates		4			6.90			0.13			36.60
Genotypes	20	20	864.73**	387.77**	849.56**	13.13**	4.26**	14.21**	10986.08**	2416.88**	10046.06**
Parents	5	5	911.28**	291.38**	1023.29**	2.20**	1.17	2.70**	2323.13**	674.50**	2641.11**
Crosses	14	14	525.40**	447.56**	624.78**	11.33**	3.35**	10.94**	11543.22**	2480.70**	9823.66**
P. vs. Crosses	1	1	538.56**	32.76	3127.57**	92.88**	32.39**	117.48**	46500.94**	10235.23**	50184.31**
Genotype x Sowing		20			402.96**			3.18**			3356.90**
Parents x Sowing		5			179.37**			0.67			356.52**
Crosses x Sowing		14			348.18**			3.74**			4200.26**
P. vs. Crosses x Sowing		1			2287.75**			7.79**			6551.85**
Error	40	80	7.80	10.34	9.07	0.35	0.50	0.42	77.79	21.95	49.87

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

S1, S2 and Comb. Early, late planting dates and the combined analysis, respectively.

Table (7):cont.

Source of variance	d.f.		Number of seeds/plant			100 Seed weight (gm)			Seed yield /plant (gm)		
	Single	Comb.	S1	S2	comb	S1	S2	comb	S1	S2	comb
Replication	2		122.94**	1.24		0.49	0.89		1.01	0.80	
Sowing dates		1			391910.3**			198.33**			16105.35**
Rep. with sowing dates		4			62.09			0.69			0.91
Genotypes	20	20	63046.41**	18989.46**	60068.16**	25.04**	23.22**	37.15**	1972.54**	382.79**	1510.71**
Parents	5	5	14786.96**	3689.44**	15905.67**	31.25**	53.75**	81.32**	166.88**	6.40	101.88**
Crosses	14	14	68062.84**	19383.43**	58189.73**	24.19**	12.59**	23.89**	2174.99**	460.20**	1566.12**
P. vs. Crosses	1	1	234113.6**	89973.94**	307178.6**	5.99**	19.38**	1.91	8166.64**	1180.90**	7779.24**
Genotype x Sowing		20			21967.71**			11.12**			844.62**
Parents x Sowing		5			257.72**			3.68**			71.41**
Crosses x Sowing		14			29256.55**			12.89**			1069.07**
P. vs. Crosses x Sowing		1			16908.92**			23.47**			1568.30**
Error	**40**	**80**	**269.55**	**25.74**	**147.64**	**0.67**	**0.65**	**0.66**	**6.58**	**4.51**	**5.54**

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

S1, S2 and Comb. Early, late planting dates and the combined analysis, respectively.

Table(8): Mean performance of parents and F1's for all studied traits in the two planting dates as well as combined data.

Genotypes	Flowering days			Maturity days			First pod height (cm)			Plant height (cm)			No. of branches/plant		
	S1	S2	Comb.	S1	S2	Comb.	S1	S2	Comb.	S1	S2	Comb.	S1	S2	Comb.
P1(Clark)	35.00	30.00	32.50	121.00	114.00	117.50	7.40	5.59	6.50	62.64	56.12	59.38	3.05	2.37	2.71
P2 (Giza 83)	32.00	29.00	30.50	115.67	105.33	110.50	5.21	5.60	5.40	62.65	61.65	62.15	2.71	2.20	2.45
P3 (Ware)	35.00	29.00	32.00	118.33	111.33	114.83	5.35	4.80	5.08	35.65	35.77	35.71	3.58	3.63	3.60
P4 (Holladay)	44.67	45.33	45.00	141.67	110.00	125.83	5.46	6.44	5.95	41.25	44.08	42.67	4.97	3.65	4.31
P5 (L 86 K73)	31.00	27.67	29.33	108.00	94.67	101.33	5.30	4.63	4.97	47.44	43.33	45.39	3.13	2.98	3.06
P6 (H2L12)	36.00	33.00	34.50	138.67	118.67	128.67	9.49	5.40	7.44	82.97	55.68	69.33	4.29	2.62	3.45
P1 x P2	33.33	32.33	32.83	117.33	103.00	110.17	6.67	4.77	5.72	71.94	47.40	59.67	3.77	3.34	3.55
P1x P3	37.00	30.00	33.50	113.67	103.00	108.33	11.67	3.03	7.35	79.22	27.21	53.22	9.83	4.00	6.92
P1 x P4	44.00	34.33	39.17	140.00	120.00	130.00	5.19	6.64	5.92	78.95	53.22	66.09	6.06	5.99	6.03
P1 x P5	35.00	32.00	33.67	105.00	91.00	98.00	7.04	4.47	5.76	55.42	47.00	51.21	3.29	4.27	3.78
P1x P6	38.67	39.00	38.83	113.00	100.00	106.50	6.87	3.45	5.16	79.00	42.69	60.85	5.27	3.95	4.61
P2 x P3	41.33	32.00	36.67	115.33	95.33	105.33	12.11	7.33	9.72	85.56	63.56	74.56	9.00	5.22	7.11
P2 x P 4	37.00	34.00	35.50	144.67	124.00	134.33	4.00	7.03	5.52	80.33	67.94	74.14	9.44	7.25	8.35
P2 x P5	32.00	30.00	31.00	103.00	91.33	97.17	5.67	4.39	5.03	78.33	32.53	55.43	6.42	4.11	5.26
P2 x P6	41.00	40.00	40.50	116.67	94.00	105.33	6.67	4.06	5.66	68.99	68.45	68.72	4.89	3.03	3.96
P3 x P4	43.00	41.00	42.00	143.33	120.33	131.83	7.08	6.97	7.03	43.08	41.75	42.42	5.68	4.13	4.91
P3 x P5	37.00	34.67	35.83	140.00	119.33	129.67	9.20	6.74	7.97	80.45	58.06	69.26	6.51	4.17	5.61
P3 x P6	44.00	35.00	39.50	138.00	118.33	128.17	12.21	6.78	9.50	99.03	58.03	78.53	6.53	4.35	5.44
P4 x P5	34.00	35.33	34.67	141.67	121.67	131.67	8.06	4.40	6.23	76.63	44.21	60.42	6.89	4.62	5.75
P4 x P6	42.00	37.00	39.50	144.00	124.00	134.00	7.49	7.36	7.42	89.11	60.70	74.94	6.68	4.79	5.74
P5 x P6	35.00	35.33	35.17	139.00	118.00	128.50	7.47	6.61	7.04	72.37	52.71	62.54	4.37	3.64	4.00
Mean	37.54	34.10	35.82	126.57	109.40	117.98	5.54	4.04	4.79	70.05	50.58	60.31	7.41	5.58	6.49
L.S.D. 0.05	1.85	1.85	1.82	2.54	2.28	2.37	1.41	1.20	1.29	4.61	5.31	4.89	0.97	1.17	1.06
L.S.D. 0.01	2.47	2.47	2.41	3.96	3.05	3.18	1.89	1.61	1.71	6.16	7.10	6.49	1.30	1.56	1.40
X P	35.61	32.33	33.97	123.89	109.00	116.44	6.37	5.41	5.89	55.43	49.44	52.44	3.62	2.91	3.26
X F1	38.29	34.80	36.56	127.64	109.55	118.60	7.83	5.60	6.74	75.89	51.03	63.47	6.31	4.46	5.40

Table (8): cont.

Genotypes	No. of pods/plant			No. of seeds/plant			100 Seed weight (gm)			seed yield/plant (gm)		
	S1	S2	Comb.	S1	S2	Comb.	S1	S2	Comb.	S1	S2	Comb.
P1(Clark)	80.73	54.71	67.72	186.46	150.89	168.68	15.51	13.03	14.27	26.92	18.39	22.66
P2 (Giza 83)	134.44	76.74	105.52	312.35	170.34	241.34	13.88	12.01	12.94	41.46	20.78	31.12
P3 (Ware)	55.89	40.19	48.04	114.90	87.46	101.18	20.94	22.46	21.70	25.42	21.66	23.54
P4 (Holladay)	89.12	70.83	79.98	232.38	159.59	195.99	16.30	14.68	15.49	36.91	22.50	29.71
P5 (L 86 K73)	111.90	76.57	94.24	248.30	165.80	207.05	11.36	11.29	11.33	24.62	20.08	22.35
P6 (H2L12)	112.22	75.00	93.61	278.85	189.70	234.27	14.00	11.65	12.83	38.45	21.64	30.05
P1 x P2	80.16	63.03	71.60	191.17	170.84	181.00	12.53	12.03	12.30	23.86	20.03	21.95
P1x P3	261.17	54.67	157.92	610.34	127.64	368.99	19.97	9.73	14.85	119.61	11.69	65.65
P1 x P4	206.49	105.71	156.10	491.82	286.72	389.27	17.36	11.98	14.67	81.11	33.87	57.49
P1 x P5	72.21	86.00	79.11	171.35	203.93	187.64	11.68	13.16	12.42	20.03	26.16	23.10
P1x P6	152.07	103.53	127.80	265.27	262.55	263.91	16.92	11.55	14.23	42.05	28.81	35.43
P2 x P3	211.00	125.22	168.11	590.78	284.22	437.50	15.89	15.97	15.93	92.94	44.51	68.73
P2 x P 4	282.33	174.00	228.17	593.50	471.55	532.53	14.76	13.47	14.12	87.73	65.59	76.66
P2 x P5	179.83	73.11	126.47	447.00	168.78	307.85	12.31	11.28	11.80	55.07	19.57	37.32
P2 x P6	120.11	76.85	98.48	288.67	239.06	263.86	14.07	12.91	13.49	44.79	28.53	36.66
P3 x P4	92.75	74.78	83.77	220.03	188.80	204.42	20.78	18.22	19.50	45.00	33.83	39.41
P3 x P5	146.96	100.96	123.96	339.42	257.11	298.26	18.13	14.00	16.07	59.40	35.04	47.22
P3 x P6	129.98	82.05	106.02	269.70	168.87	219.29	19.58	13.75	16.67	51.72	24.02	37.87
P4 x P5	152.78	97.79	125.29	416.64	258.53	337.58	13.93	11.51	12.72	49.08	27.43	38.26
P4 x P6	162.11	102.21	132.16	294.09	246.73	270.41	16.65	12.75	14.70	50.00	30.94	40.47
P5 x P6	112.89	88.44	100.67	267.41	229.00	248.20	15.61	12.05	13.83	40.12	26.37	33.25
Mean	140.34	85.83	113.08	325.26	213.72	269.49	15.82	13.31	14.56	50.30	27.69	38.99
L.S.D. 0.05	14.55	7.73	11.47	27.09	8.37	20.05	1.35	1.33	1.32	4.23	3.50	3.82
L.S.D. 0.01	19.47	10.34	15.21	36.25	11.20	26.83	1.81	1.78	1.75	5.66	4.69	5.07
X P	97.38	65.67	81.52	228.87	153.96	191.42	15.33	14.19	14.76	32.30	20.84	26.57
X F1	157.52	93.89	125.71	363.81	237.62	300.71	16.01	12.96	14.49	57.50	30.43	43.96

Table (9): Significance of mean squares due to analysis of variance for F2's crosses for all studied traits in each planting dates as well as combined analysis.

Source of variance	d.f.		Flowering days			Maturity days			First pod height (cm)		
	Single	Comb.	S1	S2	Comb.	S1	S2	Comb.	S1	S2	Comb.
Replication	2		0.90*	2.73		4.59*	0.03		0.16	0.21	
Sowing dates		1			122.03**			9481.34**			31.94**
Rep. with sowing dates		4			1.82			2.29*			0.19
Genotypes	20	20	63.42**	66.92**	123.09**	659.29**	385.39**	986.08**	11.41**	12.26**	20.86**
Parents	5	5	101.60**	134.89**	229.71**	596.09**	204.80**	657.51**	11.85**	2.38	9.67**
Crosses	14	14	35.99**	35.23**	63.60**	713.43**	477.37**	1165.33**	10.61**	11.03**	19.94**
P. vs. Crosses	1	1	256.51**	170.77**	422.94**	217.30**	0.51	119.48**	20.36**	79.01**	89.79**
Genotype x Sowing		20			7.25**			58.59**			2.81
Parents x Sowing		5			6.78**			143.38**			4.55**
Crosses x Sowing		14			7.62**			25.47**			1.70
P. vs. Crosses x Sowing		1			4.35*			98.34**			9.58*
Error	40	80	0.19	1.48	0.83	1.39	0.30	0.84	1.66	1.85	1.75

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

S1, S2 and Comb. Early, late planting dates and the combined analysis, respectively.

Table (9): cont.

Source of variance	d.f.		plant height (cm)			No. of branches/plant			No. of pods/plant		
	Single	Comb.	S1	S2	Comb.	S1	S2	Comb.	S1	S2	Comb.
Replication	2		19.94	0.24		0.03	0.48		136.42	2.65	
Sowing dates		1			3246.33**			13.81**			30723.92**
Rep. with sowing dates		4			10.09			0.25			69.54
Genotypes	20	20	655.63**	396.94**	972.30**	1.45**	1.22**	2.09**	1095.64**	424.89**	1068.95**
Parents	5	5	1164.92**	387.12	1374.54**	0.68	1.30*	0.79	1477.39**	671.98**	1753.68**
Crosses	14	14	400.80**	355.24**	707.57**	1.12	0.95*	1.71**	1037.32**	363.20**	899.70**
P. vs. Crosses	1	1	1676.82**	1029.84**	2667.42**	9.89**	4.58**	13.96**	3.42	53.01	14.75
Genotype x Sowing		20			80.27**			0.57			451.58**
Parents x Sowing		5			177.50**			1.20			395.69
Crosses x Sowing		14			48.48			0.35			500.82**
P. vs. Crosses x Sowing		1			39.23			0.51			41.67
Error	40	80	31.88	28.75	30.32	0.58	0.45	0.51	247.23	96.21	171.72

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

S1, S2 and Comb. Early, late planting dates and the combined analysis, respectively.

Table (9): cont.

Source of variance	d.f.		Number of seeds/plant			100 Seed weight (gm)			Seed yield /plant (gm)		
	Single	Comb.	S1	S2	Comb.	S1	S2	Comb.	S1	S2	Comb.
Replication	2	0	2.49	1.03		1.82	0.14		0.33	3.05	
Sowing dates		1			119934.9**			172.55**			4634.21**
Rep. with sowing dates		4			1.76			0.98			1.69
Genotypes	20	20	6028.36**	2616.12**	7062.76	15.42**	12.87**	23.71**	151.06**	29.04**	108.59**
Parents	5	5	13317.18**	4111.91**	15292.79**	33.86**	25.67**	55.17**	173.85**	7.19	101.25**
Crosses	14	14	3703.25**	2267.64**	4537.99**	9.93**	8.05**	13.49**	151.77**	38.70**	117.25**
P. vs. Crosses	1	1	2135.73	15.80	1259.44	0.11	16.42**	9.58**	27.14	3.01	24.11
Genotype x Sowing		20			1581.71			4.59**			71.51**
Parents x Sowing		5			2136.30			4.36**			79.79**
Crosses x Sowing		14			1432.90			4.50**			73.23**
P. vs. Crosses x Sowing		1			892.08			6.94**			6.04
Error	40	80	1436.40	498.35	967.38	0.90	0.65	0.77	35.65	5.60	20.63

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

S1, S2 and Comb. Early, late planting dates and the combined analysis, respectively.

Table(10): Mean performance of parents and F2's for all studied traits in the two planting dates as well as combined data.

Genotypes	Flowering days			Maturity days			First pod height (cm)			Plant height (cm)			No. of branches/plant		
	S1	S2	Comb.	S1	S2	Comb.	S1	S2	Comb.	S1	S2	Comb.	S1	S2	Comb.
P1(Clark)	33.00	31.00	32.00	121.00	115.00	118.00	7.03	4.85	5.94	64.54	54.82	59.68	2.96	2.44	2.70
P2 (Giza 83)	31.00	29.67	30.33	116.33	107.00	111.67	6.37	4.50	5.44	68.20	61.33	64.77	3.39	2.87	3.13
P3 (Ware)	35.00	29.00	32.00	120.00	111.00	115.50	6.00	4.64	5.33	33.50	31.23	32.36	3.23	3.86	3.55
P4 (Holladay)	46.00	46.00	46.00	143.00	111.00	127.00	5.40	6.10	5.75	37.67	40.36	39.01	3.50	3.24	3.37
P5 (L 86 K73)	30.00	28.00	29.00	106.00	95.00	100.50	5.70	3.87	4.78	49.17	43.84	46.51	3.77	3.73	3.75
P6 (H2L12)	37.00	33.00	35.00	139.00	119.00	129.00	10.77	6.03	8.40	84.83	56.00	70.42	4.33	2.27	3.30
P1 x P2	31.00	30.00	30.50	118.00	103.00	110.50	6.05	5.60	5.83	62.93	54.67	58.80	3.95	3.33	3.64
P1x P3	31.00	30.00	30.50	114.00	103.00	108.50	7.88	5.53	6.71	67.30	50.83	59.07	4.31	3.26	3.79
P1 x P4	27.67	24.00	25.83	141.00	121.00	131.00	8.54	10.36	9.45	75.38	65.67	70.52	5.01	4.00	4.51
P1 x P5	31.00	28.67	29.83	106.00	92.00	99.00	5.10	5.27	5.18	61.30	47.67	54.48	3.89	3.60	3.75
P1x P6	31.00	31.00	31.00	114.00	101.00	107.50	7.97	7.65	7.81	74.51	70.49	72.50	4.20	3.91	4.06
P2 x P3	28.00	28.00	28.00	117.00	97.00	107.00	9.61	9.73	9.67	73.17	72.63	72.90	4.47	3.33	3.90
P2 x P 4	40.67	39.00	39.83	145.00	125.00	135.00	9.15	8.93	9.04	63.85	57.89	60.87	4.63	3.82	4.23
P2 x P5	29.00	30.00	29.50	104.00	91.00	97.50	4.18	3.99	4.09	47.33	36.58	41.96	3.62	3.00	3.31
P2 x P6	31.67	29.00	30.33	118.00	95.00	106.50	8.73	8.44	8.59	76.45	67.63	72.04	3.46	3.39	3.42
P3 x P4	36.00	27.67	31.83	145.00	121.00	133.00	6.81	5.84	6.33	40.91	37.10	39.00	4.71	5.02	4.87
P3 x P5	28.00	27.67	27.83	141.00	121.00	131.00	8.57	7.07	7.82	67.67	55.46	61.57	5.04	3.97	4.50
P3 x P6	30.00	30.00	30.00	139.00	117.00	128.00	9.36	7.20	8.28	73.75	57.72	65.73	5.85	4.37	5.11
P4 x P5	29.67	28.00	28.83	142.00	120.00	131.00	9.48	7.78	8.63	68.13	52.80	60.46	4.53	3.83	4.18
P4 x P6	31.00	30.00	30.50	143.00	123.00	133.00	11.27	9.79	10.53	84.73	64.73	74.73	4.42	3.33	3.88
P5 x P6	27.33	24.00	25.67	138.00	118.00	128.00	9.33	9.00	9.17	78.67	61.33	70.00	4.00	2.80	3.40
Mean	32.14	30.17	31.16	127.16	109.81	18.48	7.78	6.77	7.27	64.47	54.32	59.40	4.16	3.49	3.83
L.S.D. 0.05	0.72	2.01	1.48	1.94	0.90	1.49	2.13	2.24	2.15	9.32	8.85	8.94	1.25	1.10	1.16
L.S.D. 0.01	0.96	2.69	1.97	2.60	1.21	1.98	2.84	3.00	2.85	12.47	11.84	11.86	1.68	1.48	1.54
X P	35.33	32.78	34.06	124.22	109.67	116.95	6.88	5.00	5.94	56.30	47.93	52.13	3.53	3.07	3.30
X F2	30.87	29.13	30.00	128.33	109.87	119.10	8.14	7.48	7.81	67.74	56.88	62.31	4.41	3.66	4.04

Table (10): cont.

Genotypes	No. of pods/plant			No. of seeds/plant			100 Seed weight (gm)			seed yield/plant (gm)		
	S1	S2	Comb.	S1	S2	Comb.	S1	S2	Comb.	S1	S2	Comb.
P1(Clark)	85.56	54.81	70.19	185.56	148.67	167.11	14.41	12.69	13.55	27.96	18.43	23.19
P2 (Giza 83)	129.41	74.70	102.06	304.79	168.90	236.85	13.72	12.10	12.91	43.10	20.05	31.58
P3 (Ware)	68.43	44.18	56.31	119.27	85.50	102.38	20.75	19.71	20.23	28.10	20.12	24.11
P4 (Holladay)	88.27	81.53	84.90	220.47	163.61	192.04	17.67	13.94	15.80	36.98	22.08	29.53
P5 (L 86 K73)	96.20	74.43	85.32	243.67	169.93	206.80	11.06	12.34	11.70	24.95	21.77	23.36
P6 (H2L12)	116.73	78.47	97.60	277.20	193.63	235.42	15.30	12.54	13.92	40.75	22.46	31.61
P1 x P2	90.40	67.00	78.70	191.87	168.33	180.10	14.79	12.87	13.83	27.66	18.68	23.17
P1x P3	73.62	61.67	67.64	197.00	157.67	177.33	12.89	13.51	13.20	25.21	20.38	22.79
P1 x P4	134.93	64.00	99.47	256.31	162.90	209.61	17.22	11.51	14.36	44.48	20.76	32.62
P1 x P5	79.83	52.53	66.18	222.00	145.68	183.84	12.83	12.34	12.59	27.76	17.52	22.64
P1x P6	84.10	80.17	82.14	224.33	209.45	216.89	15.97	12.98	14.48	34.97	26.92	30.95
P2 x P3	100.56	76.10	88.33	191.94	158.23	175.09	17.73	13.94	15.84	34.20	18.48	26.34
P2 x P 4	101.22	91.27	96.25	193.95	188.83	191.39	16.60	12.25	14.42	32.33	25.76	29.05
P2 x P5	81.31	60.79	71.05	186.96	126.72	156.84	12.12	11.58	11.85	20.75	14.72	17.74
P2 x P6	93.80	56.15	74.98	244.73	164.13	204.43	14.93	11.64	13.28	36.05	19.05	27.55
P3 x P4	83.26	52.29	67.77	153.32	106.40	129.86	18.56	18.01	18.29	28.90	27.04	27.97
P3 x P5	118.97	72.94	95.95	259.17	163.99	211.58	16.15	12.63	14.39	41.59	18.83	30.21
P3 x P6	124.62	74.05	99.34	278.41	170.17	224.29	15.44	12.27	13.85	42.62	21.01	31.81
P4 x P5	105.70	63.05	84.38	202.85	125.12	163.98	15.58	12.77	14.18	31.36	19.84	25.60
P4 x P6	115.24	61.61	88.43	212.22	146.67	179.44	15.67	11.59	13.63	32.83	18.96	25.90
P5 x P6	81.67	56.23	68.95	169.00	114.67	141.83	14.42	11.45	12.94	22.11	17.08	19.59
Mean	97.80	66.57	82.19	215.95	154.25	185.10	15.42	13.08	14.25	32.60	20.47	26.54
L.S.D. 0.05	25.95	16.19	21.28	62.54	36.84	50.51	1.56	1.33	1.43	9.85	3.91	7.38
L.S.D. 0.01	34.72	21.66	28.23	83.68	49.29	66.99	2.09	1.78	1.90	13.18	5.23	9.78
X P	97.43	68.02	82.73	225.16	155.04	190.10	15.49	13.89	14.69	33.64	20.82	27.23
X F2	97.95	65.99	81.97	212.27	153.90	183.10	15.39	12.76	14.08	32.85	20.34	26.26

In most traits, the mean values were differed from planting date to another. This finding coincided with that reached above for significant genotypes by planting dates mean squares (Table 9).

It is worth mentioning the best performing F_1 crosses had better mean values than those of F_2-crosses in most of the studied traits. The crosses exhibited superiority for seed yield/plant and some of its components in the F_1 generation also produced the highest mean values in the F_2 generation (Tables 8 and 10).

2.1. Heterosis (F_1) :

Mean squares for parent vs. crosses as an indication to average heterosis overall crosses was of appreciable magnitude in both sowing dates as well as their combined for all investigated traits except maturity date, first pod height and plant height in early sowing date and 100-seed weight in the combined analysis (Table 7).

Significant mean squares due to interaction between parents vs. crosses and sowing dates were detected for all traits except flowering date. For the exceptional trait, insignificant interaction between parent vs. crosses and sowing dates was detected. These results indicated that the heterotic effect were not affected by sowing changes.

Heterosis expressed as the percentage deviation of F_1 mean performance from its mid-parent and better-parent average values for all the studied traits at both sowing dates and an average over both sowing dates are presented in Table (11).

With regard to number of days to flowering, the cross (P_4xP_5) in early sowing, three crosses (P_1xP_4), (P_2xP_4) and (P_4xP_6) in late sowing and two crosses (P_2xP_4) and (P_4xP_5) in the combined analysis, gave significant negative heterotic effects relative to mid-parent. However, ten, eight and eight crosses expressed significant positive heterotic effects relative to mid-parent in early, late sowing dates and the combined analysis, respectively. Meanwhile, fourteen, fourteen and thirteen crosses exceeded significant better-parent value in the same order. None of the crosses exhibited significant negative heterotic effects relative to better-parent. Significant negative heterotic effect for flowering date was previously detected by **Leffel and Weiss (1958), Weber *et al.* (1970), Kaw *et al.* (1979), Paschall and Wilcox (1975), Nelson and Bernard (1984), Habeeb *et al.* (1988 a), Sptaware *et al.* (1990), Malik and Singh (1991), Gadag and Upa Dhyaya (1995), Ibrahim *et al.* (1996), Bastawisy *et al.* (1997), El-Hosary *et al.* (1997), Habeeb (1998 a), Lewers *et al.* (1998 b), El-Hosary *et al.* (2000) and Mansour *et al.* (2002).**

For maturity date, five, seven and seven crosses manifested significant negative heterotic effects in early, late sowing dates and the combined analysis over mid-parent, respectively. Also, four, seven and six crosses exhibited significant negative heterotic effects relative to better-parent in the same order. Also, the cross (P_1xP_6) had highest desirable heterotic effects.

Earliness if found in soybean is favourable for escaping destructive injuries by leaf worm. The crosses (P_1xP_6), (P_1xP_3), (P_2xP_3), (P_2xP_5) and (P_2xP_6) expressed significant negative heterosis for maturity relative to better-parent. Hence, it could be concluded that these crosses are valuable in breeding for earliness and yield potentiality, whereas these crosses gave significant positive heterotic effects for seed yield/plant. These results are in agreement with **Mohamed and Kramer (1951), Hanway (1956), Anand (1962), Kwon (1962), Weber *et al.* (1970), Paschall and Wilcox (1975), Sedova (1982), Zhang and Cao (1982), Mehta *et al.* (1984), Nelson and Bernard (1984), Belic *et al.* (1985), Habeeb *et al.* (1988 b), Sptaware *et al.* (1990), El-Refaey and Radi (1991 a), Halvankar and Patil (1992), Zhang *et al.* (1992), Radi *et al.* (1993), Gadag and Upa Dhyaya (1995), Choukan (1996), Bastawisy *et al.* (1997), El-Hosary *et al.* (1997), Habeeb (1998 a), Refat (1998), El-Hosary *et al.* (2001) and Mansour (2002).**

For first pod height, six, six and five crosses expressed significant positive heterotic effects relative to mid-parent in early, late of sowing date and the combined analysis, respectively. Also, eleven, seven, and eight crosses exhibited significant positive heterotic effects relative to better-parent in the same order. However, two, four and one hybrids gave significant negative heterotic effects relative to mid-parent in the same order. While, zero, three and one crosses showed significant negative heterotic effects compared the better-parent in the same order. The cross (P_1xP_4) showed the high desirable heterotic effects for earliness. However, the cross (P_2xP_3) showed the high desirable heterotic effects form { **Belic *et al.* (1985), Bastawisy *et al.* (1997), El-Hosary *et al.* (1997), Habeeb (1998 a), Ragaa *et al.* (1998), Refat (1998), Yassien and Abd El-Mohsen (2000), El-Hosary *et al.* (2001) and Mansour *et al.* (2002)** }.

For plant height, thirteen, six and nine parental combinations exhibited significant positive heterotic effects relative to mid-parent values in early, late sowing dates as well as the combined analysis, respectively. Meanwhile, nine, three and seven crosses manifested significant positive heterotic effects relative to better-parent value in the same order. The crosses (P_3xP_5) and (P_4xP_5) had the most desirable heterotic effects for this trait. Significant positive heterotic effects for plant height was reached before by **Mohamed and Kramer (1951), Hanway (1956), Zhang and Cao (1982), Habeeb *et al.* (1988 b), Ibrahim *et al.* (1996), El-Hosary *et al.* (1997), Lewers *et al.* (1998) and Ragaa *et al.* (1998).**

For number of branches per plant, thirteen, ten and thirteen hybrids significantly exceeded the mid-parent values at early and late sowing dates as well as the combined analysis, respectively. Also, nine, seven and ten crosses from previous crosses exhibited significant positive heterotic effects relative to better parent value in the same order. The crosses (P_1xP_3), (P_2xP_3) and (P_2xP_4) had the most desirable heterotic effects for this trait. The results agreed with those reported by **Hanway (1956), Zhang and Cao (1982), Kang (1990), Sptaware *et al.* (1990), Halvankar and Patil (1992), Ibrahim *et al.* (1996), Jose Bruno (1997), Taware *et al.* (1997), El-Hosary *et al.* (2001) and Mansour *et al.* (2002).**

Concerning number of pods/plant, eleven and ten parental combinations significantly exceeded mid-parent and better-parent values, respectively, in both planting dates and the combined analysis. The cross (P_1xP_3) gave the highest value of heterotic effect for this trait followed by cross (P_2xP_4) and then by (P_1xP_4) **{Zhang and Cao (1982), Habeeb *et al.* (1988 a), Kang (1990), Ibrahim *et al.* (1996), Bastawisy (1997), Jose Bruno (1997), Habeeb (1998 a), El-Hosary *et al.* (2001) and Mansour *et al.* (2002)}.**

For 100-seed weight, eight and one hybrid showed significant positive heterotic effects relative to mid-parent value in early sowing date and the combined analysis, respectively. While, the two crosses i.e. (P_5xP_6) and (P_1xP_6) expressed significant positive heterotic effects relative to better-parent in early sowing date. Significant positive heterotic effect was reached before by **Leffel and Weiss (1958), Weber *et al.* (1970), Paschall and Wilcox (1975), Sedova (1982), Habeeb *et al.* (1988 a), Yang *et al.* (1992), Taware *et al.* (1997), Habeeb (1998 b) and El-Hosary *et al.* (2001).**

For number of seeds/plant, eleven, fourteen and thirteen parental combinations significantly exceeded the mid-parent value in early and late sowing dates and the combined analysis, respectively. While, seven, eleven and eleven hybrids from the previous crosses exhibited significant positive heterotic effects relative to better-parent value in the same order. The cross (P_2xP_4) gave the highest value of heterotic effect followed by cross (P_1xP_3) and then by cross (P_1xP_4). The same results reported by **Weber *et al.* (1970), Nelson and Bernard (1978), Kaw *et al.* (1979), Thseng (1981), Dencescu (1983), Ma *et al.* (1984), Sptaware *et al.* (1990), Yang *et al.* (1992), Ibrahim *et al.* (1996) and Mansour *et al.* (2002).**

Concerning seed yield/plant, thirteen, eleven and thirteen parental combinations significantly exceeded out of respective mid-parent value in early, late sowing dates and the combined analysis, respectively. Also, ten, eleven and twelve hybrids showed significant heterotic effect relative to better-parent in the same order. Also, the crosses (P_1xP_3), (P_2xP_3), (P_2xP_4), (P_3xP_5) and (P_1xP_4) had the highest seed yield/plant. These crosses exhibited heterosis one or more of traits contributing yield. The highest seed yield/plant resulted from the highest number of seeds/plant and 100-seed weight for the genotype (P_1xP_3). The heterotic magnitude, however, differed from case to case. This finding agrees with the general trend where the expression of heterosis for a complex trait could be explained on the basis of component interaction, as the numerical value recorded for a complex trait is always a function of its components. It could be concluded that these crosses would be efficient and prospective in wheat breeding programs for improving seed yield/plant. Significant positive heterotic effects relative to higher yielding parent were also reached before by **Mohamed and Kramer (1951), Leffel and Weiss (1958), Nelson and Bernard (1984), Belic *et al.* (1985), Choukan (1996), El-Hosary *et al.* (2001) and Mansour *et al.* (2002).**

2.2. Remain heterosis (F_2) :

Mean squares for parents vs. hybrids as an indication of average remain heterosis of over all crosses was significant for all the studied traits except number of pods/plant, number of seeds/plant and seed yield/plant in both sowing dates and the combined analysis, maturity date and 100-seed weight in early and late sowing dates, respectively (Table 9).

Remain heterosis expressed as the percentage deviation of F_2 mean performance from its mid-parent and better-parent average values for all the studied traits at two planting dates and an average over the two sowing dates are presented in Table (12).

With regard to number of days to flowering date, eleven, six and ten perantal combinations expressed significant negative heterotic effects relative to mid-parent value in early, late sowing dates and the combined over them, respectively. While, eight, three and seven exhibited significant negative remain heterosis relative to better-parent in the same order.

For maturity date, five, seven and seven parental combinations gave significant negative remain heterosis relative to mid-parent value in early, late planting dates and the combined data, respectively. Also, three, seven and six crosses expressed remain heterosis relative to better-parent in the same order. The two crosses (P_1xP_3) and (P_1xP_6) gave the highest negative remain heterotic effects. Significant negative heterotic effects in the F_2 for earliness was previously reported by **Mohamed and Kramer (1951)**, **Anand (1962)**, **Sedova (1982)**, **Zhang and Cao (1982)**, **Habeeb *et al.* (1988 b)**, **Halvankar and Patil (1992)**, **Radi *et al.* (1995)**, **Choukan (1996)**, **Bastawisy *et al.* (1997)**, **El-Hosary *et al.* (1997)**, **Habeeb (1998 b)**, **El-Hosary *et al.* (2001)** and **Mansour (2002)**.

For first pod height, six, eight and seven crosses exhibited significant positive heterotic effects in early, late planting dates and the combined analysis, respectively.

For plant height, nine, eight and nine parental combinations gave significant positive remain heterotic effects relative to mid-parent in early, late planting dates as well as the combined analysis, respectively. Also, three six, and four hybrids from the previous crosses gave significant positive remain heterosis relative to better-parent in the same order. Positive heterosis for plant height was recorded before by **Hanway (1956)**, **Kwon (1962)**, **Anand and Torrie (1963)**, **Habeeb *et al.* (1988 b)**, **Loiselle *et al.* (1990)**, **El-Hosary *et al.* (1997)**, **Lewers *et al.* (1998 b)** and **Mansour (2002)**.

For number of branches/plant, the three crosses (P_1xP_4), (P_3xP_4) and (P_3xP_6) exhibited significant positive heterosis relative to mid- and better-parent values in the combined analysis. These results agreed with **Zhang and Cao (1982), Kang (1990), El-Refay and Radi (1991 b), El-Hosary *et al.* (2001) and Mansour (2002).**

The most desirable remain heterotic effects were presented by three crosses (P_1xP_4), (P_3xP_5) and (P_3xP_6) relative to mid-parent in early sowing date and the combined analysis for number of pods/plant. While the cross (P_1xP_4) in early sowing date exhibited significant positive remain heterotic effects compared with better parent value. These findings agreed with **Anand (1962), Zhang and Cao (1962), Habeeb *et al.* (1988 a), Bastawisy (1997), Habeeb (1998 a) and Mansour (2002).**

Concerning number of seeds/plant, two, four and two parental combinations expressed significant positive remain heterosis effects relative to mid-parent values in early, late sowing dates as well as the combined analysis, respectively. None of the hybrids exhibited significant remain heterotic effects relative to mid-parent values {**Anand and Torrie (1963), Martin and Wilcox (1973), Kaw *et al.* (1979), Dencescu (1983), Yang *et al.* (1992) and Mansour (2002)**}.

For 100-seed weight the cross (P_1xP_3) gave significant positive heterotic effects relative to mid-parent in the early sowing date. However, other crosses gave significant negative or insignificant heterosis effects relative to mid- or better-parent values.

For seed yield/plant, the two crosses (P_1xP_4) and (P_3xP_5) in early sowing date and cross (P_3xP_4)) in late sowing date exhibited significant positive remain heterotic effects relative to mid- and better-parent values.

Table (11): Percentage of heterosis over both mid-parents and better parent values for F1's in the two planting dates as well as combined data.

Cross	Flowering days						Maturity days					
	S1		S2		Comb		S1		S2		Comb	
	M.P.	B.P.	M.P.	B.P.	M.P.	B.P.	M.P.	B.P.	M.P.	B.P.	M.P.	B.P.
P1xP2	-0.51	4.16	9.59**	11.48**	4.22	7.64*	-0.85	1.44	-6.08**	-2.21*	-3.36**	-0.30
P1xP3	5.71*	4.71*	1.69	3.45	3.88	4.69	-5.01**	-3.94**	-8.58**	-7.48**	-6.74**	-5.66**
P1xP4	10.46**	25.71**	-8.85**	14.43**	1.08	20.52**	6.60**	15.70**	7.14**	9.09**	6.85**	10.64**
P1xP5	6.06*	13.97**	10.98**	15.65**	8.91**	14.80**	-8.30**	-2.78*	-12.78**	-3.88**	-10.43**	-3.29**
P1xP6	8.93**	10.49**	23.81**	30.00**	15.91**	19.48**	-12.97**	-6.61**	-14.04**	-12.28**	-13.47**	-9.36**
P2xP3	23.37**	29.16**	10.34**	10.34**	17.34**	20.23**	-1.43	-0.29	-12.00**	-9.49**	-6.51**	-4.68**
P2xP4	-3.48	15.63**	-8.52**	17.24**	-5.96**	16.39**	12.43**	25.07**	15.17**	17.73**	13.68**	21.57**
P2xP5	1.59	3.23	5.88*	8.42*	3.63	5.69	-7.90**	-4.63**	-8.67**	-3.53**	-8.26**	-4.11**
P2xP6	20.59**	28.13**	29.03**	37.93**	24.62**	32.79**	-8.26**	0.86	-16.07**	-10.76**	-11.92**	-4.68**
P3xP4	7.95**	22.86**	10.32**	41.38**	9.09**	31.25**	10.25**	21.13**	8.73**	9.39**	9.56**	14.80**
P3xP5	12.12**	19.35**	22.36**	25.30**	16.84**	22.16**	23.71**	29.63**	15.85**	26.05**	19.98**	27.97**
P3xP6	23.94**	25.71**	12.90**	20.69**	18.80**	23.44**	7.39**	16.62**	2.90**	6.29**	5.27**	11.62**
P4xP5	-10.14**	9.68**	-3.21	27.68**	-6.71**	18.21**	13.49**	31.18**	18.89**	28.52**	15.93**	29.94**
P4xP6	4.13*	16.67**	-5.53*	12.12**	-0.63	14.49**	2.73**	3.84**	8.45**	12.73**	5.30**	6.49**
P5xP6	4.48	12.90**	16.47**	27.68**	10.20**	19.91**	12.70**	28.70**	10.62**	24.64**	11.74**	26.81**

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

S1, S2 and Comb. early, late planting dates and the combined analysis, respectively.

Table (11):cont.

Cross	First pod height(cm)						Plant height(cm)					
	S1		S2		Comb		S1		S2		Comb	
	M.P.	B.P.	M.P.	B.P.	M.P.	B.P.	M.P.	B.P.	M.P.	B.P.	M.P.	B.P.
P1xP2	5.79	28.02*	-14.75	-14.67	-3.87	5.93	14.84**	14.83**	-19.50**	-23.70**	-1.80	-3.99
P1xP3	83.06**	118.13**	-41.68**	-36.88**	26.94**	44.69**	61.20**	26.47**	-40.78**	-51.51**	11.94**	-10.37*
P1xP4	-19.29*	-4.95	10.39	18.78	-4.90	-0.50	51.99**	26.04**	6.23	-5.17	29.52**	11.30**
P1xP5	10.87	32.83*	-12.52	-3.46	0.44	15.90	0.96	-11.53**	-5.48	-16.25**	-2.24	-13.76**
P1xP6	-18.65*	-7.16	-37.22**	-36.11**	-25.97**	-20.62*	8.51**	-4.78**	-23.63**	-23.93**	-5.45	-12.23**
P2xP3	129.36**	132.44**	40.96**	52.71**	85.50**	91.34**	74.08**	36.57**	30.49**	3.10	52.38**	19.97**
P2xP4	-25.02*	-23.22	16.78	25.54*	-2.73	2.22	54.63**	28.22**	28.52**	10.20*	41.46**	19.29**
P2xP5	7.90	8.83	-14.17	-5.18	-2.99	1.21	42.30**	25.03**	-38.03**	-47.23**	3.09	-10.81**
P2xP6	-9.25	28.02*	-26.18**	-24.81*	-11.84	4.81	-5.25	-16.85**	16.68**	11.03*	4.53	-0.88
P3xP4	30.99**	32.34*	24.02*	45.21**	27.47**	38.39**	12.04*	4.44	4.57	-5.29	8.24	-0.59
P3xP5	72.77**	73.58**	42.95**	45.57**	58.61**	60.36**	93.65**	69.58**	46.80**	33.99**	70.80**	52.59**
P3xP6	64.56**	128.22**	32.94**	41.25**	51.76**	87.01**	66.97**	19.36**	26.91**	4.22	49.52**	13.27**
P4xP5	49.81**	52.08**	-20.51*	-4.97	14.10	25.35*	72.80**	61.53**	1.16	0.29	37.22**	33.11**
P4xP6	0.20	37.18**	24.32**	36.30**	10.83	24.71*	43.47**	7.40**	21.69**	9.02	33.82**	8.09*
P5xP6	1.01	40.94**	31.80**	42.76**	13.46	41.65**	10.99**	-12.78**	6.47	-5.33	9.03*	-9.79**

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

S1, S2 and Comb. early, late planting dates and the combined analysis, respectively.

Table (11):cont.

Cross	Number of branches/plant						Number of pods/plant					
	S1		S2		Comb		S1		S2		Comb	
	M.P.	B.P.	M.P.	B.P.	M.P.	B.P.	M.P.	B.P.	M.P.	B.P.	M.P.	B.P.
P1xP2	30.90*	23.61	46.17*	40.93	37.60*	31.00	-25.49**	-40.37**	-4.10	-17.87**	-17.34**	-32.15**
P1xP3	196.53**	174.58**	33.33	10.19	119.33**	92.22**	282.33**	223.51**	15.21*	-0.07	172.84**	133.20**
P1xP4	51.12**	21.93*	99.00**	64.11**	71.79**	39.91**	143.14**	131.70**	68.41**	49.24*	111.37**	95.17**
P1xP5	6.47	5.11	59.63**	43.29*	31.02	23.53	-25.03**	-35.47**	31.02**	12.32**	-2.31	-16.05*
P1xP6	43.60**	22.84*	58.32**	50.76*	49.68**	33.62*	57.63**	35.51**	59.63**	38.04**	58.43**	36.52**
P2xP3	186.17**	-151.4**	79.07**	43.80**	135.04**	97.50**	121.72**	56.95**	114.18**	63.17**	118.95**	59.32**
P2xP4	145.83**	89.94**	147.86**	98.63**	147.04**	93.74**	152.58**	110.00**	135.82**	126.74**	146.01**	116.23**
P2xP5	119.86**	105.11**	58.69**	37.92*	90.93**	71.90**	46.00**	33.76**	-4.62	-4.73	26.62**	19.85**
P2xP6	39.71**	13.99	25.73	15.65	34.24*	14.78	-2.61	-10.66	1.29	0.14	-1.09	-6.67
P3xP4	32.87**	14.29	13.46	13.15	24.15*	13.92	27.92**	4.07	34.71**	5.58	30.87**	4.74
P3xP5	94.04**	81.84**	26.17	14.88	68.47**	55.83**	75.17**	31.11**	72.94**	31.85**	74.25**	31.54**
P3xP6	65.95**	52.21**	39.20*	19.83	54.33**	51.11**	54.64**	15.83*	42.46**	9.40*	49.69**	13.26*
P4xP5	70.12**	38.63**	39.37*	26.58	56.04**	33.41**	52.00**	36.53**	32.69**	27.71**	43.83**	32.95**
P4xP6	44.28**	34.41**	52.79**	31.23*	47.94**	33.18**	61.03**	44.46**	40.18**	36.28**	52.27**	41.18**
P5xP6	17.79	1.86	30.00	22.15	22.89	15.94	0.74	0.60	16.70**	15.50**	7.18	6.82

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

S1, S2 and Comb. early, late planting dates and the combined analysis, respectively.

Table (11):cont.

Cross	Number of seeds/plant						100-Seed weight(gm)					
	S1		S2		Comb		S1		S2		Comb	
	M.P.	B.P.	M.P.	B.P.	M.P.	B.P.	M.P.	B.P.	M.P.	B.P.	M.P.	B.P.
P1xP2	-23.35**	-38.8**	6.36**	0.29	-11.71**	25.00**	-14.75**	-19.21**	-3.91	-7.67	-9.59*	-13.81**
P1xP3	305.06**	227.33**	7.10*	-15.41	173.47**	118.75**	9.57**	-4.63	-45.17**	-56.68**	-17.43**	-31.51**
P1xP4	134.85**	111.64**	84.69**	79.66**	113.49**	98.62**	9.15*	6.50	-13.53**	-18.39**	-1.41	-5.29
P1xP5	-21.18**	-30.99**	28.79**	23.00**	-0.12	-9.37*	-13.06**	-24.69**	8.22	1.00	-2.97	-12.96**
P1xP6	14.02**	-4.78	54.17**	38.40**	30.99**	12.65**	14.67**	9.09*	-6.40	-11.36*	5.02	-0.28
P2xP3	176.55**	89.14**	120.50**	66.85**	155.46**	81.28**	-8.73*	-24.12**	-7.34*	-28.90**	-8.03*	-26.59**
P2xP4	117.91**	90.01**	185.85**	176.83**	143.54**	120.66**	-2.19	-9.45*	0.94	-8.24	-0.67	8.84*
P2xP5	59.46**	43.11**	0.42	-0.92	37.31**	27.56**	-2.46	-11.31*	-3.18	-6.08	-2.76	-8.81
P2xP6	-2.34	-7.58	32.80**	26.02**	10.96**	9.33*	0.93	0.50	9.13	7.49	4.70	4.25
P3xP4	26.72**	-5.31	52.84**	18.30**	37.58**	4.30	11.60**	-0.76	-1.88	-18.88**	4.87	-10.14**
P3xP5	86.91**	36.70**	103.04**	55.07**	93.53**	44.05**	12.26**	-13.42**	-17.04**	-37.67**	-2.69	-25.94**
P3xP6	36.99**	-3.28	21.86**	-10.98**	30.74**	-6.39	12.08**	-6.49*	-19.38**	-38.78**	-3.45	-23.18**
P4xP5	73.35**	67.80**	58.90**	55.93**	67.52**	63.04**	0.72	-14.54**	-11.36*	-21.59**	-5.15	-17.88**
P4xP6	15.05**	5.47	41.28**	30.06**	25.70**	15.43**	9.90*	2.15	-3.15	-13.15*	3.81	-5.10
P5xP6	1.45	-4.10	28.83**	20.72**	12.48**	5.95	23.11**	11.50*	5.06	3.43	14.49**	7.79

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

S1, S2 and Comb. early, late planting dates and the combined analysis, respectively.

Table (11):cont.

Cross	seed yield per plant(gm)					
	S1		S2		Comb	
	M.P.	B.P.	M.P.	B.P.	M.P.	B.P.
P1xP2	-30.21**	-42.45**	-2.27	-3.61	-18.37*	-29.47**
P1xP3	357.05**	344.32**	-41.62**	-46.03**	184.20**	178.89**
P1xP4	154.14**	119.75**	65.66**	50.53**	119.55**	93.50**
P1xP5	-22.27*	-25.59**	36.00**	30.28**	2.64	1.94
P1xP6	28.65**	9.36	43.94**	33.13**	34.43**	17.90**
P2xP3	177.93**	124.17**	109.76**	105.49**	151.48**	120.85**
P2xP4	123.89**	111.60**	203.10**	191.51**	152.05**	146.34**
P2xP5	66.68**	32.83**	-4.21	-5.82	39.59**	19.92**
P2xP6	12.10*	8.03	34.51**	31.84**	19.86**	17.80**
P3xP4	44.39**	21.92**	53.22**	50.36**	48.02**	32.65**
P3xP5	137.41**	133.67**	67.90**	61.77**	105.80**	100.59**
P3xP6	61.95**	34.51**	10.95	10.90	41.33**	26.02**
P4xP5	59.53**	32.97**	28.84**	21.91**	46.98**	28.78**
P4xP6	32.70**	30.04**	40.19**	37.51**	35.44**	34.68**
P5xP6	27.22**	4.34	26.41**	21.86**	26.91**	10.65

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

S1, S2 and Comb. early, late planting dates and the combined analysis, respectively.

Table (12): Percentage of heterosis over both mid-parents and better parent values for F2 crosses in the two planting dates as well as combined data for all studied traits.

Cross	Flowering days						Maturity days					
	S1		S2		Comb.		S1		S2		Comb.	
	M.P.	B.P.	M.P.	B.P.	M.P.	B.P.	M.P.	B.P.	M.P.	B.P.	M.P.	B.P.
P1 x P2	-3.13	0.00	-1.10	1.11	-2.13	0.56	-0.56	1.44	-7.21**	-3.74**	-3.78**	-1.05
P1x P3	-8.82**	-6.06**	0.00	3.45	-4.69	-4.69*	-5.39**	-5.00**	-8.85**	-7.21**	-7.07**	-6.06**
P1 x P4	-29.95**	-16.15**	-37.66**	-22.58**	-33.77**	-19.28**	6.82**	16.53**	7.08**	9.01**	6.94**	11.02**
P1 x P5	-1.59	3.33**	-2.81	2.39	-2.20	2.86	-6.61**	0.00	-12.38**	-3.16**	-9.38**	-1.49*
P1x P6	-11.43**	-6.06**	-3.13	0.00	-7.46**	-3.13*	-12.31**	-5.79**	-13.68**	-12.17**	-12.96**	-8.90**
P2 x P3	-15.15**	-9.68**	-4.55	-3.45	-10.16**	-7.68**	-0.99	0.58	-11.01*	-9.35**	-5.80**	-4.18**
P2 x P 4	5.64*	31.19**	3.08	31.45**	4.36	31.32**	11.83**	24.65**	14.68**	16.82**	13.13.**	20.89**
P2 x P5	-4.92	-3.33**	4.04	7.14*	-0.56	1.72	-6.45**	-1.89*	-9.90**	-4.21**	-8.09**	-2.99**
P2 x P6	-6.85*	2.16	-7.45*	-2.26	-7.15*	0.00	-7.57**	1.44	-15.93**	-11.21**	-11.50**	-4.63**
P3 x P4	-11.11**	2.86**	-26.21**	-4.59	-18.39**	-0.53	10.27**	20.83**	9.01**	9.01**	9.69**	15.15**
P3 x P5	-13.85**	-6.67**	-2.91	-1.18	-8.75**	-4.03	24.78**	33.02**	17.48**	27.37**	21.30**	30.35**
P3 x P6	-16.67**	-14.29**	-3.23	3.45	-10.45**	-6.25**	7.34**	15.83**	1.74**	5.41**	4.70**	10.82**
P4 x P5	-21.92**	-1.10	-24.32**	0.00	-23.12**	-0.59	14.06**	33.96**	16.50**	26.32**	15.16**	30.35**
P4 x P6	-25.30**	-16.22**	-24.05**	-9.09**	-24.69**	-12.86**	1.42*	2.88**	6.96**	10.81**	3.91**	4.72**
P5 x P6	-18.42**	8.90**	-21.31**	-14.29**	-19.78**	-11.48**	12.65**	30.19**	10.28**	24.21**	11.55**	27.36**

* and ** significant at 0.05 and 0.01 levels of probability, respectively.
S1, S2 and Comb. early, late planting dates and the combined analysis, respectively.

Table (12): cont.

Cross	First pod height(cm)						Plant height(cm)					
	S1		S2		Comb.		S1		S2		Comb.	
	M.P.	B.P.	M.P.	B.P.	M.P.	B.P.	M.P.	B.P.	M.P.	B.P.	M.P.	B.P.
P1 x P2	-9.70	-5.02	19.79	24.44	2.46	7.17	-5.12	-7.73	-5.86	-10.86	-5.50	-9.22
P1x P3	20.95	31.33	16.54	19.18	19.08	25.89	37.42**	4.42	18.14	-7.28	28.36**	-1.02
P1 x P4	37.41*	58.15**	89.22**	113.61**	61.68**	64.35**	47.63**	16.96*	37.99**	19.79*	42.91**	18.16*
P1 x P5	-19.87	-10.53	20.87	36.18	-3.36	8.37	7.90	-4.89	-3.37	-13.04	2.61	-8.71
P1x P6	-10.45	13.37	40.63	57.73*	8.93	31.48	-0.17	-12.17*	27.22**	25.88**	11.45	2.95
P2 x P3	55.38**	60.17**	112.91**	116.22**	79.57**	81.43**	43.89**	7.29	56.94**	18.42*	50.11**	12.55*
P2 x P 4	55.48**	69.44**	68.49**	98.44**	61.57**	66.18**	20.62*	-6.38	13.86	-5.61	17.31*	-6.02
P2 x P5	-30.74	-26.67	-4.66	3.10	-19.96	-14.44	-19.35*	-30.60**	-30.44**	-40.36**	-24.59**	-35.22**
P2 x P6	1.87	37.05*	60.30**	87.56**	24.13	57.90**	-0.09	-9.88	15.28*	10.27	6.58	2.30
P3 x P4	19.47	26.11	8.19	25.22	14.26	18.76	14.96	8.60	3.65	-8.08	9.29	-0.03
P3 x P5	46.50*	50.35**	66.16*	82.69**	54.70*	63.60**	63.71**	37.62**	47.76**	26.51*	56.13**	32.38**
P3 x P6	11.63	56.00**	34.96	55.17*	20.61	55.35**	24.65**	-13.06**	32.34**	3.07	27.90**	-6.66
P4 x P5	70.81**	75.56**	56.07**	101.03**	63.91**	80.54**	56.91**	38.56**	25.42*	20.44*	41.39**	29.99**
P4 x P6	39.39**	108.70**	61.42**	62.35**	48.83**	83.13**	38.33**	-0.12	34.35**	15.59*	36.58**	6.12
P5 x P6	13.30	63.68**	81.82**	132.56**	39.15*	91.84**	17.42*	-7.26	22.86*	9.52	19.73*	-0.60

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

S1, S2 and Comb. early, late planting dates and the combined analysis, respectively.

Table (12): cont.

Cross	No. of branches/plant						No. of pods/plant					
	S1		S2		Comb.		S1		S2		Comb.	
	M.P.	B.P.	M.P.	B.P.	M.P.	B.P.	M.P.	B.P.	M.P.	B.P.	M.P.	B.P.
P1 x P2	24.41	16.52	25.42	16.03	24.87	16.29	-15.90	-30.14**	3.47	-10.31	-8.62	-22.89*
P1x P3	39.26	33.44	3.49	-15.54	21.28	6.76	-4.38	-13.96	24.60	12.52	6.94	-3.63
P1 x P4	55.11**	43.14*	40.85*	23.46	48.60*	33.83*	55.24**	52.86**	-6.12	-21.50*	28.27*	17.16
P1 x P5	15.60	3.18	16.69	-3.49	16.28	0.00	-12.16	-17.02	-18.71	-29.42**	-14.89	-22.43
P1x P6	15.23	-3.00	66.03**	60.25**	35.33	23.03	-16.85	-27.95*	20.30	2.17	-2.09	-15.84
P2 x P3	35.05	31.86	-1.04	-13.73	16.77	9.86	1.66	-22.29*	28.03*	1.87	11.55	-13.45
P2 x P 4	34.40	32.29*	25.04	17.90	30.15	25.52	-7.00	-21.78*	16.84	11.95	2.96	-5.69
P2 x P5	1.12	-3.98	-9.09	-19.57	-3.78	-11.73	-27.92**	-37.17**	-18.47	-18.62	-24.17*	-30.38**
P2 x P6	-10.36	-20.09	31.91	18.12	6.38	3.64	-23.78*	-27.52**	-26.68**	-28.44**	-24.89**	-26.53**
P3 x P4	39.97*	34.57	41.41*	30.05*	40.75*	37.18*	6.27	-5.68	-16.81	-35.86**	-4.02	-20.18
P3 x P5	44.00*	33.69*	4.61	2.85	23.29	20.00	44.53**	23.67	22.99	-2.00	35.49**	12.46
P3 x P6	54.76**	35.10*	42.58*	13.21	49.20**	43.93**	34.61**	6.76	20.75	-5.63	29.09*	1.78
P4 x P5	24.62	20.16	9.90	2.68	17.42	11.47	14.60	9.88	-19.15*	-22.67*	-0.86	-1.10
P4 x P6	12.90	2.08	20.87	2.78	16.34	15.13	12.43	-1.28	-22.99*	-24.43*	-3.09	-9.40
P5 x P6	-1.23	-7.62	-6.67	-24.93	-3.55	-9.33	-23.29*	-30.04**	-26.45**	-28.34**	-24.61*	-29.35**

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

S1, S2 and Comb. early, late planting dates and the combined analysis, respectively.

Table (12): cont.

Cross	No. of seeds/plant						100-Seed weight(gm)					
	S1		S2		Comb.		S1		S2		Comb.	
	M.P.	B.P.	M.P.	B.P.	M.P.	B.P.	M.P.	B.P.	M.P.	B.P.	M.P.	B.P.
P1 x P2	-21.74	-37.05**	6.01	-0.34	-10.83	-23.96*	5.15	2.64	3.83	1.42	4.54	2.07
P1x P3	29.25	6.17	34.66*	6.05	31.60	6.12	26.68**	-37.88**	-16.61**	-31.46**	-21.85**	-34.75**
P1 x P4	26.25	16.26	4.33	-0.43	16.73	9.15	7.36	-2.55	-13.56**	-17.43**	-2.15	-9.11*
P1 x P5	3.44	-8.89	-8.55	-14.27	-1.67	-11.10	0.75	-10.96*	-1.40	-2.76	-0.28	-7.08
P1x P6	-3.05	-19.07	22.38*	8.17	7.76	-7.87	7.51	4.38	2.89	2.29	5.42	4.02
P2 x P3	-9.48	-37.03**	24.39	-6.32	3.23	-26.08*	2.87	-14.55**	-12.36**	-29.27**	-4.41	-21.70**
P2 x P 4	-26.15*	-36.37**	13.28	11.50	-10.75	-19.19	5.77	-6.06	-5.91	-12.12*	0.45	-8.73
P2 x P5	-31.82**	-38.66**	-25.20**	-25.43*	-29.30**	-33.78**	-2.18	-11.66*	-5.24	-6.16	-3.70	-8.21
P2 x P6	-15.90	-19.71**	-9.45	-15.23	-13.43	-13.69	2.89	-2.42	-5.52	-7.18	-1.01	-4.60
P3 x P4	-9.74	-30.46*	-14.58	-34.97**	-11.79	-32.38*	-3.38	-10.55**	7.04*	-8.63*	1.53	-9.59**
P3 x P5	42.82**	6.36	28.40*	-3.50	36.87*	2.31	1.54	-22.17**	-21.19**	-35.92**	-9.87*	-28.87**
P3 x P6	40.44**	0.44	21.93	-12.12	32.79*	-4.73	-14.34**	-25.59**	-23.91**	-37.75**	-18.89**	-31.54**
P4 x P5	-12.59	-16.75	-24.98*	-26.37*	-17.77	-20.71	8.46	-11.83**	-2.82	-8.39	3.13	-10.25*
P4 x P6	-14.72	-23.44*	-17.89*	-24.25*	-16.04	-23.78*	-4.94	-11.32*	-12.46**	-16.86*	-8.28	-13.73**
P5 x P6	-35.11**	-39.03**	36.92**	-40.78**	-35.86**	-39.75**	9.41	-5.75	-7.96	-8.69	1.01	-7.04

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

S1, S2 and Comb. early, late planting dates and the combined analysis, respectively.

Table (12): cont.

Cross	Seed yield per plant(gm)					
	S1		S2		Comb.	
	M.P.	B.P.	M.P.	B.P.	M.P.	B.P.
P1 x P2	-22.15	-35.82**	-2.91	-6.83	-15.39	-26.63*
P1x P3	-10.06	-10.28	5.73	1.29	-3.64	-5.47
P1 x P4	36.99**	20.28*	2.49	-5.98	23.75	10.46
P1 x P5	4.93	-0.72	-12.84	-19.52*	-2.73	-3.08
P1x P6	1.79	-14.18	31.67**	19.86*	12.96	-2.09
P2 x P3	-3.93	-20.65	-7.99	-8.15	-5.40	-16.59
P2 x P 4	-19.26	-24.99*	22.29*	16.67	-4.93	-8.01
P2 x P5	-39.02**	-51.86**	-29.60**	-32.38**	-35.42**	-43.83**
P2 x P6	-14.01	-16.36	-10.37	-15.18	-12.80	-12.76
P3 x P4	-11.19	-21.85	28.15**	22.46*	4.29	-5.28
P3 x P5	56.80**	48.01**	-10.10	-13.50	27.28	25.30
P3 x P6	23.81	4.59	-1.32	-6.46	14.18	0.63
P4 x P5	1.28	-15.20	-9.51	-10.14	-3.20	-13.31
P4 x P6	-15.53	-19.44	-14.86	-15.58	-15.28	-18.06
P5 x P6	-2.25	-21.20	-22.77*	-23.95**	-28.73*	-38.03**

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

S1, S2 and Comb. early, late planting dates and the combined analysis, respectively.

3. Combining Ability :

3.1. F_1 generation :

The analysis of variance for combining ability in each sowing dates as well as the combined analysis for all studied traits are presented in Table (13). The mean squares associated with general and specific combining ability were highly significant in all cases. To get an idea about the predicted performance of a single-cross progeny in each case, the relative size of general to specific combining ability mean squares may be helpful. High ratios which largely exceed the unity were obtained in flowering and maturity dates, first pod height and 100-seed weight in both sowing dates as well as the combined data and plant height at late of sowing date and the combined analysis, indicating that the largest part of the total genetic variability associated with those cases under both environments was a results of additive and additive by additive gene action. For the other traits, however non-additive type of gene action seemed to be more prevalent. The results obtained herein are in harmony with previously reached by **Limproongratana and Maneephong (1979)** for the number of branches per plant and seed yield/plant, **Dencescu (1983)** for number of seeds, seed weight/plant and 100-seed weight, **Singh (1983)** for all characters, **Alam *et al.* (1984)** for number of seeds/plant and 100-seed weight, **Cecon *et al.* (1985)** for seed number/pod, 100-seed weight and plant height, **Habeeb *et al.* (1988 b)** for all traits, **Sood *et al.* (1996)** for seed yield/plant. **Bastawisy (1998)** for all traits except number of pods/plant, **Habeeb (1998 b)** for all traits except first pod height, number of pods/plant and number of seeds/plant and **Mansour (2002)** for first pod height, plant height, number of pods and seeds/plant, 100-seed weight and seed yield/plant.

Highly significant GCA by sowing dates and SCA by sowing dates mean squares were obtained for all the studied traits, indicating that the magnitude of both GCA and SCA varied from sowing date to another. These findings agree to a large extent with those obtained before from the ordinary analysis of variance. Whereas the genotypes by sowing dates mean squares were significant.

With the exception of maturity date and first pod height, it is fairly evident that mean squares of SCA x sowing dates/SCA were much higher than GCA x sowing dates/GCA. Such results indicated that non-additive gene effects were much more influenced by the planting dates than additive genetic effects in these traits. Specific combining ability was tested by several investigators to be more sensitive to environmental changes than GCA. **Gilbert (1958), Leffel and Weiss (1958)** for days to flowering, **Weber *et al.* (1970)** for seed yield, maturity date and plant height, **Kaws and Menon (1981)** for seed yield, **Kadlec (1987)** for seed yield, **Ibrahim *et al.* (1996)** for seed yield and its component, **Habeeb (1998 b)** for all studied traits, **Refat (1998)** for all traits except flowering date and number of branches/plant, **Yassien and Abd El-Mohsen (2000)** for number of seeds/pod and seed yield/plant and **Mansour *et al.* (2002)** for maturity date, plant height, number of pods and seed yield per plant.

3.2. F_2-generation :

Analysis of variance for combining ability as outlined by Griffing's (1956) method-2, model-1 in each planting dates as well as the combined analysis for all the studied traits are presented in Table (14). The mean squares associated with general combining ability (GCA) and specific combining ability (SCA) were significant for all traits except for

GCA mean squares in early planting date for number of branches/plant. It is evident that non-additive type of gene action was the more important part of the total genetic variability for number of branches/plant in early planting date. For other cases, both additive and non-additive gene effects were involved in determining the performance of single cross progeny. Also, when GCA/SCA ratio was used, it was found that all traits exhibited high GCA/SCA ratios exceeded the unity except number of pods/plant, indicating the predominance of additive gene action in the inheritance of such traits. For the number of pods/plant, the magnitude of additive and non-additive types of gene action were similar for this trait. This result confirms that reached for F_1 data presented in Table (13).

GCA/SCA ratio were higher in magnitude in F_2 than F_1 generation for most traits, revealing that the additive and additive by additive gene effects were increased and non-additive gene effects was also reduced in the F_2 generation. The same trend had been reported by Srivastava *et al.* (1978) for number of days to maturity, plant height, pod number/plant, 100-seed weight and seed yield/plant, Ziya Gizlice *et al.* (1993) for seed yield, Bastawisy (1998) for number of seeds/pod and Mansour *et al.* (2002) for number of pods per plant, number of seeds/plant and seed yield/plant.

3.3. <u>General combining ability effects</u> :

3.3.1. <u>F_1-generation</u> :

Estimates of GCA effects (g_i) for individual parental genotypes in each traits at both planting dates as well as the combined analysis are presented in Table (15). General combining ability effects computed herein were found to differ significantly from zero in all traits. High positive values would be of interest under all traits in question except flowering and maturity dates and first pod height where high negative ones would be useful from the breeder point of view. The parental variety Clark (P_1) gave significant (g_i) effects for maturity and flowering dates and the high of first pod. While, it was poor combiner for most of other cases. The parental variety Giza 83 (P_2) ranked the second good combiner after L 86-k-73 (P_5) for earliness (flowering and maturity dates) and first pod height in both planting dates as well as the combined analysis. Also, it gave significant positive (g_i) effects for plant height, number of pods/plant, seeds and seed yield/plant at both sowing dates as well as the combined analysis. Moreover, it seemed to be the best combiner for number of pods and seeds/plant.

The parental variety Ware (P_3) exhibited significant desirable (g_i) effects for 100-seed weight in both planting dates as well as the combined analysis, number of branches and seed yield/plant in the early planting date and the combined data. Meanwhile, it expressed insignificant or undesirable (g_i) effects for other cases.

The parental variety Holladay (P_4) expressed significant positive (g_i) effects for number of branches, pods, seed and seed yield/plant and 100-seed weight at both planting dates as well as the combined analysis. However, it gave undesirable (g_i) effects for other traits.

The parental line L 86-k-73 (P_5) exhibited significant negative (g_i) effect for earliness (flowering and maturity dates and lower first pod height). However, it seemed to be poor combiner for other traits.

The parental line H_2L_{12} (P_6) expressed significant desirable (g_i) effects for higher plant only. While, it gave undesirable (g_i) effects for other traits.

Significant correlation coefficient values between the parental performance and its (g_i) effects obtained for flowering date and 100-seed weight in both sowing dates and the combined analysis, maturity date, plant height in early sowing date and number of seeds/plant in late sowing date (Table 15). These findings indicate that the parental variety and/or line gave a good index of intrinsic performance of their (g_i) effects. Therefore, selection among the tested parental population for initiating any proposed breeding program could be practiced either on mean performance or (g_i) effects basis with similar efficiency.

For other cases, insignificant correlation coefficient values were detected between the two variables. This disagreement revealed that hybrids characterized with high values could be expected for these cases. This result may be due to high magnitude of non-additive gene effect in some of these cases (Table 15). A rather good agreement between ranking of parental performance was reported by **Leffel and Weiss (1958), Weber *et al.* (1970), Nelson and Bernard (1984), Habeeb *et al.* (1988 a), Sptaware *et al.* (1990), Ibrahim *et al.* (1996), Habeeb (1998 b), El-Hosary *et al.* (2001) and Mansour *et al.* (2002).**

3.3.2. F_2-generation :

Estimates of GCA effects (g_i) for individual parent for the studied traits are presented in Table (16). Results indicated that the parental variety Clark (P_1) gave significant desirable (g_i) effects for earliness (flowering and maturity dates) and plant height. While, the parental variety Giza 83 (P_2) gave significant desirable (g_i) effects for maturity date, first pod height, plant height, number of pods/plant and number of seeds/plant. The parental variety Ware (P_3) gave significant desirable (g_i) effects for flowering date, first pod height, number of branches/plant and 100-seed weight. The parental variety Holladay (P_4) showed significant positive (g_i) effects for number of branches/plant, number of pods/plant, 100-seed weight and seed yield/plant. The parental line L 86-k-73 (P5) seemed to be good combiner for earliness (flowering and maturity dates and first pod height). While, it was considered as a poor general combiner for yield and its components. The parental line H_2L_{12} (P_6) gave significant positive (g_i) effects for plant height, number of pods/plant, number of seeds/plant and seed yield/plant. It could be concluded that the best combiner for the most studied traits in the F_2 generation were the same for the corresponding traits in the F_1 (Table 15).

Significant correlation coefficient values between the parental performance and its (g_i) effects were obtained for flowering date, first pod height and 100-seed weight in both sowing dates and the combined analysis, plant height in both planting dates, maturity date and seed yield/plant in early sowing date, number of branches/plant in late planting date, number of pods/plant in late sowing date and the combined analysis and number of seeds/plant in early sowing date and the combined analysis (Table 16). Also, the other cases gave the high correlation coefficient values. Therefore, selection among the tested parental population for initiating any proposed breeding program could be practiced either on mean performance or (g_i) effects basis with similar efficiency.

3.4. Specific combining ability effects :

3.4.1. F_1-generation :

Specific combining ability effects of the parental combinations are presented in Table (17).

For flowering date, four, three and four crosses exhibited significantly negative effects at early and late of planting dates as well as the combined data, respectively. Also, seven, six and six parental combinations expressed significantly (S_{ij}) effects for maturity date in the same order. The cross (P_1xP_3) exhibited (S_{ij}) effects for flowering and maturity dates in both planting dates as well as the combined data. However, the best crosses were the two crosses (P_2xP_4) and (P_4xP_5) for flowering date and the four crosses (P_1xP_5), (P_1xP_6), (P_2xP_5) and (P_2xP_6) for maturity date. Also, the three crosses (P_1xP_6), (P_2xP_5) and (P_2xP_6) exhibited significantly negative (S_{ij}) effects for first pod height in the combined analysis. The rest of crosses gave significantly positive or insignificant (S_{ij}) effects. Earliness, if found in soybean is favorable for escaping from leav warm, shess conditions and intensive production. The most previously mentioned involved one or two good combiners for earliness (flowering, maturity and first pod height). In addition, the (P_1xP_6), (P_2xP_3) and (P_2xP_4) gave significant positive (S_{ij}) effects for seed yield/plant. Hence, it could be concluded that these crosses valuable in breeding for earliness and high seed yield/plant.

For plant height, nine, eight and seven crosses exhibited significantly (S_{ij}) effects in early, late of planting dates as well as the combined analysis, respectively. The highest positive (S_{ij}) effects were obtained by cross (P_3xP_5) followed by crosses (P_3xP_6) and (P_2xP_3). On the other side, three, five and six parental combinations exhibited significantly negative (S_{ij}) effects in the same order.

For number of branches/plant, seven, three and two crosses expressed significantly positive (S_{ij}) effects in early, late of planting dates as well as the combined data, respectively. The two crosses (P_1xP_3) and (P_2xP_4) had the highest positive (S_{ij}) effects in the combined analysis.

Nine, seven and nine hybrids had significant positive (S_{ij}) effects in early, late of planting dates as well as the combined analysis, respectively. Regarding number of seeds/plant, seven, eight and nine crosses exhibited significantly positive (S_{ij}) effects in early, late of planting dates as well as the combined analysis, respectively. The highest average value of number of seeds/plant resulted from the highest average value of number of pods/plant.

Considering seed yield/plant, eight, seven and six parental combinations expressed significantly positive (S_{ij}) effects in early, late of planting dates as well as the combined analysis, respectively. The rest crosses gave insignificant or significant negative (S_{ij}) effects. The best crosses were (P_1xP_6) and (P_2xP_3) for number of pods, seeds/plant and seed yield/plant in both sowing dates and the combined analysis. The highest value of number of pods/plant resulted from the highest number of branches/plant for the genotype (P_2xP_4). The increase of seed yield/plant due to the increase of number of branches/plant, number of pods/plant and number of seeds/plant for genotype namely (P_2xP_4).

Regarding 100-seed weight, six, three and three parental combinations exhibited significantly positive (S_{ij}) effects in early, late planting dates as well as the combined analysis, respectively. The cross (P_3xP_4) was the best hybrid in both sowing dates as well as the combined data.

In all traits, the values of (S_{ij}) effect were differed from sowing date to another. This finding coincided with that reached above for significant SCA by sowing date mean square (Table 13).

The most previous crosses that showed high (S_{ij}) effects had one or two good combiners. Such combinations would show desirable transgressive segregates, providing that the additive genetic system present in the good combiner as well as the complementary and epistatic effects present in cross act in the same direction to reduce undesirable plant characteristics and maximize the character in view. Therefore, the previous crosses might be prime importance in breeding program for traditional breeding procedures.

3.4.2. F_2-generation :

Specific combining ability effects of the parental combinations for all traits at both planting dates and the combined analysis are presented in Table (18).

For flowering time, seven hybrids exhibited significant negative (S_{ij}) effects in early and late of planting dates as well as the combined analysis. The results indicated that the cross (P_1xP_4) had the best desirable (S_{ij}) effect. The rest crosses gave significantly positive or insignificant (S_{ij}) effects.

Seven, six and six hybrids exhibited significant negative (S_{ij}) effects for maturity date in early and late of planting dates as well as the combined analysis, respectively. Also, the results indicated that the crosses (P_1xP_5), (P_1xP_6), (P_2xP_5) and (P_2xP_6) had the desirable (S_{ij}) effects in the combined analysis.

For the first pod height, the two crosses (P_2xP_5) and (P_3xP_4) expressed significant negative (S_{ij}) effects at early, late planting dates as well as the combined analysis. The highest value of first pod height resulted from the highest plant height for the genotype (P_2xP_3).

Regarding plant height, six, five and six parental combinations expressed significant positive (S_{ij}) effects at early, late planting dates as well as the combined analysis, respectively. The cross (P_2xP_3) had the highest values of (S_{ij}) effects followed by cross (P_2xP_5) and then by cross (P_3xP_4) in both planting dates as well as the combined analysis. The rest crosses gave significant negative or insignificant (S_{ij}) effects.

For number of branches/plant two, three and three parental combinations exhibited significant positive (S_{ij}) effects at early and late planting dates as well as the combined analysis, respectively. The rest crosses had significant negative or insignificant (S_{ij}) effects.

The cross (P_3xP_5) gave the highest positive (S_{ij}) effects for number of pods and seeds/plant in both planting dates and the combined analysis followed by cross (P_2xP_6).

Regarding 100-seed weight, the cross (P_1xP_6) exhibited significant positive (S_{ij}) effects in both planting dates as well as the combined analysis. Also, the two crosses (P_1xP_4) and (P_2xP_3) in early planting date, cross (P_3xP_4) in late planting date and two crosses (P_1xP_2) and (P_3xP_4) in the combined analysis expressed significant positive (S_{ij}) effects. The rest crosses gave significant negative or insignificant (S_{ij}) effects.

Table (13): Observed of mean squares of general and specific combining ability for F1 crosses in diallel analysis for all studied traits in each planting dates as well as combined data.

Source of variance	d.f.		Flowering days			Maturity days			First pod height(cm)		
	Single	Comb.	S1	S2	Comb.	S1	S2	comb	S1	S2	Comb.
GCA	5	5	46.66**	47.83**	87.62**	553.62**	222.13**	726.85**	8.06**	2.05**	4.34**
SCA	15	15	9.34**	10.87**	15.36**	109.06**	104.37**	205.19**	4.64**	1.59**	3.57**
GCA x Sowing		5			6.88**			48.89**			5.77**
SCA x Sowing		15			4.86**			8.24**			2.65**
Error	**40**	**80**	**0.42**	**0.42**	**0.42**	**0.79**	**0.64**	**0.71**	**0.24**	**0.18**	**0.21**
GCA/SCA			5.00	4.40	5.70	5.08	2.13	3.54	1.74	1.29	1.22
GCA x S/GCA					0.08			0.07			1.33
SCA x S/SCA					0.32			0.04			0.74

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

S1, S2 and Comb. Early, late planting dates and the combined analysis, respectively.

GCA and SCA,general and specific combining ability.

Table (13):cont.

Source of variance	d.f.		Plant height (cm)			No. of branches/plant			No. of pods/plant		
	Single	Comb.	S1	S2	Comb.	S1	S2	Comb.	S1	S2	Comb.
GCA	5	5	277.54**	170.86**	384.60**	3.04**	1.30**	3.78**	1316.43**	657.72**	1620.38**
SCA	15	15	291.81**	115.39**	249.38**	4.82**	1.46**	5.05**	4443.89**	854.93**	3924.79**
GCA x Sowing		5			63.80**			0.56**			353.77**
SCA x Sowing		15			157.83**			1.22**			1374.03**
Error	**40**	**80**	**2.60**	**3.45**	**3.02**	**0.12**	**0.17**	**0.14**	**25.93**	**7.32**	**16.62**
GCA/SCA			0.95	1.48	1.54	0.63	0.89	0.75	0.30	0.77	0.41
GCA x S/GCA					0.17			0.15			0.22
SCA x S/SCA					0.63			0.24			0.35

* and ** significant at 0.05 and 0.01 levels of probability, respectively.
S1, S2 and Comb. Early, late planting dates and the combined analysis, respectively.
GCA and SCA,general and specific combining ability.

Table (13):cont.

Source of variance	d.f.		No. of seeds/plant			100 Seed weight(gm)			Seed yield /plant(gm)		
	Single	Comb.	S1	S2	Comb.	S1	S2	Comb.	S1	S2	Comb.
GCA	5	5	10338.64**	5451.91**	12014.21**	28.16**	19.35**	44.16**	388.73**	108.72**	368.47**
SCA	15	15	24574.41**	6622.46**	22692.22**	1.74**	3.87**	1.79**	747.11**	133.89**	548.61**
GCA x Sowing		5			3776.34**			3.35**			128.98**
SCA x Sowing		15			8504.65**			3.83**			332.39**
Error	**40**	**80**	**89.85**	**8.58**	**49.21**	**0.22**	**0.22**	**0.22**	**2.19**	**1.50**	**1.85**
GCA/SCA			0.42	0.82	0.53	16.18	5.00	24.67	0.52	0.81	0.67
GCA x S/GCA					0.31			0.08			0.35
SCA x S/SCA					0.37			2.14			0.61

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

S1, S2 and Comb. Early, late planting dates and the combined analysis, respectively.

GCA and SCA,general and specific combining ability.

Table (14): Estimates of mean squares of general and specific combining ability of F2 crosses for diallel cross analysis in all studied traits and each planting dates as well as combined data.

Source of variance	d.f.		Flowering days			Maturity days			First pod height(cm)		
	Single	Comb.	S1	S2	Comb.	S1	S2	Comb.	S1	S2	Comb.
GCA	5	5	37.22**	32.48**	68.09**	561.89**	207.68**	716.46**	6.79**	4.15**	9.72**
SCA	15	15	15.78**	18.92**	32.01**	105.72**	102.05**	199.44**	2.81**	4.07**	6.03**
GCA x Sowing		5			1.61**			53.12**			1.22
SCA x Sowing		15			2.68**			8.34**			0.84
Error	**40**	**80**	**0.06**	**0.49**	**0.28**	**0.46**	**0.10**	**0.28**	**0.55**	**0.62**	**0.58**
GCA/SCA			2.36	1.72	2.13	5.31	2.04	3.59	2.42	1.02	1.61
GCA x S/GCA					0.02			0.07			0.13
SCA x S/SCA					0.08			0.04			0.14

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

S1, S2 and Comb. early, late planting dates and the combined analysis, respectively.

GCA and SCA,general and specific combining ability.

Table (14):cont.

Source of variance	d.f.		Plant height (cm)			No. of branches/plant			No. of pods/plant		
	Single	Comb.	S1	S2	Comb.	S1	S2	Comb.	S1	S2	Comb.
GCA	5	5	457.64**	203.43**	608.96**	0.38	0.61**	0.78**	261.24*	129.29**	371.81**
SCA	15	15	138.85**	108.61**	229.15**	0.52**	0.34*	0.67**	399.87**	145.74**	351.15**
GCA x Sowing		5			52.12**			0.21			18.72
SCA x Sowing		15			18.30*			0.19			194.46**
Error	**40**	**80**	**10.63**	**9.58**	**10.11**	**0.19**	**0.15**	**0.17**	**82.41**	**32.07**	**57.24**
GCA/SCA			3.30	1.87	2.66	0.73	1.79	1.16	0.65	0.89	1.06
GCA x S/GCA					0.09			0.27			0.05
SCA x S/SCA					0.08			0.01			0.55

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

S1, S2 and Comb. early, late planting dates and the combined analysis, respectively.

GCA and SCA,general and specific combining ability.

Table (14):cont.

Source of variance	d.f.		No. of seeds/plant			100 Seed weight(gm)			Seed yield /plant(gm)		
	Single	Comb.	S1	S2	Comb.	S1	S2	Comb.	S1	S2	Comb.
GCA	5	5	2090.93**	1209.34**	2970.16**	14.82**	11.33**	23.63**	54.01**	9.73**	49.04**
SCA	15	15	1982.29**	759.61**	2148.95**	1.91**	1.95**	2.66**	49.13**	9.67**	31.92**
GCA x Sowing		5			330.11			2.52**			14.69
SCA x Sowing		15			592.95*			1.20**			26.88**
Error	**40**	**80**	**478.80**	**166.12**	**322.46**	**0.30**	**0.22**	**0.26**	**11.88**	**1.87**	**6.88**
GCA/SCA			1.05	1.59	1.38	7.76	5.81	8.88	1.10	1.01	1.54
GCA x S/GCA					0.11			0.11			0.30
SCA x S/SCA					0.03			0.45			0.84

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

S1, S2 and Comb. early, late planting dates and the combined analysis, respectively.

GCA and SCA,general and specific combining ability.

Table (15): Estimates of general combining ability effects for all parents and all studied traits and each planting dates as well as combined data in the F1-generation.

Parent	Flowering days			Maturity days			First pod height(cm)		
	S1	S2	Comb.	S1	S2	Comb.	S1	S2	Comb.
P1(Clark)	-0.56**	-1.38**	-0.97**	-6.88**	-2.60**	-4.74**	0.05	-0.69**	-0.32**
P2 (Giza 83)	-1.76**	-1.54**	-1.65**	-7.21**	-5.93**	-6.57**	-0.79**	0.04	-0.37**
P3 (Ware)	1.19**	-1.00**	0.10	0.13	1.65**	0.89**	1.39**	0.19	0.78**
P4 (Holladay)	3.32**	4.21**	3.76**	13.88**	8.03**	10.95**	-1.14**	0.78**	-0.18**
P5 (L 86 K73)	-3.43**	-2.00**	-2.72**	-5.17**	-4.39**	-4.78**	-0.48**	-0.40**	-0.44**
P6 (H2L12)	1.24**	1.71**	1.47**	5.25**	3.24**	4.24**	0.98**	0.08	0.53**
L.S.D. 0.05	0.42	0.42	0.20	0.58	0.52	0.26	0.32	0.27	0.14
L.S.D. 0.01	0.56	0.56	0.26	0.78	0.70	0.34	0.43	0.37	0.19
L.S.D. 5% gi-gi	0.65	0.65	0.32	0.90	0.81	0.42	0.50	0.43	0.23
L.S.D. 1% gi-gi	0.87	873.00	0.43	1.20	1.08	0.56	0.67	0.57	0.30
r	0.895*	0.950**	0.930**	0.872*	-0.053	0.351	0.475	0.539	0.230

*** and ** significant at 0.05 and 0.01 levels of probability, respectively.**
S1, S2 and Comb. Early,late planting dates and the combined analysis, respectively.
r, correlation coefficient between mean and general combining ability effects.
$==(gi_ -gi)

Table (15):cont.

Parent	Plant height(cm)			No. of branches/plant			No. of pods/plant		
	S1	S2	Comb.	S1	S2	Comb.	S1	S2	Comb.
P1(Clark)	-0.07	-3.04**	-1.55**	-0.56**	-0.25	-0.40**	-6.10**	-9.81**	-7.95**
P2 (Giza 83)	2.51**	6.14**	4.33**	0.02	-0.12	-0.05	19.99**	8.11**	14.05**
P3 (Ware)	-3.96**	-4.24**	-4.10**	0.74**	0.17	0.46**	-3.59*	-10.34**	-6.97**
P4 (Holladay)	-4.97**	0.25	-2.36**	0.74**	0.73**	0.73**	11.54**	11.92**	11.73**
P5 (L 86 K73)	-4.03**	-4.11**	-4.07**	-0.63**	-0.12	-0.38**	-11.74**	-0.17	-5.95**
P6 (H2L12)	10.51**	4.99**	7.75**	-0.31**	-0.41**	-0.36**	-10.10**	0.28	-4.91**
L.S.D. 0.05	1.05	1.21	0.53	0.22	0.27	0.12	3.32	1.76	1.25
L.S.D. 0.01	1.41	1.62	0.71	0.30	0.36	0.16	4.44	2.36	1.66
L.S.D. 5% gi-gi	1.63	1.88	0.87	0.34	0.41	0.19	5.15	2.73	2.03
L.S.D. 1% gi-gi	2.18	2.51	1.15	0.46	0.55	0.25	6.89	3.66	2.69
r	0.951**	0.736	0.883*	0.519	0.644	0.730	0.323	0.006	0.500

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

S1, S2 and Comb. Early,late planting dates and the combined analysis, respectively.

r, correlation coefficient between mean and general combining ability effects.

$==(gi_ -gi)

Table (15):cont.

Parent	No. of seeds/plant			100- seeds weight(gm)			Seed yield /plant(gm)		
	S1	S2	Comb.	S1	S2	Comb.	S1	S2	Comb.
P1(Clark)	-21.74**	-17.82**	-19.78**	-0.15	-1.08**	-0.62**	-1.45**	-4.56**	-3.00**
P2 (Giza 83)	57.38**	22.38**	39.88**	-1.67**	-0.44*	-1.05**	4.40**	3.25**	3.82**
P3 (Ware)	-2.09	-36.81**	-19.45**	3.19**	2.93**	3.06**	8.43**	-0.18	4.13**
P4 (Holladay)	25.50**	34.44**	29.97**	0.67**	0.52**	0.59**	4.33**	5.36**	4.84**
P5 (L 86 K73)	-17.30**	-5.89**	-11.60**	-2.04**	-1.07**	-1.56**	-9.89**	-2.38**	-6.14**
P6 (H2L12)	-41.75**	3.70**	-19.02**	0.01	-0.86**	-0.42**	-5.81**	-1.48**	-3.65**
L.S.D. 0.05	6.18	1.91	2.15	0.31	0.30	0.14	0.97	0.80	0.42
L.S.D. 0.01	8.27	2.56	2.86	0.41	0.41	0.19	1.29	1.07	0.55
L.S.D. 5% gi-gi	9.58	2.96	3.49	0.48	0.47	0.23	1.50	1.24	0.68
L.S.D. 1% gi-gi	12.82	3.96	4.63	0.64	0.63	0.31	2.00	1.66	0.90
r	0.959**	0.971**	0.982**	0.959**	0.971**	0.982**	0.193	0.756	0.455

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

S1, S2 and Comb. Early,late planting dates and the combined analysis, respectively.

r, correlation coefficient between mean and general combining ability effects.

$==(gi_ -gi)

Table (16): Estimates of general combining ability (*gca*) effects for all parents in all studied traits in each planting dates and as well as combined data in the F2-generation.

Parent	Flowering days			Maturity days			First pod height (cm)		
	S1	S2	Comb.	S1	S2	Comb.	S1	S2	Comb.
P1(Clark)	-0.92**	-0.69**	-0.81**	-6.89**	-2.33**	-4.61**	0.61*	-0.41	-0.51**
P2 (Giza 83)	-0.33**	0.51*	0.09	-6.93**	-5.46**	-6.19**	0.50*	-0.21	-0.35**
P3 (Ware)	-0.25**	-1.24**	-0.74**	0.74**	1.54**	1.14**	-0.03	-0.34	-0.18
P4 (Holladay)	4.00**	3.68**	3.84**	13.99**	7.92**	10.95**	0.20	0.94**	0.57**
P5 (L 86 K73)	-2.50**	-2.11**	-2.31**	-5.89**	-4.58**	-5.24**	0.80**	-0.82**	-0. 81**
P6 (H2L12)	0.00	-0.15	-0.08	4.99**	2.92**	3.95**	1.72**	0.84	1.28**
L.S.D. 0.05	0.16	0.46	0.16	0.44	0.21	0.16	0.48	0.51	0.23
L.S.D. 0.01	0.22	0.61	0.21	0.59	0.28	0.22	0.65	0.68	0.31
L.S.D. 5% gi-gi	0.25	0.71	0.26	0.69	0.32	0.26	0.75	0.79	0.38
L.S.D. 1% gi-gi	0.34	0.95	0.35	0.92	0.43	0.35	1.01	1.06	0.50
r	0.950**	0.933**	0.945**	0.876*	0.519	0.771	0.879*	0.974**	0.863**

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

S1, S2 and Comb. Early, late planting dates and the combined analysis, respectively.

r, correlation coefficient between mean and general combining ability effects.

$==(gi_ -gi)

Table (16): cont.

Parent	Plant height (cm)			No. of branches/plant			No. of pods/plant		
	S1	S2	Comb.	S1	S2	Comb.	S1	S2	Comb.
P1(Clark)	2.40*	2.34*	2.37**	-0.23	-0.18	-0.20**	-6.33*	-3.87*	-5.10**
P2 (Giza 83)	1.10	3.98**	2.54**	-0.27	-0.23	-0.25**	5.19	4.34*	4.76**
P3 (Ware)	-7.69**	-5.51**	-6.60**	0.22	0.40**	0.31**	-5.84	-5.02**	-5.46**
P4 (Holladay)	-5.37**	-2.67*	4.02**	0.15	0.25*	0.20*	4.03	3.66	3.85**
P5 (L 86 K73)	-3.74**	-4.84**	-4.29**	-0.06	0.03	-0.02	-3.09	-1.45	-2.27
P6 (H2L12)	13.31**	6.71**	10.01	0.19	-0.27*	-0.04	6.03*	2.40	4.22**
L.S.D. 0.05	2.13	2.02	0.97	0.29	0.25	0.13	5.92	3.69	2.32
L.S.D. 0.01	2.84	2.70	1.29	0.38	0.34	0.17	7.92	4.94	3.08
L.S.D. 5% gi-gi	3.29	3.13	1.58	0.44	0.39	0.21	9.17	5.72	3.76
L.S.D. 1% gi-gi	4.41	4.19	2.10	0.59	0.52	0.27	12.27	7.66	4.99
r	0.959**	0.892*	0.738	0.456	0.829*	0.615	0.779	0.884*	0.887*

* and ** significant at 0.05 and 0.01 levels of probability, respectively.
S1, S2 and Comb. Early, late planting dates and the combined analysis, respectively.
r, correlation coefficient between mean and general combining ability effects.
$==(gi_ -gi)

Table (16): cont.

Parent	No. of seeds/plant			100- seeds weight(gm)			Seed yield /plant(gm)		
	S1	S2	Comb.	S1	S2	Comb.	S1	S2	Comb.
P1(Clark)	-6.13	7.70	0.79	-0.68**	-0.37*	-0.52**	-1.53	-0.27	-0.90*
P2 (Giza 83)	13.42	8.04	10.73**	-0.54**	-0.63**	-0.59**	1.12	-0.81	0.15
P3 (Ware)	-24.16**	-19.03**	-21.60**	1.79**	2.28**	2.04**	0.06	0.33	0.20
P4 (Holladay)	-6.15	-2.82	-4.67	1.38**	0.31*	0.84**	1.96	1.65**	1.80**
P5 (L 86 K73)	1.95	-7.96	-3.00	-1.84**	-0.76**	-1.30**	-4.34**	-1.47**	-2.91**
P6 (H2L12)	21.43**	14.08**	17.75**	-0.11	-0.82**	-0.47**	2.73*	0.58	1.6**
L.S.D. 0.05	14.27	8.41	5.51	0.36	0.30	0.16	2.25	0.89	0.81
L.S.D. 0.01	19.10	11.25	7.31	0.48	0.41	0.21	3.01	1.19	1.07
L.S.D. 5% gi-gi	22.11	13.02	8.92	0.55	0.47	0.25	3.48	1.38	1.30
L.S.D. 1% gi-gi	29.58	17.43	11.64	0.74	0.63	0.34	4.66	1.85	1.73
r	0.939**	0.785	0.908*	0.975**	0.985**	0.983**	0.836*	0.314	0.729

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

S1, S2 and Comb. Early, late planting dates and the combined analysis, respectively.

r, correlation coefficient between mean and general combining ability effects.

$==(gi_ -gi)

Table (17): Estimates of specific combining ability effects for F1 crosses in all studied traits and each planting dates as well as combined data .

Cross	Flowering days			Maturity days			First pod height (cm)		
	S1	S2	Comb.	S1	S2	Comb.	S1	S2	Comb.
P1 x P2	-1.89**	1.15*	-0.37	4.85**	2.13**	3.49**	0.00	-0.16	-0.08
P1x P3	-1.18*	-1.72**	-1.45**	-6.15**	-5.45**	-5.80**	2..83**	-2.03**	0.40
P1 x P4	3.70**	2.60**	0.55	6.43**	5.17**	5.80**	-1.13*	0.97*	-0.08
P1 x P5	1.78**	1.28*	1.53**	-9.53**	-11.41**	-10.47**	0.07	-0.03	0.02
P1x P6	0.45	4.57**	2.51**	-11.95**	10.04**	-10.99**	-1.57**	-1.52**	-1.54**
P2 x P3	4.36**	0.45	2.40**	-4.15**	-9.79**	-6.97**	4.10**	1.53**	2.82**
P2 x P 4	-2.10**	-2.76**	-2.43**	11.43**	12.51**	11.97**	-1.48**	0.63	-0.42
P2 x P5	-0.35	-0.55	-0.45	-11.20**	-7.74**	-9.47**	-0.47	-0.84*	-0.65*
P2 x P6	3.99**	5.74**	4.86**	-7.95**	-12.70**	-10.32**	-0.93*	-1.04**	-0.99**
P3 x P4	0.95	3.70**	2.32**	2.76**	1.26	2.01**	-0.57	0.43	-0.07
P3 x P5	1.70**	3.57**	2.63**	18.47**	12.67**	15.57**	0.88	1.38**	1.13**
P3 x P6	4.03**	0.20	2.11**	6.05**	4.05**	5.05**	2.44**	0.95*	1.70**
P4 x P5	-3.43**	-0.97	-2.20**	6.39**	8.63**	7.51**	2.27**	-1.56**	0.35
P4 x P6	-0.10	-3.01**	-1.55**	-1.70*	3.34**	0.82	0.24	0.92*	0.58*
P5 x P6	-0.35	1.53	0.59	12.35**	9.76**	11.05	-0.44	1.35**	0.46
L.S.D.0.05 sij	1.16	1.16	0.81	1.59	1.43	1.05	0.88	0.75	0.57
L.S.D.0.01 sij	1.55	1.55	1.07	2.13	1.91	1.40	1.18	1.01	0.76
L.S.D.0.05 (sij-sik)	1.73	1.73	1.20	2.38	2.13	1.57	1.32	1.12	0.85
L.S.D.0.01 (sij-sik)	2.31	2.31	1.59	3.18	2.85	2.08	177.00	1.50	1.13
L.S.D.0.05 (sij-skl)	1.60	1.60	0.45	2.20	1.97	0.59	1.22	1.04	0.32
L.S.D.0.01 (sij-skl)	2.14	2.14	0.60	2.94	2.64	0.79	1.63	1.39	0.43

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

S1, S2 and Comb. Early, late planting dates and the combined analysis, respectively.

Table (17):cont.

Cross	Plant height (cm)			Number of branches/plant			Number of pods /plant		
	S1	S2	Comb.	S1	S2	Comb.	S1	S2	Comb.
P1 x P2	-0.55	-6.29**	-3.42**	-1.23**	-0.34	0.78**	-74.07**	-21.11**	-47.59**
P1x P3	13.20**	-16.09**	-1.45	4.11**	0.04	2.07**	130.53**	-11.01**	59.76**
P1 x P4	13.94**	5.43**	9.68**	0.34	1.47**	0.91**	60.71**	17.77**	39.24**
P1 x P5	-10.53**	3.57*	-3.48**	-1.06**	0.60	-0.23	-50.29**	10.15**	-20.07**
P1x P6	-1.50	-9.84**	-5.67**	0.59	0.57	0.58*	27.93**	27.22**	27.57**
P2 x P3	16.96**	11.08**	14.02**	2.70**	1.13**	1.91**	54.26**	41.62**	47.94**
P2 x P 4	12.74**	10.97**	11.86**	3.14**	2.60**	2.87**	110.46**	68.14**	89.30**
P2 x P5	9.80**	-20.08**	-5.14**	1.49**	0.31	0.90**	31.24**	-20.66**	5.29*
P2 x P6	-14.09**	6.74**	-3.68**	-0.36	-0.48	-0.42	-30.12**	-17.37**	-23.75**
P3 x P4	-18.04**	-4.84**	-11.44	-1.34**	-0.81*	-1.07**	-55.54**	-12.62**	-34.08**
P3 x P5	18.40**	15.83**	17.11**	0.86**	0.62	0.74**	21.95**	25.64**	23.80**
P3 x P6	22.43**	6.70**	14.57**	0.56	0.55	0.55*	3.33	6.28*	4.80
P4 x P5	15.58**	-2.51	6.53**	1.24**	-0.02	0.61*	12.64**	0.21	6.43*
P4 x P6	13.51**	4.94**	9.23**	0.71*	0.44	0.58*	20.33**	4.18	12.25**
P5 x P6	-4.16**	1.25	-1.46	-0.23	0.13	-0.05	-5.61	2.50	-1.56
L.S.D.0.05 sij	2.89	3.33	2.17	0.61	0.73	0.47	9.12	4.85	5.08
L.S.D.0.01 sij	3.86	4.45	2.88	0.81	0.98	0.62	12.21	6.48	6.74
L.S.D.0.05 (sij-sik)	4.31	4.97	3.24	0.91	1.09	0.70	13.61	7.23	7.59
L.S.D.0.01 (sij-sik)	2.77	6.64	4.29	1.22	1.46	0.93	18.22	9.68	10.06
L.S.D.0.05 (sij-skl)	3.99	4.60	1.22	0.84	1.01	0.26	12.60	6.70	2.87
L.S.D.0.01 (sij-skl)	5.34	6.15	1.62	1.13	1.36	0.35	16.86	8.96	3.80

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

S1, S2 and Comb. Early, late planting dates and the combined analysis, respectively.

Table (17):cont.

Cross	Number of seed/plant			100-Seed weight (gm)			Seed yield/plant (gm)		
	S1	S2	Comb.	S1	S2	Comb.	S1	S2	Comb.
P1 x P2	-169.72**	-47.44**	-108.58**	-1.43**	0.24	-0.60*	-29.39**	-6.35**	-17.87**
P1x P3	308.91**	-31.45**	138.73**	1.12*	-5.42**	-2.15**	62.33**	-11.26**	25.54**
P1 x P4	162.80**	56.39**	109.60**	1.03*	-0.76	0.13	27.93**	5.39**	16.66**
P1 x P5	-114.87**	13.93**	-50.47**	-1.95**	2.00**	0.03	-18.93**	5.42**	-6.75**
P1x P6	3.50	62.96**	33.23**	1.24*	0.18	0.71*	-0.99	7.17**	3.09**
P2 x P3	210.24**	84.93**	147.59**	-1.45**	0.16	-0.64*	29.81**	13.75**	21.78**
P2 x P 4	185.36**	201.02**	193.19**	-0.06	0.08	0.01	28.70**	29.29**	29.00**
P2 x P5	81.67**	-61.50**	10.08*	0.21	-0.52	-0.15	10.26**	-8.98**	0.64
P2 x P6	-52.22**	-0.74	-26.48**	-0.09	0.89*	0.40	-4.10**	-0.92	-2.51**
P3 x P4	-128.64**	-22.55**	-75.59**	1.11*	1.47**	1.29**	-18.06**	0.96	-8.55**
P3 x P5	33.55**	86.09**	59.82**	1.17*	-1.16**	0.00	10.57**	9.91**	10.24**
P3 x P6	-11.72	-11.74**	-11.73**	0.56	-1.63**	-0.53	-1.19	-2.01	-1.60
P4 x P5	83.17**	16.27	49.72**	-0.51	-1.24**	-0.88**	4.35**	-3.23**	0.56
P4 x P6	-14.92	-5.13	-10.02*	0.15	-0.22	-0.03	1.18	-0.62	0.28
P5 x P6	1.19	17.48*	9.34*	1.83**	0.67	1.25**	5.53**	2.55*	4.04**
L.S.D.0.05 sij	16.98	5.25	8.75	0.85	0.83	0.58	2.65	2.19	1.69
L.S.D.0.01 sij	22.72	7.02	11.60	1.13	1.11	0.77	3.55	2.94	2.25
L.S.D.0.05 (sij-sik)	25.34	7.83	13.05	1.26	1.24	0.87	3.96	3.28	2.53
L.S.D.0.01 (sij-sik)	33.91	10.48	17.31	1.69	1.66	1.16	5.30	4.38	3.35
L.S.D.0.05 (sij-skl)	23.46	7.25	4.93	1.17	1.15	0.33	3.66	3.03	0.96
L.S.D.0.01 (sij-skl)	31.39	9.70	6.54	1.56	1.54	0.44	4.89	4.06	1.27

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

S1, S2 and Comb. Early, late planting dates and the combined analysis, respectively.

Table (18): Estimates of specific combining ability effects for F2 crosses studied in each planting dates as well as combined data.

Cross	Flowering days			Maturity days			First pod height (cm)		
	S1	S2	Comb.	S1	S2	Comb.	S1	S2	Comb.
P1 x P2	0.11	0.01	0.06	4.66**	0.98**	2.82**	-0.63	-0.55	-0.59
P1x P3	0.02	1.76**	0.89**	-7.01**	-6.02**	-6.51**	0.73	-0.49	0.12
P1 x P4	-7.56**	-9.16**	-8.36**	6.740**	5.61**	6.18**	1.17	3.06**	2.11**
P1 x P5	2.27**	1.30*	1.79**	-8.38**	-10.89**	-9.64**	-1.28	-0.27	-0.78
P1x P6	-0.23	1.67*	0.72*	-11.26**	-9.39**	-10.32**	-0.93	0.44	-0.24
P2 x P3	-3.56**	-1.45*	-2.51**	-3.96**	-8.89**	-6.43**	2.35**	3.52**	2.94**
P2 x P 4	4.86**	4.63**	4.74**	10.79**	12.73**	11.76**	1.67*	1.43*	1.55*
P2 x P5	-0.31	1.42*	0.56	-10.34**	-8.77**	-9.55**	-2.30**	-1.75*	-2.02**
P2 x P6	-0.14	-1.54*	-0.84*	-7.21**	-12.27**	-9.74**	-0.27	1.04	0.39
P3 x P4	0.11	-4.95**	-2.42**	3.12**	1.73**	2.43**	-1.14	-1.53*	-1.33**
P3 x P5	-1.39**	0.84	-0.28	18.99**	14.23**	16.61**	1.62*	1.46*	1.54**
P3 x P6	-1.89**	1.21	-0.34	6.12**	2.73**	4.43**	-0.11	-0.07	-0.09
P4 x P5	-3.98**	-3.74**	-3.86**	6.74**	6.86**	6.80**	2.30**	0.89	1.6**
P4 x P6	-5.14**	-3.7**	-4.42**	-3.13**	2.36**	-0.39	1.57*	1.23	1.4**
P5 x P6	-2.31**	-3.91**	-3.11**	11.74**	9.86**	10.80**	0.63	2.20**	1.42**
L.S.D.0.05 sij	0.45	1.26	0.66	1.22	0.57	0.66	1.33	1.41	0.95
L.S.D.0.01 sij	0.60	1.68	0.87	1.63	0.76	0.88	1.78	1.88	1.26
L.S.D.0.05 (sij-sik)	0.67	1.88	0.98	1.82	0.85	0.99	1.99	2.10	1.42
L.S.D.0.01 (sij-sik)	0.90	2.51	1.30	2.43	1.13	1.31	2.66	281.00	1.89
L.S.D.0.05 (sij-skl)	0.62	1.74	0.37	1.68	0.78	0.37	1.84	1.94	0.54
L.S.D.0.01 (sij-skl)	0.83	2.33	0.49	2.25	1.05	0.49	2.46	2.60	0.71

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

S1, S2 and Comb. early, late planting dates and the combined analysis, respectively.

Table (18):cont.

Cross	Plant height (cm)			Number of branches/plant			Number of pods /plant		
	S1	S2	Comb.	S1	S2	Comb.	S1	S2	Comb.
P1 x P2	-5.04	-5.97*	-5.50**	0.30	0.25	0.28	-6.26	-0.04	-3.15
P1x P3	8.12**	-0.32	3.90	0.16	-0.45	-0.15	-12.02	4.04	-3.99
P1 x P4	13.88**	11.68**	12.78**	.0.93*	0.44	0.68**	39.42**	-2.36	18.53**
P1 x P5	-1.83	-4.15	-2.99	0.02	0.26	0.14	-8.55	-8.72	-8.63
P1x P6	-5.66	7.13*	0.73	0.08	0.87*	0.48	-13.41	15.08**	0.84
P2 x P3	15.28**	19.84**	17.56**	0.37	-0.33	0.02	3.41	10.26*	6.84
P2 x P 4	3.65	2.26	2.95	0.60	0.30	0.45	-5.80	16.70**	5.45
P2 x P5	-14.51**	-16.87**	-15.69**	-0.20	-0.29	-0.25	-18.58*	-8.68	-13.63**
P2 x P6	-2.43	2.63	0.10	-0.61	0.39	-0.11	-15.22	-17.15**	-16.19**
P3 x P4	-10.50**	-9.05**	-9.77**	0.19	0.87*	0.53*	-12.74	-12.87*	-12.80**
P3 x P5	14.62**	11.49**	13.06**	0.72	0.05	0.39	30.10**	12.89*	21.49**
P3 x P6	3.66	2.20	2.93	1.28**	0.74*	1.01**	26.62*	10.16*	18.39**
P4 x P5	12.77**	5.99*	9.35**	0.28	0.06	0.17	6.95	-5.73	0.61
P4 x P6	12.32**	6.37*	9.34**	-0.07	-0.15	-0.11	7.37	-11.01*	-1.82
P5 x P6	4.62	5.15	4.88*	-0.28	-0.46	-0.37	-19.08*	-11.29*	-15.18**
L.S.D.0.05 sij	5.84	5.55	3.96	0.78	0.69	0.51	16.26	10.14	9.42
L.S.D.0.01 sij	7.81	7.42	5.26	1.05	0.93	0.68	21.76	13.57	12.51
L.S.D.0.05 (sij-sik)	8.72	8.28	5.91	1.17	1.03	0.77	24.27	15.14	14.06
L.S.D.0.01 (sij-sik)	11.66	11.07	7.84	1.57	1.38	1.02	32.47	20.26	18.67
L.S.D.0.05 (sij-skl)	8.07	7.51	2.23	1.08	0.96	0.29	22.47	14.02	5.32
L.S.D.0.01 (sij-skl)	10.80	10.05	2.96	1.45	1.28	0.39	30.06	18.75	7.06

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

S1, S2 and Comb. early, late planting dates and the combined analysis, respectively.

Table (18):cont.

Cross	Number of seed/plant			100-Seed weight (gm)			Seed yield/plant (gm)		
	S1	S2	Comb.	S1	S2	Comb.	S1	S2	Comb.
P1 x P2	-31.38	-1.66	-16.52	0.60	0.80	0.69*	-4.54	-0.71	-2.62
P1x P3	11.34	14.75	13.04	-3.65**	-1.48**	-2.56**	-5.93	-0.15	-3.04
P1 x P4	53.00**	3.78	28.39*	1.09*	-1.51**	-0.21	11.45**	-1.09	5.18**
P1 x P5	10.22	-8.31	0.96	-0.07	0.39	0.16	1.03	-1.20	-0.09
P1x P6	-6.93	33.42**	13.25	1.34**	1.09*	1.22**	1.16	6.14**	3.65*
P2 x P3	-13.27	14.98	0.85	1.06*	-0.78	0.14	0.41	-1.51	-0.55
P2 x P 4	-28.91	29.37*	0.23	0.34	-0.50	-0.08	-3.35	4.45**	0.55
P2 x P5	-44.37*	-27.61*	-35.99**	-0.92	-0.10	-0.51	-8.63**	-3.46**	-6.05**
P2 x P6	-6.07	-12.23	-9.15	0.16	0.01	0.09	-0.41	-1.19	-0.80
P3 x P4	-31.96	-25.99*	-28.97*	-0.30	2.35**	1.16**	-5.72	4.59**	-0.57
P3 x P5	65.43**	36.74**	51.08**	0.78	-1.97**	-0.60	13.27**	-0.50	6.38**
P3 x P6	65.19**	20.88	43.04**	-1.66**	-2.27**	-1.97**	7.22*	-0.38	3.42*
P4 x P5	-8.55	-18.34	-13.45	0.62	0.15	0.38	1.14	-0.81	0.16
P4 x P6	-18.65	-18.83	-18.74	-1.01*	-0.97*	-0.99*	-4.46	-3.74**	-4.10*
P5 x P6	-70.34**	-45.7**	-58.02**	0.96	-0.04	0.46	-8.89**	-2.50**	-5.69**
L.S.D.0.05 sij	39.20	23.09	22.36	0.98	0.84	0.63	6.18	2.45	3.27
L.S.D.0.01 sij	52.45	30.89	29.69	1.31	1.12	0.84	8.26	3.28	4.33
L.S.D.0.05 (sij-sik)	58.50	34.46	33.38	1.46	1.25	0.94	9.22	3.65	4.88
L.S.D.0.01 (sij-sik)	78.27	46.10	44.31	1.96	1.67	1.25	12.33	4.89	6.47
L.S.D.0.05 (sij-skl)	54.16	31.90	12.62	1.35	1.15	0.36	8.53	3.38	1.84
L.S.D.0.01 (sij-skl)	72.47	42.68	16.75	1.81	1.54	0.47	11.42	4.53	2.45

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

S1, S2 and Comb. early, late planting dates and the combined analysis, respectively.

Considering seed yield/plant, the three crosses (P_1xP_4) and (P_3xP_5) and (P_3xP_6) at early planting date and the combined analysis and three crosses (P_1xP_6), (P_2xP_4) and (P_3xP_4) in late planting date exhibited significant positive (S_{ij}) effects. In these traits, most of the previous crosses had significant desirable (S_{ij}) effects in the F_1-generation. The mentioned combinations might be of interest in breeding programs aimed at producing pure line varieties as most combinations involved at least one good combiner.

4. Genetic Components Analysis :

4.1. F_1 generation :

Assumption of this type of diallel analysis are diploid segregation, no reciprocal differences homozygous parents, no multiple alleles, uncorrelated gene distribution, no genotype by environment interaction within locations and years, and no epistasis. Failure of any one or any combination of the assumptions invalidates to some degree the inferences derived by means of the analysis. To test the validity of these assumptions, therefore two main tests were employed. First of all was the analysis of variance for the quantity (Wr-Vr) where (Vr) is the parental array variances and (Wr) is the parent-offspring covariance. This quantity is expected to be constant over arrays if all the assumptions are valid **(Jinks and Hayman, 1953, and Hayman, 1963)**. Insignificant mean squares attributable to arrays, revealing the validity of all assumptions were obtained in all cases. The second employed test was the analysis of (Wr, Vr) regression. The coefficients in this test are expected to be significantly differed from zero but not from unity if all of the assumptions are valid **(Jinks and Hayman, 1953)**. Significant regressions were obtained in 100-seed weight and the regression lines did not deviate significantly from unity. This finding again verified that the genetic system could be deduced to be additive without the complication of non allelic integration. For other traits, the regression coefficients of (Wr) on (Vr) lacked to significance indicating that the assumption of no genic interaction was not valid. The estimation of population parameters, could be possible with such partial fulfillment (Hayman, 1954 b). These estimation, however would be less reliable than those traits which completely satisfied this assumption.

Data were further subjected to the diallel analysis proposed by (Hayman, 1954 b) to obtained more information about the genetic behavior for the traits under study. The computed parameters for all cases are presented in Table (19). With the exception of maturity date, first pod height and seed yield/plant in the late of sowing date and number of branches/plant in the early sowing date, the additive component (D) reached the significant level of probability for all the studied traits. This finding is in harmony with that reached above in Table (13). For the exceptional cases, significant (D) values in spite of highly significant (GCA) estimate was obtained. Dominance may has a role in GCA estimates as emphasized by Jinks (1955). Also, this contradiction between both types of analysis might be a logical results because of the presence of complementary type of non allelic interaction which inflated the ratios of (H) t (D), (**Hayman, 1954 b and Mather and Jinks, 1971**).

For 100-seed weight, the (D) components was found to express the higher magnitude relative to the corresponding (H_1) ones (Table 19). This finding is in harmony with that reached above in Table (13).

For other cases, the values of (D) were smaller in magnitude than the respective (H_1) ones. This result revealed that non additive of gene action was more prevalent. For these cases, except number of pods and seed yield/plant in both sowing dates, and number of branches/plant in the early sowing date and first pod height in the late sowing date, which exhibited high GCA/SCA ratios which exceeded the unity from combining ability analysis contradicted with that obtained from Hayman analysis. This contradiction between both types of analysis might of non allelic interaction which inflated the ratios of (H) to (D) { **Hayman (1954 b) and Mather and Jinks (1971)** }.

The relative size of (D) and (H_1) estimated as $(H_1/D)^{1/2}$ can be used as a weighted measure of the average of dominance at each locus, showed the presence of over dominance for all traits except 100-seed weight in both sowing dates. This result is in agreement with previously reached by **Leffel and Weiss (1958)** for plant height and seed yield/plant, **Densescu (1983)** for number of seeds, seed yield and 100-seed weight, **Alam *et al.* (1984)** for seed yield, number of seeds and 100-seed weight, **Habeeb *et al.* (1988 b)** for number of seeds/plant and 100-seed weight, **Sharma *et al.* (1993)** for all studied traits except 100-seed weight, **El-Hosary *et al.* (1997)** for number of seeds/plant, first pod height, 100-seed weight, number of pods and seed yield/plant, and **Mansour *et al.* (2002)** for flowering date, maturity date, plant height and seed yield/plant.

For 100-seed weight, the values of $(H_1/D)^{1/2}$ were less unity, revealing that a partial dominance was detected. Similar results was obtained by **Densescu (1983), Alam *et al.* (1984), Habeeb *et al.* (1988 b), Cinsoy (1992), El-Hosary *et al.* (1997), Habeeb (1998 b) and El-Hosary *et al.* (2001).**

The average frequency of negative vs. positive alleles in parental populations was detected by computing the ratio ($H_2/4H_1$). Values largely deviating from one quarter were obtained for all traits except seed yield/plant, number of branches, number of pods and seeds/plant, revealing that negative and positive alleles were unequally distributed among the parents.

The relative frequencies of dominant and recessive alleles in the parental population could be also tested by computing the (F) component, significant (F) values were detected in all traits except seed yield/plant, number of branches, pods and seeds/plant, indicating asummitry of gene frequency among the parental population with an excess of recessive alleles for maturity date and first pod height in early and late sowing dates, respectively.

For the exceptional traits, insignificant (F) values were detected, indicating that dominance and recessive alleles of loci exhibiting dominance were equally distributed among the parents. This finding again confirms the results reached above for ($H_2/4H_1$) estimate. The same conclusion could also be drawn from the corresponding proportion $\{ [(4DH)^{1/2} + F] / [(4DH_1)^{1/2} - F] \}$.

The overall dominance effects of heterozygous loci (h^2) were computed. Significant (h^2) values were detected for all traits except maturity dates first pod height and plant height in the late sowing date, indicating that dominance was unidirectional. This finding confirms the results reached above for parent vs. crosses in Table (7). Appreciable heterotic effect was previously reported for plant height and 100-seed weight by **Leffel and Weiss (1958)** for number of seeds/plant, 100-seed weight and seed yield/plant by **Dencescu (1983)** for all studied traits except flowering and maturity date by **Habeeb (1988 a)**, for flowering date, number of pods/plant and seed yield/plant by **Choukan (1996)** and for number of branches, pods and seed yield/plant, first pod height and 100-seed weight by **El-Hosary *et al.* (1997)**.

Heritability estimates in narrow sense for all traits are given in Table (19). Low heritability values in narrow sense were detected for all traits except for flowering date and 100-seed weight in both planting dates and maturity date in the early sowing date, indicating that most of genetic variance may be due to non-additive genetic effects. This finding supported the previous results of genetic components where the H_1 estimates were found to have a great role in these traits (Table 19). Therefore the bulk method program for most traits might be quite promising. The same results reported by **Bastawisy *et al.* (1997)** for number of branches, number of pods, number of seeds and seed weight per plant, by **El-Hosary *et al.* (1997)** for flowering date, maturity date, number of pods/plant and seed yield/plant by **Habeeb (1998)** for maturity date, first pod height, number of seeds per pod and 100-seed weight by **Refat (1998)** for number of seeds/plant and 100-seed weight by **El-Hosary *et al.* (2001)** for number of pods, number of seeds and seed weight per plant and **Mansour (2002)** for plant height.

For the exceptional traits, high to moderate values for heritability in narrow sense were recorded, revealing the most of the phenotypic variability in each case was due to additive effects. These findings supported these data mentioned before in Table (19). Therefore, a pedigree selection program for these traits might be a quite promising.

4.2. F_2-generation :

The computed parameters for all cases are presented in Table (20). With the exception of number of branches/plant in early sowing date, the additive component (D) reached the significant level of probability for all the studied traits. This findings is in harmony with that reached above in Table (14). For the exceptional case, insignificant (D) value in spite of highly significant GCA estimate was obtained. Dominance may has a role in GCA estimate as emphasized by Jinks (1955). Also, this contradiction between both types of analysis might be a logical results because of the presence of complementary type of non allelic interaction which inflated the ratio of (H_1) to (D), **Hayman (1954 b) and Mather and Jinks (1971).**

For 100-seed weight, the (D) component was found to express the higher magnitude relative to the corresponding (H_1) ones (Table 20). This finding is in harmony with that reached above in Table (14).

Significant value of dominance component (H_1) were obtained for all the studied traits. Values of (H_1) were larger in magnitude than the respective (D) ones for all the studied traits except 100-seed weight. This result revealed that non additive type of gene action was the most prevalent genetic component for these traits. Also, the contradiction in magnitude obtained between (D) and GCA estimate could be attributed to the great role of both allelic and non allelic genic types of the expression of most traits. These results are in line with those reported by **Dencesu (1983), Alam *et al.* (1984), Loiselle *et al.* (1990), Malik and Singh (1991), Cinsoy (1992), Radi *et al.* (1993), Ziya Gizlice *et al.* (1993), Bastawisy (1997), El-Hosary *et al.* (1997) and Refat (1998).**

Theoretically (H_2) should be equal to or less than (H_1), **Hayman (1954 b).** The smaller (H_2) than (H_1) in the maturity date, number of pods/plant, number of seeds/plant and seed yield/plant in both planting dates, first pod height, plant height and 100-seed weight in early planting date and flowering date and number of branches/plant in the late of planting date, indicating that the positive U and negative V alleles frequencies at the loci for the previous cases in question are not equal in proportion in the parents. This was reflected in the estimates of the covariance of additive and dominance effects (F) which were significantly positive in the same cases except maturity date in the early sowing date. Positive estimates of (F) indicate the excess of dominant alleles. Also, the values of $H_2/4H_1$ were slightly below the maximum value of 0.25, which arises when U=V=0.5 overall loci, indicating that the positive and negative alleles were not equally distributed among the parents for the previous cases. The same conclusion could again drawn from corresponding proportion $(4DH_1)^{1/2} + F$ / $(4DH_1)^{1/2} - F$. These results were partial agreement with previously reached by **Habeeb *et al.* (1988 a), Habeeb *et al.* (1988 b), Refat (1998) and El-Hosary *et al.* (2001).**

The overall dominance effects of heterozygous loci (h^2) were computed. Significant (h^2) values were detected for all traits except number of pods/plant, number of seeds/plant and seed yield/plant in both planting dates, maturity date in late date and number of branches/plant in early sowing date, indicating that dominance was unidirectional. This finding confirms the results reached above for parent vs. crosses (Table 9). Appreciable heterotic effect was previously reported by **Sabbough (1987), Loiselle *et al.* (1990), Cinsoy (1992) and Ziya Gizlice *et al.* (1993).**

Heritability estimates in narrow sense for all traits are given in Table (20). Low heritability value in narrow sense were detected for all traits except 100-seed weight in both planting dates and maturity date in the early sowing date which moderate values was detected, indicating that most of genetic variance may be due to non-additive genetic effects. This

Table (19): Estimates of the genetic components for F1 crosses in dialle cross for all studied traits at the two sowing dates.

Genetic component	Flowering days		Maturity days		First pod height (cm)	
	S1	S2	S1	S2	S1	S2
D1	22.960**	43.370**	177.840**	68.140*	2.787	0.248
H1	36.990**	45.03	487.330**	493.870**	20.228**	6.527**
H2	28.600**	34.270**	367.520**	337.920**	13.723**	5.342**
h2	19.980**	16.670**	38.670	0.510	5.770*	0.050
F	6.050*	34.210**	-41.650*	60.040*	3.342*	-0.058*
E	0.470	0.402	0.890	0.608	0.238	0.174
$(H1/D)^{1/2}$	1.260	1.010	1.650	2.690	2.694	5.134
H2/4H1	0.190	0.190	0.188	0.170	0.170	0.205
KD/KR	1.230	2.260	0.867	1.390	1.573	0.955
Heritability	0.620	0.520	0.640	0.490	0.448	0.330
r	0.640	0.400	-0.85	-0.630	-0.222	-0.151
R2	0.410	0.160	0.730	0.400	0.049	0.023

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

S1 and S2 . Early and late planting dates , respectively.

r Correlation between parental mean performance (Yr)and order of dominance(Wr+Vr).

Table (19):cont.

Genetic components	Plant height(cm)		No. of branches/plant		No. of pods/plant	
	S1	S2	S1	S2	S1	S2
D1	301.280**	93..630*	0.624	0.226	748.650	217.734
H1	1007.460**	494.132**	16.581*	4.416*	16848.47**	3141.941*
H2	916.750**	410.250**	14.598**	4.077*	15138.11**	2906.182*
h2	1161.520**	5.135	20.005**	6.907**	10032.21**	2207.371**
F	285.960*	75.592*	0.348	-0.233	1416.208	32.203
E	2.480	3.496	0.111	0.163	25.726	7.100
$(H1/D)^{1/2}$	1.829	2.297	5.155	4.418	4.744	3.799
H2/4H1	0.227	0.208	0.220	0.231	0.225	0.231
KD/KR	1.701	1.426	1.114	0.791	1.498	1.040
Heritability	0.186	0.325	0.231	0.252	0.120	0.223
r	-0.807	-0.157	-0.850	-0.756	-0.566	-0.254
R2	0.651	0.025	0.722	0.571	0.321	0.065

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

S1 and S2 . Early and late planting dates , respectively.

r Correlation between parental mean performance (Yr)and order of dominance(Wr+Vr).

Table (19):cont.

Genetic components	No.of seeds/plant		100-seed weight(gm)		seed yield/plant(gm)	
	S1	S2	S1	S2	S1	S2
D1	4841.463	1221.620	17.697**	10.197**	53.524	0.690
H1	95797**	24429.440*	15.978*	7.296**	2866.8*	523.68*
H2	83047.760**	21847.260*	12.540*	5.173**	2495.323*	453.21*
h2	50531.470*	19434.260**	4.067*	1.172	1763.232*	254.330*
F	9168.800	-65.045	13.386*	-3.476*	91.870	-17.980
E	87.523	8.190	0.219	0.220	2.104	1.440
$(H1/D)^{1/2}$	4.448	4.472	0.950	0.846	7.319	27.524
H2/4H1	0.217	0.224	0.196	0.177	0.218	0.216
KD/KR	1.541	0.988	2.322	0.665	1.266	0.358
Heritability	0.168	0.261	0.536	0.839	0.210	0.280
r	-0.760	-0.142	0.904	-0.212	-0.476	0.295
R2	0.578	0.020	0.817	0.045	0.227	0.087

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

S1 and S2 . Early and late planting dates , respectively.

r Correlation between parental mean performance (Yr)and order of dominance(Wr+Vr).

Table (20): Estimates of the genetic components for F2 crosses in dialle cross for all studied traits at the two sowing dates.

Genetic components	Flowering days		Maturity days		First pod height(cm)	
	S1	S2	S1	S2	S1	S2
D1	33.790**	44.450**	177.840**	68.150*	3.420**	0.200*
H1	57.630**	77.550**	487.330**	493.880**	10.250**	12.10**
H2	49.250**	58.720*	367.530**	337.930**	8.230**	11.84**
h2	55.380**	36.610*	38.680*	0.520	4.100*	16.74**
F	26.570	55.990*	-41.650*	60.050*	1.820*	-2.000
E	0.070	0.510	0.900	0.610	0.530	0.590*
$(H1/D)^{1/2}$	1.306	1.321	1.655	2.692	1.732	7.729
H2/4H1	0.214	0.189	0.189	0.171	0.201	0.245
KD/KR	1.861	2.589	0.868	1.391	1.363	0.220
Heritability	0.387	0.271	0.646	0.491	0.412	0.258
r	0.741	0.899	-0.857	-0.634	-0.721	-0.691
R2	0.549	0.808	0.734	0.402	0.520	0.478

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

S1, S2 and Comb. early, late planting dates and the combined analysis, respectively.

r Correlation between parental mean performance (Yr)and order of dominance(Wr+Vr).

Table (20):cont.

Genetic components	Plant height(cm)		No. of branches/plant		No. of pods/plant	
	S1	S2	S1	S2	S1	S2
D1	377.870**	119.910*	0.040	0.280*	411.810**	193.410**
H1	505.780**	395.360**	1.420**	0.900**	1587.110**	566.670**
H2	432.060**	354.610**	1.130**	0.760**	1235.240**	452.610**
h2	356.480**	217.420**	2.040**	0.910**	-44.070	-5.540
F	259.240**	59.390	0.110	0.160*	679.150*	272.520*
E	10.440	9.130	0.180**	0.150**	80.650	30.580
$(H1/D)^{1/2}$	1.157	1.816	5.676	1.784	1.963	1.712
H2/4H1	0.214	0.224	0.200	0.209	0.195	0.200
KD/KR	1.843	1.316	1.572	1.362	2.448	2.400
Heritability	0.448	0.341	0.188	0.290	0.098	0.108
r	-0.862	-0.712	-0.192	-0.063	-0.517	-0.277
R2	0.743	0.507	0.037	0.004	0.267	0.077

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

S1, S2 and Comb. early, late planting dates and the combined analysis, respectively.

r Correlation between parental mean performance (Yr)and order of dominance(Wr+Vr).

Table (20):cont.

Genetic components	No. of seeds/plant		100 Seed weight(gm)		Seed yield /plant(gm)	
	S1	S2	S1	S2	S1	S2
D1	3983.020**	1212.410**	10.970**	8.350**	46.630*	0.570*
H1	7916.670**	3101.340**	7.580	7.060**	182.080**	38.220**
H2	5655.280**	2235.970**	6.270	6.320**	156.150**	30.350**
h2	208.070	-84.490	-0.150	3.430*	-0.430	-0.370
F	5840.800*	1538.470*	5.890*	4.240	51.270*	1.100*
E	456.040	158.220	0.310	0.210	11.320	1.830
$(H1/D)^{1/2}$	1.409	1.599	0.831	0.920	1.976	8.192
H2/4H1	0.179	0.180	0.207	0.224	0.214	0.198
KD/KR	3.167	2.315	1.954	1.763	1.771	1.267
Heritability	0.097	0.273	0.629	0.575	0.174	0.281
r	-0.356	-0.711	0.147	0.872	0.497	-0.916
R2	0.127	0.506	0.022	0.762	0.248	0.838

*** and ** significant at 0.05 and 0.01 levels of probability, respectively.**
S1, S2 and Comb. early, late planting dates and the combined analysis, respectively.
r Correlation between parental mean performance (Yr)and order of dominance(Wr+Vr).

finding supported the previous results of genetic components where the H_1 estimates were found to have a great role in these traits (Table 20). Therefore the bulk method program for most traits might be quite promising. The same results reported by **Alam *et al.* (1984), Cinsoy (1992), Yang *et al.* (1992), Taware *et al.* (1996)** and **Refat (1998).**

5. Graphical Analysis :

5.1. F_1-generation :

The data obtained herein were also subjected to genetic analysis by means of diallel cross graphs as constructed by **Jinks (1954).**

The regression of parent-odd spring covariance (Wr) on parental array variances (Vr) and their limiting parabola of the six parental diallel crosses for all traits in both planting dates are illustrated in Fig. 1 to 9.

With the exception of first pod height in late sowing date and number of pods/plant in early sowing date, significant regression lines deviate significantly from unity for most traits. This result might revealed that the genetic system could be deduced to be non-additive and complementary type of epistasis was involved. The regression line was found to pass through the origin in case of maturity date in early sowing and number of seeds/plant and seed yield per plant in both planting dates revealing the presence of complete dominance. Meanwhile it intersects the (Wr) axis below the origin for flowering date, first pod height, plant height, number of branches/plant in both planting date and maturity date in late sowing date, reflecting over-dominance. This finding agrees with the results presented in Table (19).

For number of pods/plant, the regression coefficients of (Wr) on (Vr) were found to be significantly deviate from unity indicating that complementary type of epistasis was involved. Significantly positive intercept was obtained in this trait in both planting dates suggesting partial dominance. Presence of over-dominance, however, was the conclusion of pods/plant as presented in Table (19). This contradiction between both types of analysis might be a logical result of the presence of complementary type of nonallelic interaction which inflated the ratios of (H_1) to (D) and distorted the (Vr, Wr) graph **(Hayman, 1954 b and Mather and Jinks, 1971).**

For 100-seed weight in both planting dates, the regression lines were found to be significantly positive intercept, indicating partial dominance. This result agree with results presented in Table (19).

The array points were significantly scattered along the regression line for most traits in both planting dates, corroborating with the results obtained herein for degree of dominance (Table 19). This fining might revealed the dominance effects for most genes controlling these traits.

The correlation coefficient values between parental mean (Vr) and (Wr+Vr) for each array were significant negative for plant height, number of branches/plant and number of seeds/plant in the early planting date, revealing that increasers genes were dominant over decreasers.

High and significant positive correlation coefficient values were detected for 100-seed weight in the early sowing date, indicating that decreases genes were dominant over increases.

High positive correlation coefficient values were detected for flowering date in both sowing dates, indicating that decreasers genes were dominant over increasers. For the other cases, low correlation values which could not be fruitful in getting any idea about the direction of dominance were obtained. Such low values of correlation coefficient might be due to the presence of epistatsis and to additive of most genes involving the system in these cases. Also, it might reveal that high performance for such traits was controlled by dominant and recessive genes as well.

Regarding to flowering date, the parental variety (P_4) Holladay laid in the far from the origin, indicating that it possessed the most recessive genes in this respect in both planting dates. While, (P_5) L86-k-73 and (P_6) H_2L_{12} seemed to contain largest number of dominant genes responsible for flowering date in early and late sowing dates, respectively.

For maturity date, the parental line (P_5) L86-k-73 seemed to carry the most recessive genes responsible for this trait, while, the parental variety (P_4) Holladay seemed to be carry the most dominant genes responsible for maturity date in both planting dates.

The parental variety (P_3) Ware and parental line ($_{P5}$) L86-k-73 for first pod height, (P_2) Giza 83 and (P_3) Holladay for number of branches, (P_3) Ware and (P_6) H_2L_{12} for number of seeds/plant seemed to be carry the most recessive and dominant genes responsible for these traits in both planting dates, respectively.

For plant height, the parental variety (P_3) Ware seemed to be carry the most recessive genes responsible for this trait in both planting dates. While the parental variety (P_1) Clark and line (P_6) $H2L_{12}$ seemed to contrite the largest number of dominant genes responsible for plant height, in early and late sowing dates, respectively.

The parental varieties (P_4) Holladay and (P_2) Giza 83 contained the most recessive genes in early and late sowing date, respectively, and (P_6) H_2L_{12} in both planting dates, contained the most dominant genes responsible for the expression of number of pods/plant.

For 100-seed weight, the parental variety (P_3) Ware and (P_1) Clark contained the most recessive genes in early and late sowing dates, respectively. While, the parental line (P_6) H_2L_{12} and variety Giza 83 (P_2) seemed to carry the most dominant genes in the same order responsible for this trait.

Regarding to seed yield/plant the parental varieties (P_1) Clark and (P_2) Giza 83 in early and late sowing dates contained the most recessive genes. While, the parental line H_2L_{12} (P_6) seemed to carry the most dominant genes in both planting dates.

For some traits, the response of parental varieties and/or lines were affected by sowing dates. This finding coincided with that reached above where significant genotypes and its components by planting date mean squares were detected (Table 7).

5.2. <u>F_2-generation</u> :

The data obtained herein were also subjected to genetic analysis by mean of diallel cross graphs as constructed by Jinks (1954). The regression of parent-offspring covariance (Wr) on parental array variances (Vr) and their limiting parabola of the six parental diallel crosses for all studied traits are illustrated in Figs (10 to 18).

With the exception of maturity date, first pod height, number of branches/plant and seed yield/plant in both planting dates, the slope of the regression lines did not deviate significantly from unity. This result might reveal that the genetic systems could be deduced to be additive without complication of non-allelic interaction. For the exceptional traits, regression slope was different from unity, indicating that complementary type of epistasis was involved.

The regression lines were found to intersect the (Wr) axis below the origin for all the studied traits except 100-seed weight in both planting dates and maturity date in early sowing date, suggesting over-dominance. Similar results were obtained by **Habeeb (1988 a) and El-Hosary *et al.* (2001).**

For the 100-seed weight in both planting dates, the regression lines were found to intersect the (Wr) axis above the origin, reflecting partial dominance. However, for maturity date in early planting date, the regression line passed through the origin revealing the complete dominance. Similar results were obtained by **Limproongratana and Maneephong (1979), Loiselle *et al.* (1990), Habeeb (1998 a) and Ragaa *et al.* (1998).**

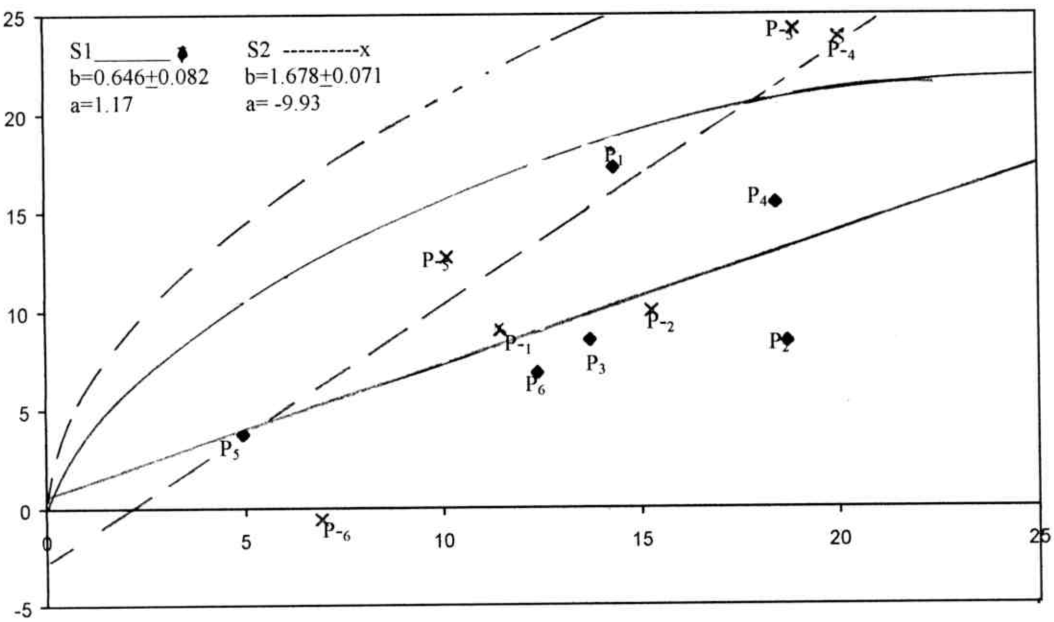
The array points were significantly scarted along the regression line for all the studied traits, revealing the genetic diversity among the parents and corroborating with the results obtained for degree of dominance in Table (20).

The parents possessed the most recessive genes and the parents contained the most dominant genes in the F_2 was coincided with that reached before the F_1 in most traits.

The correlation coefficient values between parental mean (Yr) and (Wr+Vr) for each array were significant negative for plant height in both planting dates, number of seeds and seed yield/plant in late sowing date and first pod height and maturity date in early sowing date, revealing that increasers genes were dominant over decreasers.

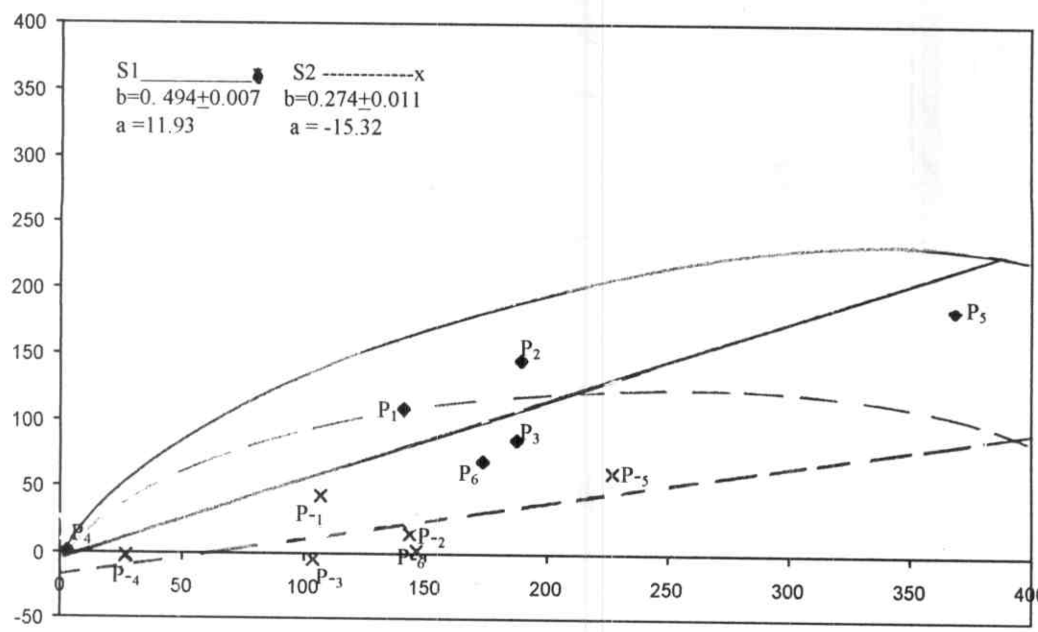
High and significant positive correlation coefficient values were detected for flowering date and 100-seed weight in late sowing date, indicating that decreasers genes were dominant over increasers.

For the other cases insignificant correlation values which could not be fruitful in getting any idea about the direction of dominance were obtained. Such low values of correlation coefficient might be due to the presence of epistasis and to additivity of most genes involving the system in these cases. Also, it might reveal that high performance for such traits was controlled by dominant and recessive genes as well.



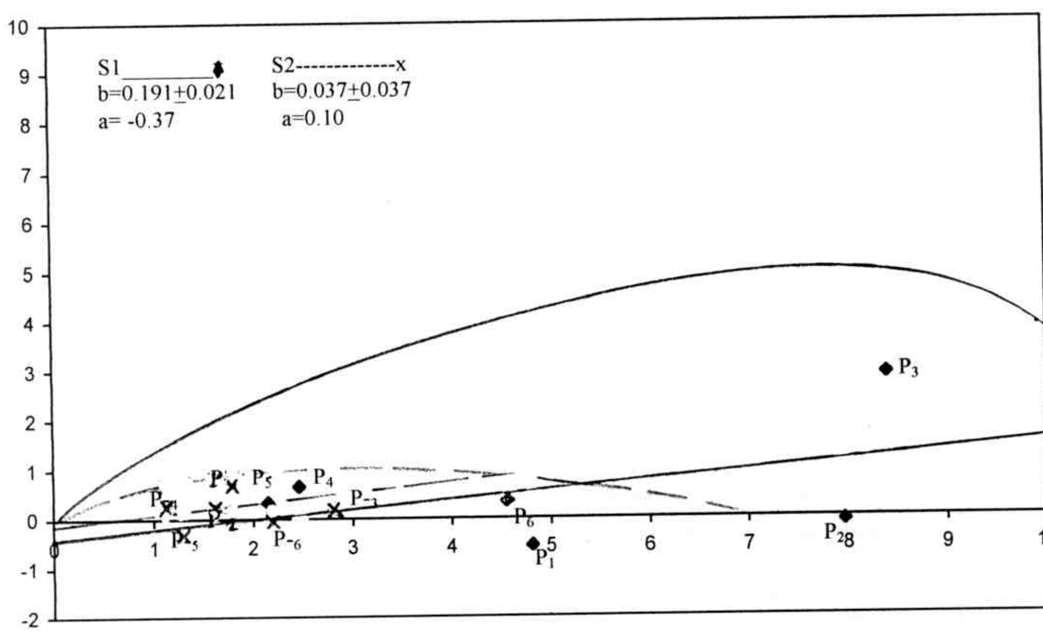
S1 first sowing date
S2 second sowing date

Fig.(1)Wr/Vr graph for flowring date in F1



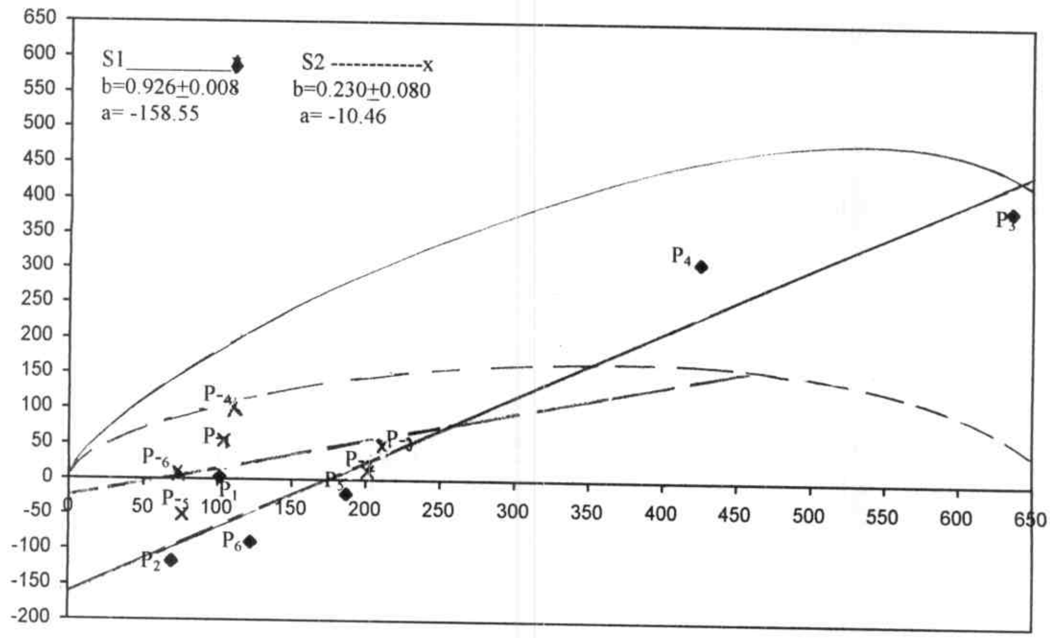
S1 first sowing date
S2 second sowing date

Fig.(2)Wr/Vr graph for maturity date in F1



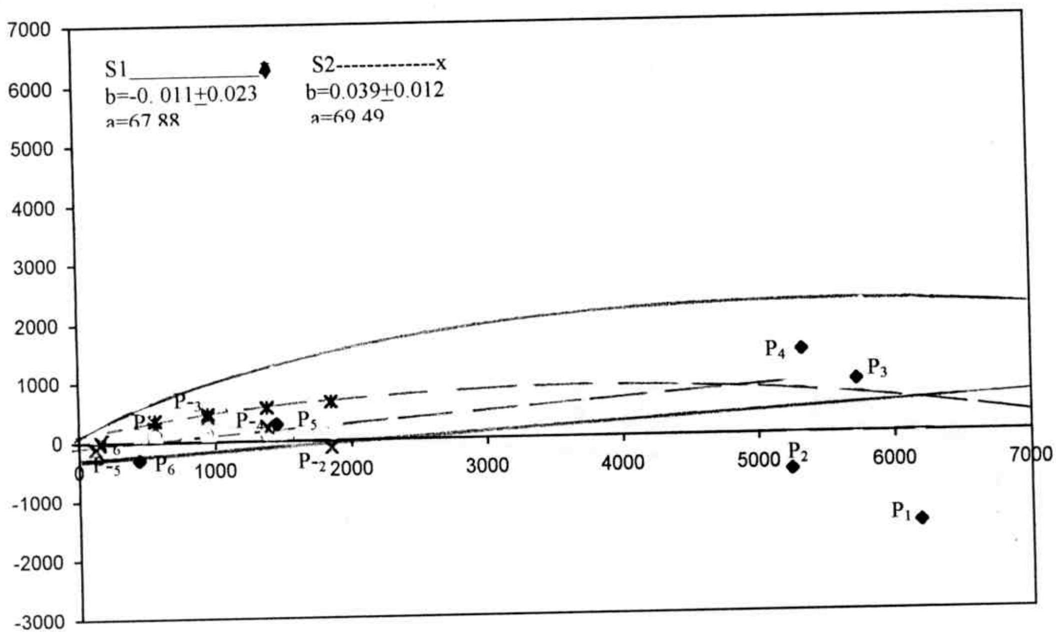
S1 first sowing date
S2 second sowing date

Fig.(3)Wr/Vr graph for first pod height in F1



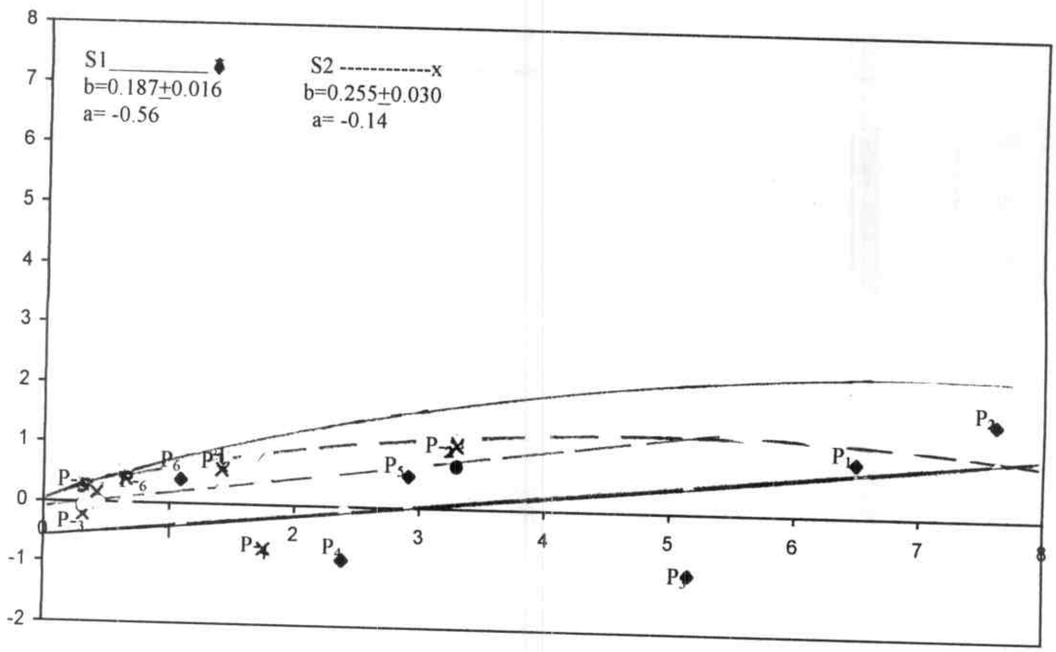
S1 first sowing date
S2 second sowing date

Fig.(4)Wr/Vr graph for plant height in F1



S1 first sowing date
S2 second sowing date

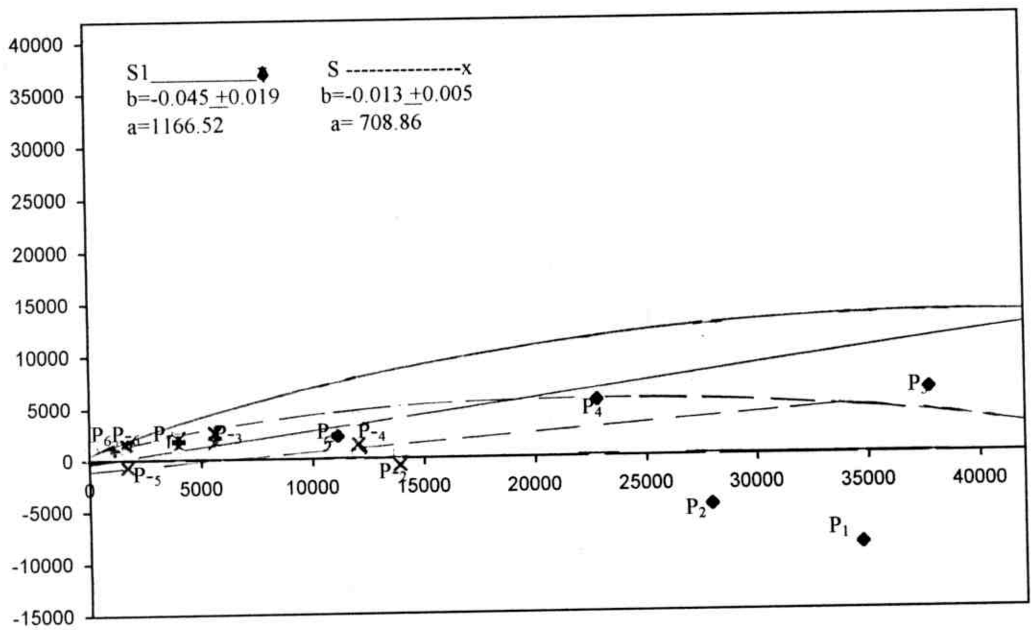
Fig.(5)Wr/Vr graph for number of pods/plant in F1



S1 first sowing date
S2 second sowing date

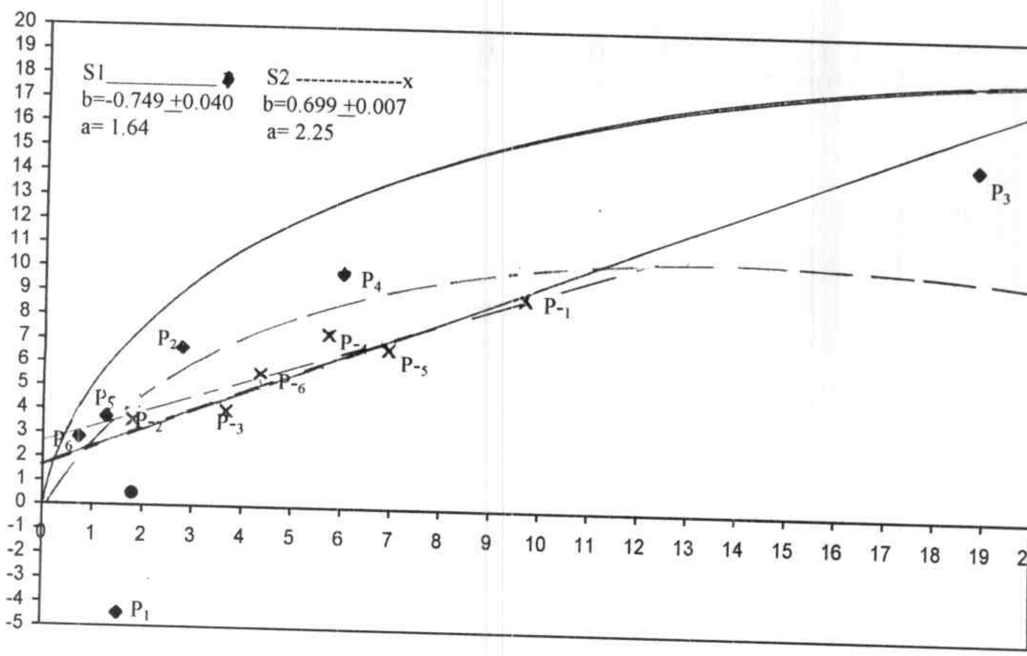
Fig.(6)Wr/Vr graph for number of branches/plant in F1

1



S1 first sowing date
S2 second sowing date

Fig.(7)Wr/Vr graph for number of seeds/plant in F1



S1 first sowing date
S2 second sowing date

Fig.(8)Wr/Vr graph for 100 Seed weight in F1

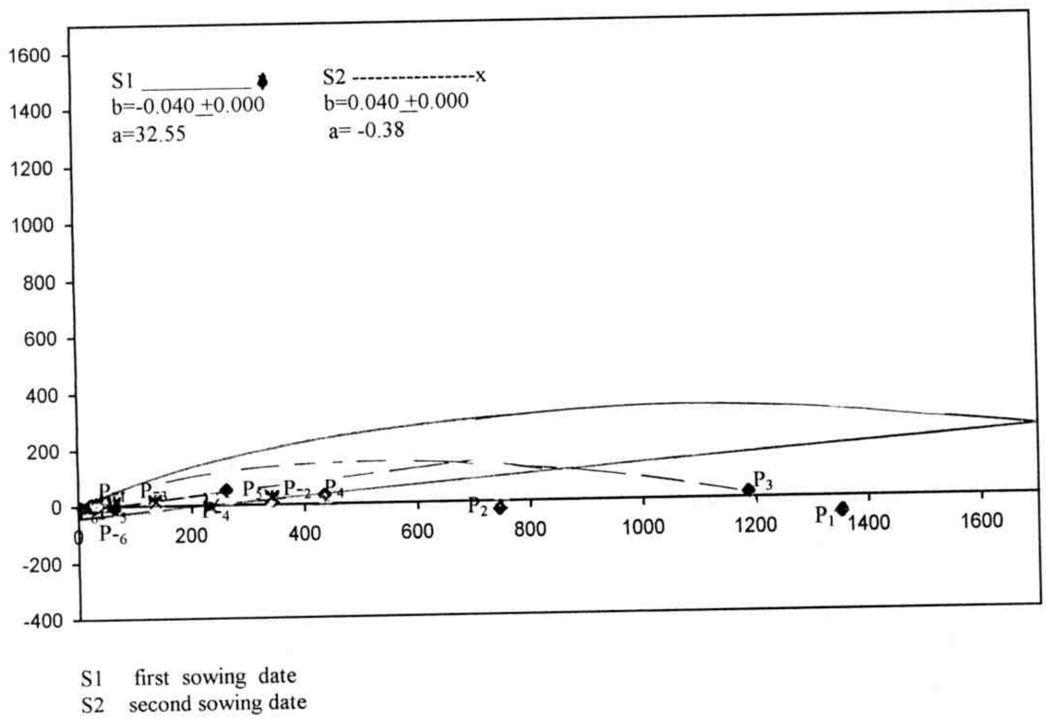
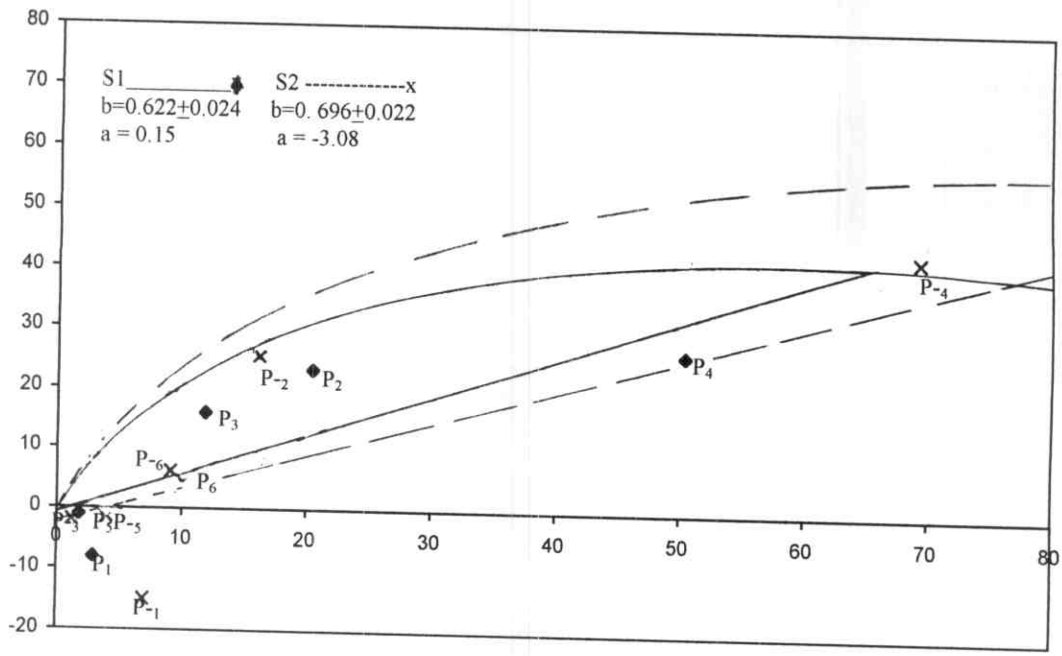
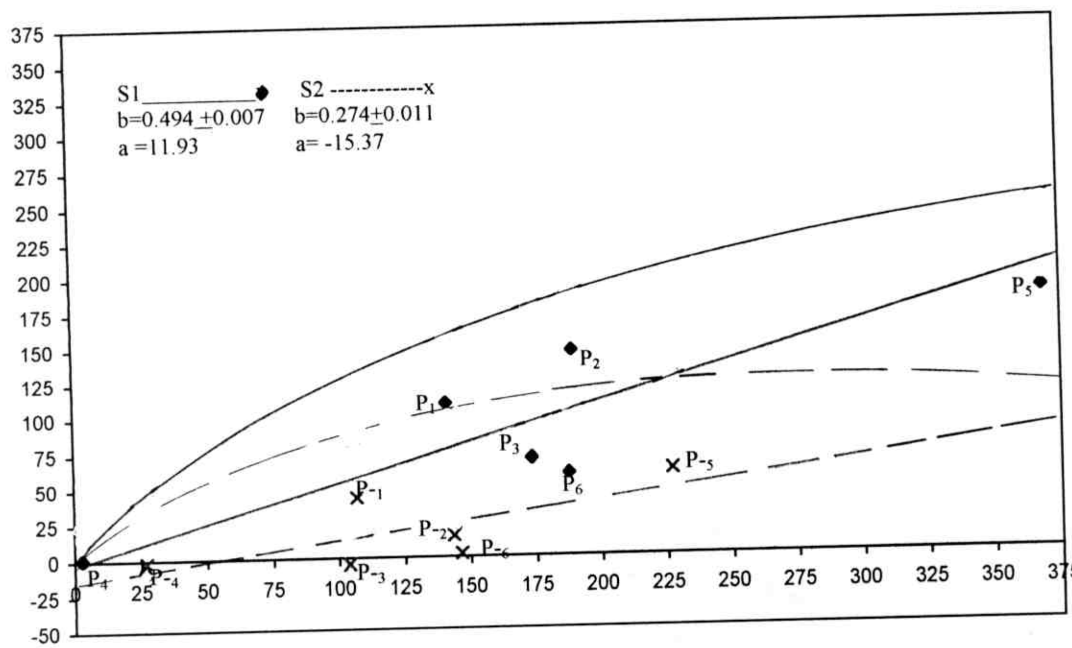


Fig.(9)Wr/Vr graph for seed yield/plant in F1



S1 first sowing date
S2 second sowing date

Fig.(10)Wr/Vr graph for flowring date in F2



S1 first sowing date
S2 second sowing date

Fig.(11)Wr/Vr graph for maturity date in F2

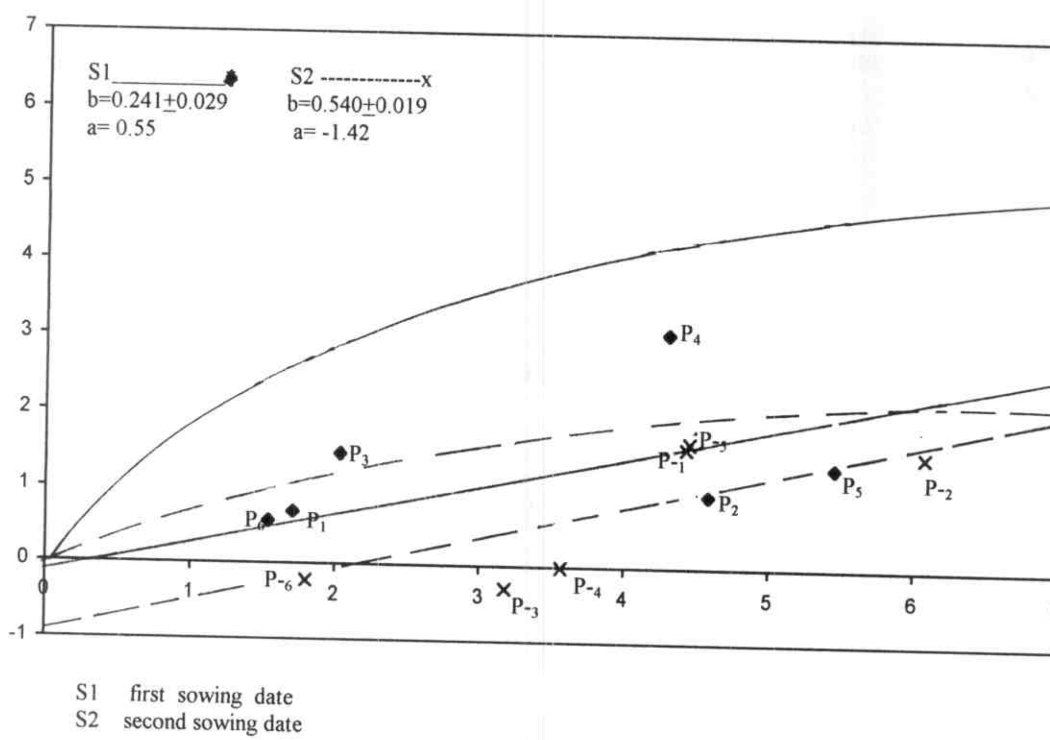
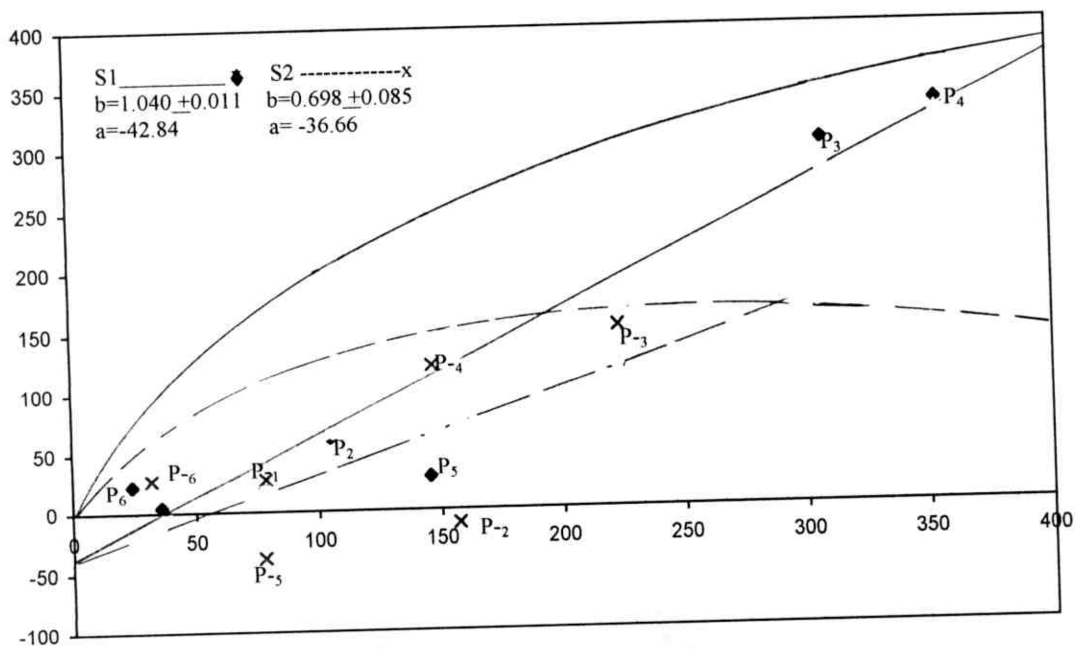
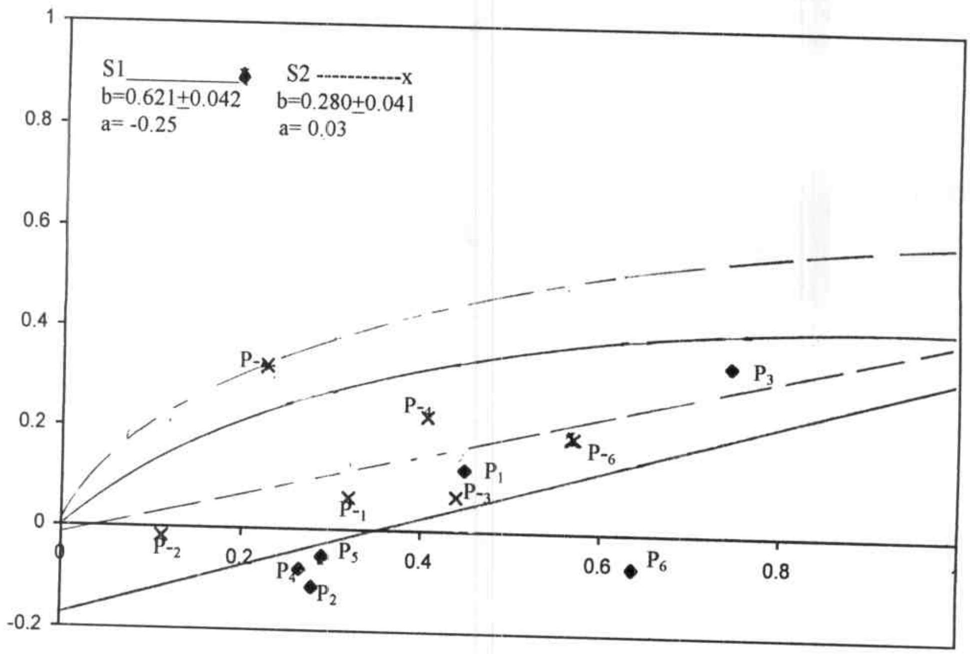


Fig.(12)Wr/Vr graph for first pod height in F2



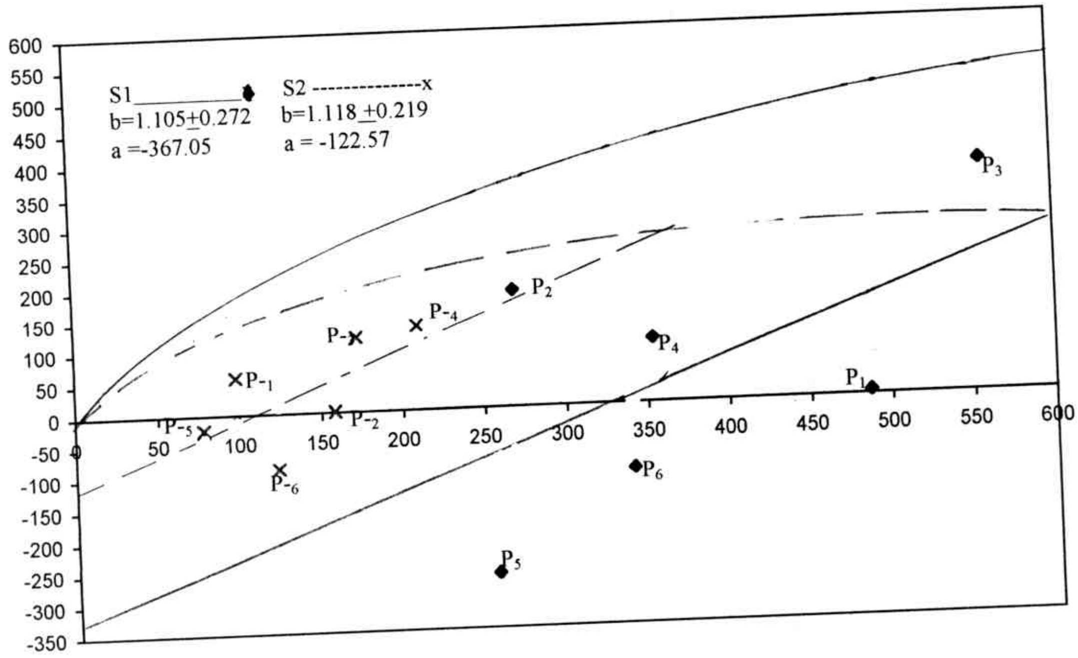
S1 first sowing date
S2 second sowing date

Fig.(13)Wr/Vr graph for Plant height in F2



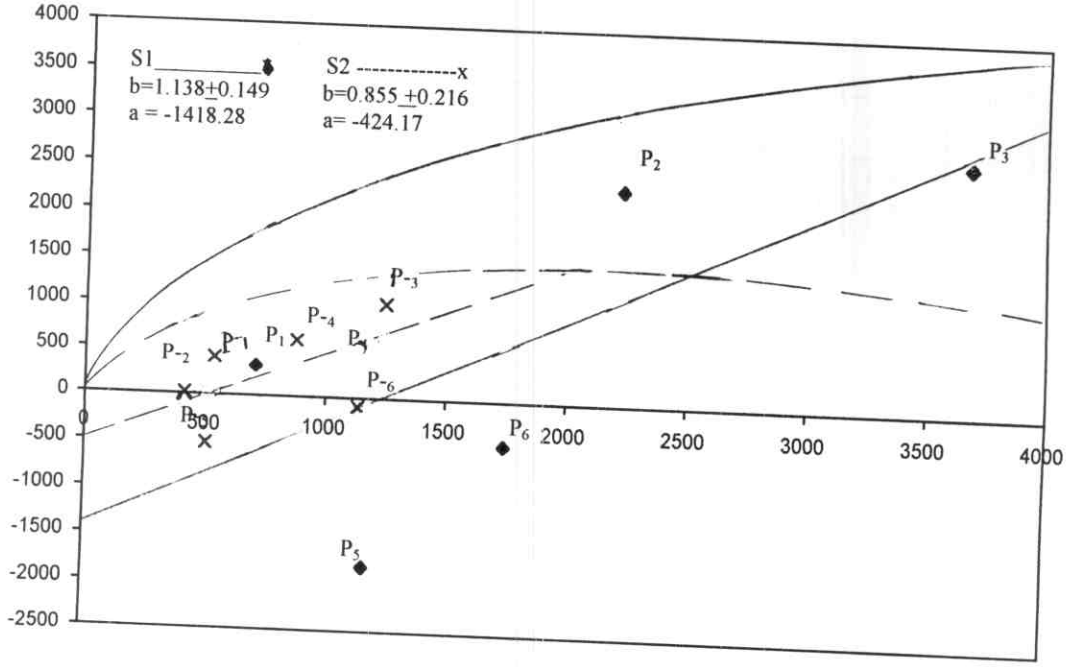
S1 first sowing date
S2 second sowing date

Fig.(14)Wr/Vr graph for number of branches/plant in F2



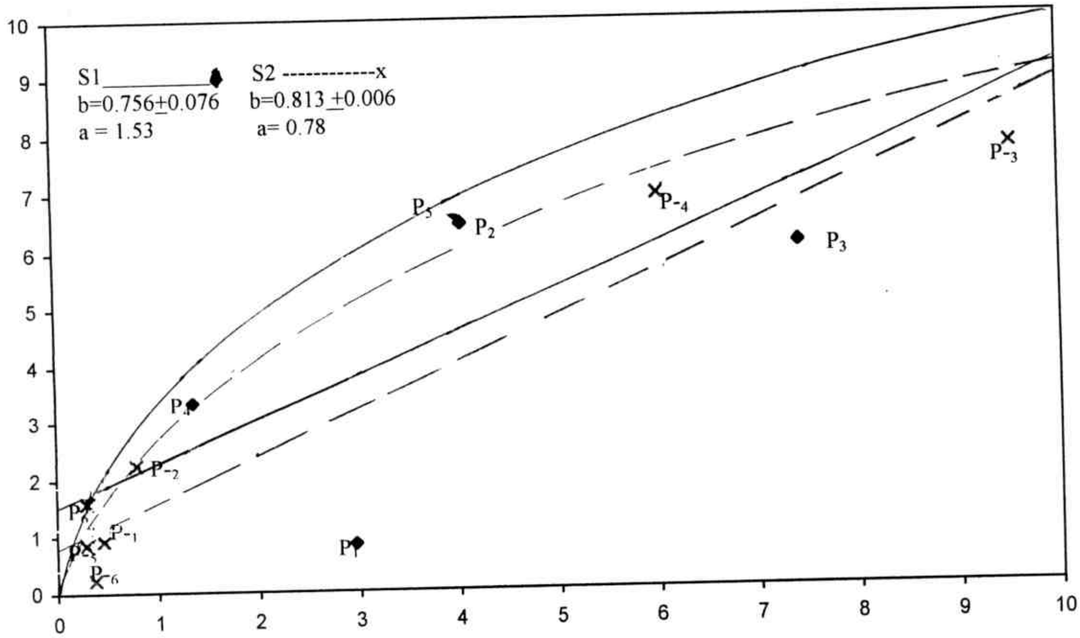
S1 first sowing date
S2 second sowing date

Fig.(15)Wr/Vr graph for number of pods/plant in F2



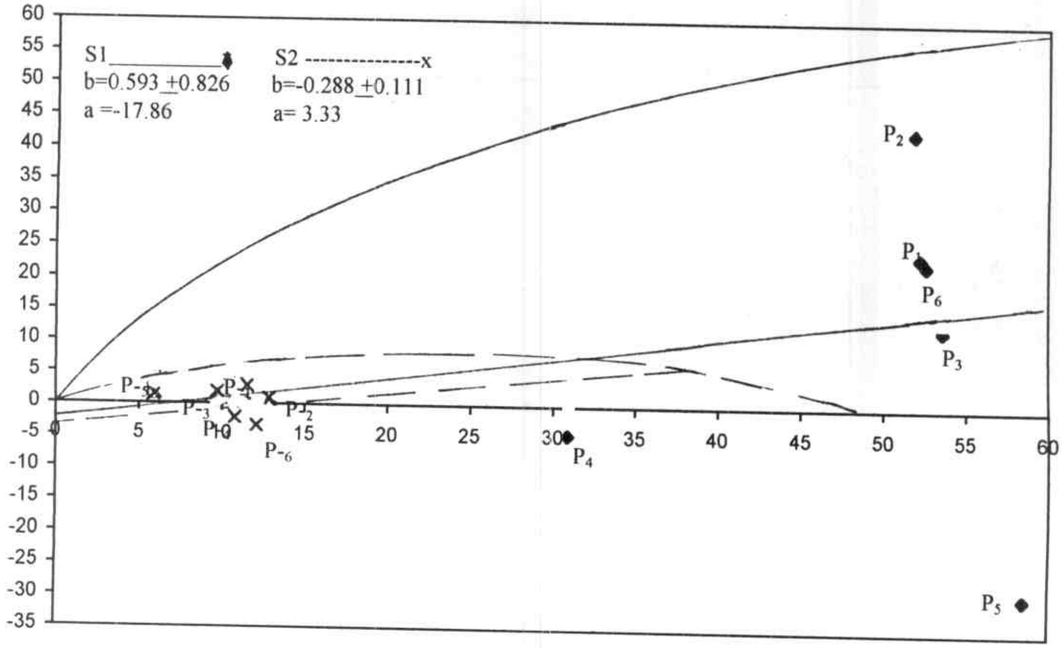
S1 first sowing date
S2 second sowing date

Fig.(16)Wr/Vr graph for number of seeds/plant in F2



S1 first sowing date
S2 second sowing date

Fig.(17)Wr/Vr graph for 100 Seed weight in F2



S1 first sowing date
S2 second sowing date

Fig.(18)Wr/Vr graph for Seed yield/plant in F2