RESULTS & DISCUSSION

IV- RESULTS AND DISCUSSION

1-Analysis of variance and mean performance:-

The analysis of variance for all studied traits at each nitrogen level as well as combined data is presented in (Table 5). Results indicated that mean squares due to nitrogen level were significant for maturity date, flag leaf area, spike length, and grain weight/spike indicating overall differences between the two nitrogen levels. On the other hand, non significant mean squares due to nitrogen levels were detected for heading date, plant height, no. of spikes/plant, no. of spikelets/spike, no. of grains/spike, 100- grain weight, grain weight /plant and total yield /plant. Such result indicates that the latter traits responded similarly to both nitrogen levels.

Significant genotypes mean squares were observed for all studied traits in each nitrogen level and the combined data indicating a wide diversity among the investigated wheat materials. Meanwhile, non significant genotypes X nitrogen level interaction mean squares were obtained for all studied traits. Such results clarified that the studied wheat genotypes behaved similarly under both nitrogen levels.

Results also showed mean squares for to parents were significant for all studied traits in both nitrogen levels and the combined data except total yield in the second nitrogen level and the combined analysis and no. of spikes/plant in the second nitrogen level . Also, hybrids mean squares were significant for all cases except no. of spikes/plant, no. of grains /spike , grain weight /spike and 100- grain weight in the second nitrogen level;

Table (5): Observed mean squares from analysis of variance for studied traits in each nitrogen level and combined data .

Source of variation	degreesof freedom		Heding date			Maturity date			Flag leaf area (cm^2)		
	S	C	N1	N2	Com.	N1	N2	Comb.	N1	N2	Comb.
N levels(N)		1			1.52			100.60**			209.21**
Rep./N	3	6	40.41	5.17	22.79	49.65	30.14	39.9	155.81	61.69	108.75
Genotype	20	20	132.91**	122.25**	251.92**	140.59**	162.05**	297.03**	211.37**	288.99**	460.40**
Parent	5	5	270.94**	225.00**	492.57**	416.80**	477.47**	887.38**	605.39**	540.16**	1132.53**
F1	14	14	92.52**	93.74**	182.84**	37.55**	46.96**	78.96**	85.51**	199.95**	241.00**
P vs.F1	1	1	8.20	7.62	15.81*	202.08**	196.23**	398.29**	3.19	279.77**	171.33*
GxN		20			3.24			5.61			39.95
PxN		5			3.37			6.88			13.02
F1xN		14			3.42			5.55			44.45
P vs.F1xN		1			0.01			0.02			111.63*
Error	60	120	2.96	4.04	3.50	5.32	4.19	4.76	19.54	34.78	27.16

* and ** Significant at 0.05 and 0.01 levels of probability, respectively.
N1, N2 and Comb. : First, second and the combined analysis, respectively.

Table (5): Cont.

Source of variati0n	Degrees of freedom		Plant hight (cm)			No. of spike/plant			Spike length (cm)		
	S	C	N1	N2	Com.	N1	N2	Comb.	N1	N2	Comb.
N levels(N)		1			3.29			3.72			1.96*
Rep./N	3	6	19.13	36.42	27.78	27.41	146.70	87.05	3.59	1.57	2.58
Genotype	20	20	112.45**	104.10**	211.03**	58.12**	76.70**	128.55**	6.18**	6.99**	12.91**
Parent	5	5	287.07**	216.21**	500.41**	157.94**	208.70**	358.82**	17.99**	18.19**	36.02**
F1	14	14	57.12**	63.71**	115.60**	26.54**	34.26**	55.30**	2.35**	3.40**	5.43**
P vs.F1	1	1	13.89	108.94**	100.30**	1.01	10.97	2.67	0.77	1.34*	2.07*
GxN		20			5.51			6.27			0.27
PxN		5			2.87			7.82			0.16
F1xN		14			5.24			5.50			0.32
P vs.F1xN		1			22.52			9.30			0.04
Error	60	120	9.56	4.80	7.18	6.58	6.81	6.70	0.42	0.28	0.35

* and ** Significant at 0.05 and 0.01 levels of probability, respectively.
N1, N2 and Comb. : First, second and the combined analysis, respectively.

Table (5): Cont.

Source of variation	Degrees of freedom		No. of spikelets/spike			No. of Grains/spike			Grain weight/spike (gm)		
	S	C	N1	N2	Com.	N1	N2	Comb.	N1	N2	Comb.
N levels(N)		1			1.17			116.67			1.20*
Rep./N	3	6	0.94	5.40	3.17	134.52	71.63	103.08	0.25	0.45	0.35
Genotype	20	20	7.63**	8.90**	15.62**	582.64**	440.17**	962.93**	2.32**	1.89**	3.79**
Parent	5	5	17.10**	20.17**	36.73**	1459.9**	1366.4**	2808.95**	6.04**	6.41**	12.42**
F1	14	14	4.78**	5.50**	9.19**	149.48**	65.03	143.17**	0.97**	0.42	0.89**
P vs.F1	1	1	0.23	0.23	0.01	2260.58**	1060.88**	3209.34**	2.57**	0.01	1.28*
GxN		20			0.92			59.88			0.42
PxN		5			0.53			17.35			0.03
F1xN		14			1.09			71.34*			0.50*
P vs.F1xN		1			0.47			112.12			1.29*
Error	60	120	0.90	1.10	1.01	37.19	37.36	37.27	0.25	0.26	0.26

* and ** Significant at 0.05 and 0.01 levels of probability, respectively.
N1, N2 and Comb. : First, second and the combined analysis, respectively.

Table (5): Cont.

Source of Variation	Degrees of freedom		100- Grain weight (gm)			Grain weight/plant (gm)			Total yield (gm)		
	S	C	N1	N2	Com.	N1	N2	Comb.	N1	N2	Comb.
levels (N)		1			0.19			49.31			468.9
Rep./N	3	6	1.19	3.25	2.22	605.84	1709.98	1157.91	572.53	11056.52	5814.52
Genotype	20	20	1.27**	1.25**	2.10**	139.46*	185.89**	201.01**	638.98*	987.44*	1066.45**
Parent	5	5	2.15**	3.24**	5.14**	269.76**	314.96**	440.91**	904.14*	954.98	1013.13
F1	14	14	1.01**	0.42	0.95**	100.77	117.7	102.28	567.79	1060.24*	1160.3**
P vs.F1	1	1	0.57	2.98**	3.07**	29.66	495.18*	383.61*	309.84	130.5	19.09
GxN		20			0.43			124.35			559.97
PxN		5			0.25			143.81			845.99
F1xN		14			0.49			116.19			467.73
P vs.F1xN		1			0.47			141.22			421.25
Error	60	120	0.30	0.31	0.31	65.96	87.57	76.76	345.24	530.63	437.94

* and ** Significant at 0.05 and 0.01 levels of probability, respectively.
N1, N2 and Comb. : First, second and the combined analysis, respectively

grains weight /plant in both nitrogen levels and the combined data, and total yield in the first nitrogen level. Such results indicate the presence of wide genetic variability among the tested parents and hybrids of wheat. However, insignificant mean squares due to parents X nitrogen levels and F_1crosses X nitrogen levels interactions were detected for all studied traits except F_1X nitrogen levels for no. of grains /spike and grain weight /spike. This means that the tested wheat parents and crosses responded similarly to both nitrogen levels.

The mean performances of the tested parents and hybrids for all traits in each nitrogen level as well as the combined data over both nitrogen levels are presented in (Table 6).

Concerning parents mean performance , results indicated that parent P_1 (Sids 4)recorded the best values for heading date , maturity date , plant height , spike length , no. of grains /spike , grain weight /spike , and 100- grain weight in each nitrogen level and the combined data . The respective mean values were 74.50 days, 117. 00 days, 93. 31cm, 17.85cm, 116.25, 5.87gm and 5.21gm in the combined analysis of both nitrogen levels.

Parent P_2 (Sakha 69) had the highest mean values for no. of spikes/plant in both nitrogen levels and the combined data, the mean values were (22.75), (26.00), and (24.38) respectively.

Parent P_4 (Gemmiza 7) expressed the highest significant mean values for flag leaf area and total yield /plant being 69.82cm^2 and 151.13gm , respectively , in the combined data and showed to be among the highest mean value (41.44 gm) for grain weight/plant in the second nitrogen level .

The highest significant mean values for no. of spikelets / spike were detected for the parent P_5 (Gemmiza 9) which recorded 27.00, 26.5 and 26.75 in the first, second nitrogen level

Table (6): Mean performance of six parental wheat varieties and their F1 crosses for morphological characters under two nitrogen fertilization level .

Genotypes	Heading date			Maturity date			Flag leaf area (cm)			Plant height (cm)		
	N1	N2	Comb.	N1	N2	Comb.	N1	N2	comb	N1	N2	Comb.
P1	73.25	75.75	74.50	117.00	117.00	117.00	68.49	66.80	67.65	93.50	93.13	93.31
P2	87.50	87.50	87.50	140.25	143.25	141.75	43.63	44.26	43.94	99.75	98.25	99.00
P3	87.75	86.25	87.00	139.50	141.75	140.63	45.61	42.34	43.98	86.75	87.00	86.88
P4	91.25	91.50	91.38	142.25	142.00	142.13	70.26	69.39	69.82	109.00	106.00	107.50
P5	98.50	98.75	98.63	144.75	145.00	144.88	44.08	48.25	46.16	107.25	105.00	106.13
P6	88.50	88.25	88.38	141.25	145.50	143.38	51.60	50.55	51.07	95.75	94.00	94.88
P1XP2	80.75	80.75	80.75	138.25	136.25	137.25	49.74	51.00	50.37	98.25	100.00	99.13
P1XP3	82.00	79.25	80.63	135.00	136.25	135.63	49.95	58.81	54.38	96.25	95.00	95.63
P1XP4	84.00	85.00	84.50	137.25	139.50	138.38	56.86	65.03	60.95	102.75	102.50	102.63
P1XP5	87.50	88.50	88.00	141.25	142.00	141.63	53.41	59.30	56.35	98.75	101.75	100.25
P1XP6	81.00	82.75	81.88	136.50	138.50	137.50	58.41	60.62	59.51	98.75	98.25	98.00
P2XP3	90.00	89.75	89.88	142.50	141.75	142.13	50.42	48.75	49.69	98.00	96.25	97.13
P2XP4	89.75	90.00	89.88	142.00	143.75	142.88	55.52	56.86	56.19	102.50	104.00	103.25
P2XP5	94.25	93.75	94.00	143.25	144.75	144.00	49.28	56.49	53.84	104.00	103.00	103.50
P2XP6	90.00	91.25	90.63	144.25	147.75	146.00	48.51	48.74	48.62	100.5	100.75	100.63
P3XP4	88.00	90.50	89.25	139.00	144.25	141.63	57.14	60.92	59.03	97.00	98.00	97.50
P3XP5	92.50	95.00	93.75	142.75	144.25	143.50	55.37	59.57	57.47	95.25	93.50	94.38
P3XP6	87.00	87.50	87.25	140.50	143.00	141.75	51.18	45.64	48.41	91.75	92.75	92.25
P4XP5	95.00	95.00	95.00	142.75	144.25	143.50	64.87	64.53	64.69	104.25	106.25	105.25
P4XP6	90.75	89.00	89.88	143.50	145.00	144.25	59.64	72.52	66.08	105.00	102.25	103.63
P5XP6	94.75	94.25	94.50	145.25	145.75	145.50	55.34	55.60	55.47	101.5	102.00	101.75
L.S.D 5%	2.43	2.84	1.85	3.26	2.90	2.16	6.25	8.34	5.16	4.37	3.10	2.65

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

N1, N2 and Comb.: First, second nitrogen levels and combined data, respectively

Table (6): Cont.

Genotypes	No. of spikes/plant			Spike leangth (cm)			No of spikelets/spike			No. of grains /spike		
	N1	N2	Comb.	N1	N2	Comb.	N1	N2	Comb.	N1	N2	Comb.
P1	4.50	4.00	4.25	17.63	18.07	17.85	22.00	21.50	21.75	118.75	113.75	116.25
P2	22.75	26.00	24.38	11.85	12.55	12.20	23.50	24.00	23.75	62.50	62.75	62.63
P3	19.50	17.50	18.50	12.48	12.43	12.45	22.50	21.50	22.00	73.00	64.75	67.25
P4	14.50	17.00	15.75	14.80	14.78	14.79	26.50	26.50	26.50	80.50	74.25	77.38
P5	16.25	17.25	16.75	12.85	13.13	12.99	27.00	26.5	26.75	81.75	78.75	80.25
P6	18.25	20.25	19.25	13.22	13.48	13.35	24.00	23.50	23.75	78.50	75.25	76.88
P1XP2	16.75	17.25	17.00	13.65	14.15	13.90	22.50	22.5	22.53	69.75	74.00	71.88
P1XP3	14.25	12.25	13.25	13.90	14.70	14.30	23.00	22.00	22.50	63.00	66.25	64.63
P1XP4	11.25	10.50	10.88	15.40	15.43	15.41	24.50	23.50	24.00	72.75	67.75	70.25
P1XP5	14.00	13.25	13.63	14.17	14.25	14.21	23.00	24.50	23.75	64.75	70.50	67.63
P1XP6	13.50	13.50	13.50	14.68	14.78	14.73	23.00	23.00	23.03	78.25	70.50	75.25
P2XP3	18.75	17.50	18.13	12.73	12.33	12.53	23.50	23.50	23.50	74.75	64.25	69.50
P2XP4	18.00	16.50	17.25	13.13	13.00	13.07	25.00	25.00	25.00	61.25	70.75	66.00
P2XP5	17.75	19.50	18.63	12.73	12.90	12.81	24.50	24.50	24.50	63.75	69.75	66.75
P2XP6	20.75	20.75	20.75	12.58	13.03	12.80	24.00	25.00	24.50	70.25	73.00	71.63
P3XP4	15.25	14.75	15.00	13.45	13.35	13.39	24.00	24.00	24.00	65.00	66.75	65.88
P3XP5	19.00	16.50	17.75	13.28	12.88	13.08	24.50	24.00	24.25	75.25	69.75	72.50
P3XP6	17.00	19.25	18.13	13.03	13.15	13.09	23.50	22.50	23.00	72.75	64.50	68.63
P4XP5	14.25	15.00	14.63	13.55	14.18	13.86	26.50	25.50	26.00	77.75	76.75	77.25
P4XP6	14.50	18.25	16.38	13.98	14.95	14.46	25.00	25.50	25.25	78.00	77.50	77.75
P5XP6	18.00	18.25	18.13	13.70	13.80	13.75	25.50	25.50	25.50	78.00	72.00	75.00
L.S.D 5%	3.63	3.69	2.56	0.92	0.75	0.59	1.34	1.48	0.99	8.62	8.64	6.04

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

N1, N2 and Comb.: First, second nitrogen levels and combined data, respectively

Table (6): Cont

Genotypes	Grain weight /spike (gm)			100- grain weight (gm)			Grain weight /plant (gm)			Total yield / plant (gm)		
	N1	N2	Comb.	N1	N2	Comb.	N1	N2	Comb.	N1	N2	Comb.
P1	6.07	5.68	5.87	5.21	5.22	5.21	24.51	21.23	22.87	125.81	123.24	124.52
P2	2.68	2.29	2.49	3.45	2.84	3.15	40.41	34.54	37.47	145.85	135.06	140.46
P3	2.85	2.34	2.59	3.11	2.99	3.05	38.20	23.80	31.00	153.67	106.70	130.19
P4	3.95	3.61	3.78	4.30	4.29	4.29	41.47	41.44	41.46	151.22	151.05	151.13
P5	3.78	3.25	3.51	4.01	3.35	3.68	47.58	39.16	43.37	145.65	142.20	143.92
P6	3.12	2.73	2.92	3.34	3.53	3.44	31.31	40.78	36.05	116.54	130.40	123.47
P1XP2	3.25	3.38	3.31	4.09	3.78	3.94	41.78	36.29	39.04	130.87	143.09	136.98
P1XP3	2.78	3.18	2.98	4.17	4.65	4.40	33.34	38.12	35.73	122.13	115.36	118.75
P1XP4	4.45	3.51	3.98	5.47	4.42	4.95	43.57	29.72	36.64	121.09	111.55	116.32
P1XP5	3.15	3.62	3.39	4.23	4.39	4.31	32.85	33.85	33.35	127.55	127.08	127.32
P1XP6	3.85	3.31	3.58	4.66	4.10	4.38	44.68	35.62	40.15	127.42	119.11	123.26
P2XP3	3.21	2.79	3.00	3.86	3.81	3.83	37.68	33.82	35.75	134.04	113.34	123.69
P2XP4	2.60	3.50	3.05	3.32	4.07	3.69	30.09	42.00	36.05	143.74	130.74	137.24
P2XP5	3.15	2.96	3.06	3.96	3.99	3.97	34.26	39.06	36.66	141.41	154.67	148.04
P2XP6	2.98	3.29	3.14	3.81	3.80	3.80	40.89	44.36	42.62	160.81	144.11	152.46
P3XP4	3.12	3.68	3.40	3.72	4.64	4.18	34.02	38.84	36.43	138.70	122.53	130.61
P3XP5	3.73	3.37	3.55	4.47	4.24	4.35	47.86	38.21	43.03	145.89	130.40	138.15
P3XP6	3.14	2.65	2.90	3.95	3.55	3.75	38.87	38.90	39.31	114.10	139.93	127.01
P4XP5	4.02	3.80	3.91	4.44	4.38	4.41	39.40	40.68	40.04	143.00	151.53	147.27
P4XP6	3.65	3.53	3.59	3.95	4.01	3.98	40.45	53.53	46.99	139.05	164.53	151.79
P5XP6	3.57	3.18	3.38	3.83	4.02	3.92	42.13	40.00	41.07	143.27	145.04	144.16
L.S.D 5%	0.71	0.73	0.50	0.78	0.79	0.55	11.49	13.23	8.67	26.28	32.58	20.72

*and ** Significant at 5% and 1% levels of probabilty, respectively .

N1, N2 and Comb.: First, second nitrogen levels and combined data, respectively

and the combined data, respectively and for grains weight/plant (43.37 gm) in the combined data (Table.6).

Regarding crosses mean performance , it is clear that the cross P_1X P_3(Sids 4 X Sakha 93) was the earliest among the studied crosses since it expressed the lowest mean values for both heading and maturity dates being 80.63 and 135.63 (days) , respectively , in the combined data .

For flag leaf area, number of grains / spike and grain weight /plant, the cross P_4 X P_6 (Gemmiza 7 X Giza 168) recorded the highest mean values being 66. 08cm^2, 77.75 and 46.99gm, respectively in the combined data. Moreover, this particular cross (P_4 X P_6) ranked the second best for total yield / plant (151. 79gm).

Concerning plant height, the cross P4 X P_5 (Gemmiza 7 X Gemmiza 9) had the highest mean values (105.25cm) followed by the cross P_4 X P_6 (Gemmiza 7 X Giza 168) 103.63 cm then the cross P_2 XP_5 (Sakha 69 X Gemmiza 9) 103.50cm. However, the cross P_3 X P_6 (Sakha 93 X Giza 168) 92.25cm was the shortest among the studied crosses for this trait in the combined analysis. The choice between taller plants and shorter plants depends mainly upon the objective.

The single cross P_2 X P_6(Sakha 69 X Giza 168) was the best among the studied crosses for no. of spikes / plant since it recorded the highest value (20.75) in both nitrogen levels as well as combined data . Also this cross had the highest mean value for total yield / plant in the first nitrogen level (160.81 gm.) and the combined data (152.46 gm.).

For spike length , the cross P_1 X P_4(Sids 4 X Gimmeza 7) exhibited the highest significant mean values which recorded 15.40 , 15.43 and 15.41 cm in the first , second nitrogen level and combined data , respectively . Meanwhile, the cross P_1 X P_6 (Sids 4XGiza168) ranked the second best for spike length since it recorded 14.73 cm in the combined data.

As for number of spikelets / spike, the highest mean values were recorded for the cross P4 X P_5 (Gemmiza 7 X Gemmiza 9) in the first nitrogen level 26.50, second nitrogen level 25.50 and the combined data (26.00). On the other hand, the cross P_1 X P_3 (Sids 4 X Sakha 93) had the lowest value 22.50 for this trait followed by the cross P_1XP_2 (Sids 4 X Sakha 69) 22.53 in the combined data.

The cross P_1 X P_4(Sids 4 X Gemmiza 7) exhibited highest mean values for both grain weight / spike (3.98gm) and 100-grain weight (4.95gm) followed by the cross P_4 X P_5(Gemmiza 7 X Gemmiza 9) 3.91gm and 4.41gm, respectively in the combined data of both nitrogen levels (Table-6).

For total yield / plant, most studied crosses expressed desirable mean performance in both nitrogen levels as well as combined data. Moreover, the highest mean values were recorded for the cross P_2 X P_6 (Sakha 69 X Giza 168) 152.46gm followed by the cross P_4 X P_6 (Gemmiza7 X Giza 168) 151.79gm then the cross P_2 X P_5 (Sakha 69 X Gemmiza 9) 148.04gm and the cross P_4 X P_5 (Gemmiza 7 X Gemmiza 9) 147.27gm in the combined analysis . On the other hand , the cross P_1 X P_4(Sids 4 X Gemmiza 7) had the lowest mean value (116.32gm)for total yield / plant followed by the cross P_1 X P_3 (Sids 4 X Sakha 93) 118.75gm . From such results it is clear that the single crosses which were superior in total yield / plant had also higher significant mean values for one or more of yield components .Therefore; these crosses are important and prospective in wheat breeding programs.

2- Heterosis:

Results in (Table 5) indicated that mean squares for parent vs. crosses as an indication to average heterosis overall crosses were of appreciable magnitude for most studied traits. These results are true in each nitrogen level and the combined of both levels. Significant interaction between parents vs. crosses and nitrogen levels were detected only for flag leaf area and grains weight / spike indicating that the heterosis expression differed from one nitrogen level to another. For the other studied traits, no significant interaction between parents vs. Crosses and nitrogen levels was detected. These results indicated that heterosis was not affected by nitrogen levels.

Heterosis expressed as the percentage deviations of F_1 mean performance from its mid - parent and better parent values for all studied traits at both nitrogen levels and the combined data are presented in (Table 7).

Results indicated that none of the studied crosses expressed negative and significant heterosis relative to mid – parent and better parent for **heading and maturity dates**. These results are true in both nitrogen levels as well as the combined analysis. However, significant and positive heterotic effects were detected in some crosses for both traits. In this connection, El- Rassas and Mitkees (1985), Hamada *et al.* (1997) and Ghanem (2001) reported that no cross was significantly earlier than respective earlier parent among studied wheat crosses.

For **flag leaf area**, five, eight and six crosses expressed significant and positive heterotic effect relative to mid – parent in the first, second nitrogen level and the combined data, respectively Four crosses manifested significant and positive

Table (7) : Percentage of heterosis over both mid-parent and better parent values in two nitrogen levels and combined data.

Genotypes	Heading date						Maturity date					
	M.P			B.P			M.P			B.P		
	N1	N2	Comb.	N1	N2	Comb.	N1	N2	Comb.	N1	N2	Comb.
P1XP2	0.47	-1.07	-0.30	10.24*	6.60*	8.42*	7.48*	4.71*	6.10*	18.16*	16.45*	17.31*
P1XP3	1.86	-2.16	-0.15	11.95*	4.62*	8.29*	5.26*	5.31*	5.29*	15.38*	16.45*	15.92*
P1XP4	2.13*	1.64	1.89*	14.68*	12.21*	13.45*	5.88*	7.72*	6.80*	17.31*	19.23*	18.27*
P1XP5	1.89	1.43	1.66*	19.45*	16.83*	18.14*	7.93*	8.40*	8.17*	20.73*	21.37*	21.05*
P1XP6	0.15	0.91	0.53	10.58*	9.24*	9.91*	5.71*	5.52*	5.62*	16.67*	18.38*	17.53*
P2XP3	2.71*	3.31*	3.01*	2.86*	4.06*	3.46*	1.88	-0.53	0.68	2.15	0.00	1.08
P2XP4	0.42	0.56	0.49	2.57*	2.86*	2.72*	0.53	0.79	0.66	1.25	1.23	1.24
P2XP5	1.34	0.67	1.01	7.71*	7.14*	7.43*	0.53	0.43	0.48	2.14	1.05	1.60
P2XP6	2.27*	3.84*	3.06*	2.86*	4.29*	3.58*	2.49	2.34	2.42*	2.85	3.14*	3.00*
P3XP4	-1.68	1.83	0.08	0.28	4.93*	2.61*	-1.33	1.67	0.17	-0.36	1.76	0.70
P3XP5	-0.67	2.70*	1.02	5.41*	10.14*	7.78*	0.44	0.61	0.53	2.33	1.76	2.05
P3XP6	-1.28	0.29	-0.50	-0.85	1.45	0.30	0.09	-0.44	-0.18	0.72	0.88	0.80
P4XP5	0.13	-0.13	0.00	4.11*	3.83*	3.97*	-0.52	0.52	0.00	0.35	1.58	0.97
P4XP6	0.97	-0.97	0.00	2.54*	0.85	1.70	1.23	0.87	1.05	1.59	2.11	1.85
P5XP6	1.34	0.80	1.07	7.06*	6.80*	6.93*	1.57	0.34	0.96	2.83	0.52	1.68
L.S.D 5%	2.11	2.46	1.60	2.43	2.84	1.85	2.82	2.51	1.87	3.26	2.90	2.16

* Significant at 5% level of probability, respectively .
N1, N2 and Comb.: First, second nitrogen levels and the combined data, respectively.

Table (7) : Cont.

Genotypes	Flag leaf area (cm.)						Plant height (cm.)					
	M.P			B.P			M.P			B.P		
	N1	N2	Comb.	N1	N2	Comb.	N1	N2	Comb.	N1	N2	Comb.
P1XP2	-11.27*	-8.16*	-9.715*	-27.38*	-23.65*	-25.52*	1.68	4.50*	3.09*	-1.50	1.78	0.14
P1XP3	-12.45*	7.77*	-2.34	-27.07*	-11.96*	-19.52*	6.80*	5.48*	6.14*	2.94	2.01	2.48
P1XP4	-18.03*	-4.50	-11.27*	-19.07*	-6.28	-12.68*	1.48	2.95*	2.22	-5.73*	-3.30	-4.52*
P1XP5	-5.11	3.09	-1.01	-22.02*	-11.23*	-16.63*	-1.62	2.71*	0.55	-7.93*	-3.10	-5.52*
P1XP6	-2.72	3.31	0.30	-14.72*	-9.25*	-11.99*	3.30	5.01*	4.16*	2.09	4.52*	3.31*
P2XP3	13.00*	12.59*	13.00*	10.55*	10.14*	10.35*	5.09*	3.91*	4.50*	-1.75	-2.04	-1.90
P2XP4	-2.50	0.06	-1.22	-20.98*	-18.06*	-19.52*	-1.80	1.84	0.02	-5.96*	-1.89	-3.93*
P2XP5	12.72*	22.13*	17.43*	11.80*	17.08*	14.44*	0.48	1.35	0.92	-3.03	-1.90	-2.47
P2XP6	1.88	2.82	2.35	-5.99	-3.58	-4.79	2.81	4.81*	3.81*	0.75	2.54	1.65
P3XP4	-1.37	9.05*	3.84	-18.67*	-12.21*	-15.44*	-0.89	1.55	0.33	-11.01*	-7.55*	-9.28*
P3XP5	23.47*	31.52*	27.50*	21.40*	23.46*	22.43*	-1.80	-2.60	-2.20	-11.19*	-10.95*	-11.07*
P3XP6	5.30	-1.73	1.79	-0.81	-9.71*	-5.26*	0.55	2.49	1.52	-4.18	-1.33	-2.76*
P4XP5	13.47*	9.71*	11.59*	-7.67*	-7.00	-7.34*	-3.58	0.71	-1.44	-4.36	0.24	-2.06
P4XP6	-2.12	20.93*	9.41*	-15.12*	4.51	-5.31*	2.56	2.25	2.41*	-3.67	-3.54*	-3.61*
P5XP6	15.68*	12.55*	14.12*	7.25*	9.99*	8.62*	0.00	2.51	1.26	-5.36*	-2.86	-4.11*
L.S.D 5%	5.41	7.22	4.47	6.25	8.34	5.16	3.79	2.69	2.30	4.37	3.40	2.65

* Significant at 5% level of probability, respectively .
N1, N2 and Comb.: First, second nitrogen levels and the combined data, respectively.

Table (7) : Cont.

Genotypes	No. of spikes /plant						Spike length (cm.)					
	M.P			B.P			M.P			B.P		
	N1	N2	Comb.	N1	N2	Comb.	N1	N2	Comb.	N1	N2	Comb.
P1XP2	22.94*	15.00*	18.97*	-26.37*	-33.65*	-30.01*	-7.39*	-7.58*	-7.49*	-22.58*	-21.69*	-22.14*
P1XP3	18.75*	13.95*	16.35*	-26.92*	-30.00*	-28.46*	7.67*	-3.61*	2.03*	-21.16*	-18.65*	-19.91*
P1XP4	18.42*	0.00	9.21*	-22.41*	-38.24*	-30.33*	-5.03*	-6.06*	-5.55*	-12.65*	-14.61*	-13.63*
P1XP5	34.94*	24.71*	29.83*	-13.85*	-23.19*	-18.52*	-7.02*	-8.65*	-7.84*	-19.63*	-21.14*	-20.39*
P1XP6	18.68*	11.34*	15.01*	-26.03*	-33.33*	-29.68*	-4.83*	-6.31*	-5.57*	-16.73*	-18.21*	-17.47*
P2XP3	-11.24*	-19.54*	-15.39*	-17.58*	-32.69*	-25.14*	4.64*	-1.28*	1.68*	2.00*	-1.75*	0.13*
P2XP4	-3.36*	-23.26*	-13.31*	-20.88*	-36.54*	-28.71*	-1.46*	-4.87*	-3.17*	-11.28*	-12.04*	-11.66*
P2XP5	-8.97*	-9.83*	-9.40*	-21.98*	-25.00*	-23.49*	3.08*	0.47	1.78*	-0.93*	-1.75*	-1.34*
P2XP6	1.22	-10.27*	-4.53*	-8.79*	-20.19*	-14.49*	0.36	0.12	0.24	-4.84*	-3.34*	-4.09*
P3XP4	-10.29*	-14.49*	-12.39*	-21.79*	-15.71*	-18.75*	-1.54*	-1.87*	-1.71*	-9.26*	-9.68*	-9.47*
P3XP5	6.29*	-5.04*	0.625	-2.56*	-5.71*	-4.14*	4.86*	0.78*	2.82*	3.35*	-1.90*	0.73*
P3XP6	-9.93*	1.99	-3.97*	-12.82*	-4.94*	-8.88*	1.40*	1.51*	1.46*	-1.44*	-2.45*	-1.95*
P4XP5	-7.32*	-12.41*	-9.87*	-12.31*	-13.04*	-12.68*	-1.99*	1.61*	-0.19	-8.45*	-4.06*	-6.26*
P4XP6	-11.45*	-2.01	-6.73*	-20.55*	-9.88*	-15.22*	-0.21	5.80*	2.80*	-5.54*	1.15*	-2.20*
P5XP6	4.35*	-2.67	0.84	-1.37	-9.88*	-5.625*	5.10*	3.72*	4.41*	3.63*	2.37*	3.00*
L.S.D 5%	3.14	3.20	2.22	3.63	3.69	2.56	0.80	0.65	0.51	0.92	0.75	0.59

* Significant at 5% level of probability, respectively .

N1, N2 and Comb.: First, second nitrogen levels and the combined data, respectively.

Table (7) : Cont.

Genotypes	No. of spikelets /spike						No. of grains /spike					
	M.P			B.P			M.P			B.P		
	N1	N2	Comb.	N1	N2	Comb.	N1	N2	Comb.	N1	N2	Comb.
P1XP2	-1.10	-1.10	-1.10*	-4.26*	-6.25*	-5.26*	-23.03*	16.15*	-3.44	-41.26*	-34.95*	-38.11*
P1XP3	3.37*	2.33*	2.85*	2.22*	2.33*	2.28*	-34.29*	-25.77*	-30.03*	-46.95*	-41.76*	-44.36*
P1XP4	1.03	-2.08*	-0.53	-7.55*	-11.32*	-9.44*	-26.98*	-27.93*	-27.46*	-38.74*	-40.44*	-39.59*
P1XP5	-6.12*	2.08*	-2.02*	-14.81*	-7.55*	-11.18*	-35.41*	-26.75*	-31.08*	-45.47*	-38.02*	-41.75*
P1XP6	0.00	2.22*	1.11*	-4.17*	-2.13*	-3.15*	-20.66*	-25.4*	-23.03*	-34.11*	-38.02*	-36.07*
P2XP3	2.17*	3.30*	2.74*	0.00	-2.08*	-1.04*	10.33*	0.78	5.56*	2.40	-0.77	0.82
P2XP4	0.00	-0.99	-0.50	-5.66*	-5.66*	-5.66*	-14.34*	3.28	-5.53*	-23.91*	-4.71	-14.31*
P2XP5	-2.97*	-2.97*	-2.97*	-9.26*	-7.55*	-8.41*	-11.61*	-1.41	-6.51*	-22.02*	-11.43*	-16.73*
P2XP6	1.05	5.26*	3.16*	0.00	4.17*	2.09*	-0.35	5.80	2.73	-10.51*	-2.99	-6.75*
P3XP4	-2.04*	0.00	-1.02*	-9.43*	-9.43*	-9.43*	-15.31*	-3.96	-9.64*	-19.25*	-10.10*	-14.68*
P3XP5	-1.01	0.00	-0.51	-9.26*	-9.43*	-9.35*	-2.75	-2.79	-2.77	-7.95	-11.43*	-9.69*
P3XP6	1.08	00..	0.54	-2.08*	-4.26*	-3.17*	-3.96	-7.86*	-5.91*	-7.32	-14.29*	-10.81*
P4XP5	-0.93	-3.77*	-2.35*	-1.85*	-3.77*	-2.81*	-4.16	0.33	-1.92	-4.89	-2.54	-3.72
P4XP6	-0.99	2.00*	0.51	-5.66*	-3.77*	-4.72*	-1.89	3.68	0.90	-3.11	2.99	-0.06
P5XP6	0.00	2.00*	1.00	-5.56*	-3.77*	-4.67*	-2.65	-6.49	-4.57	-4.59	-8.57*	-6.58*
L.S.D. 5%	1.16	1.28	0.86	1.34	1.48	0.99	4.47	7.49	5.23	8.62	8.64	6.04

* Significant at 5% level of probability, respectively .
N1, N2 and Comb.: First, second nitrogen levels and the combined data, respectively.

Table (7) : Cont.

Genotypes	Grain weight /Spike (gm.)						100- grain weight (gm.)					
	M.P			B.P			M.P			B.P		
	N1	N2	Comb.	N1	N2	Comb.	N1	N2	Comb.	N1	N2	Comb.
P1XP2	-25.71*	-15.18*	-20.45*	-46.46*	-40.49*	-43.48*	-5.54*	-6.20*	-5.87*	-21.5*	-27.59*	-24.55*
P1XP3	-37.67*	-20.70*	-29.19*	-54.20*	-44.01*	-49.11*	0.42*	13.28*	6.85*	-19.96*	-10.92*	-15.44*
P1XP4	-11.18*	-24.43*	-17.81*	-26.69*	-38.20*	-32.45*	15.04*	-7.05*	4.00*	4.99*	-15.33*	-5.17*
P1XP5	-36.04*	-18.92*	-27.48*	-48.11*	-36.27*	-42.19*	-8.24*	2.45*	-2.90*	-18.81*	-15.90*	-17.36*
P1XP6	-16.21*	-21.28*	-18.75*	-36.57*	-41.73*	-39.15*	9.01*	-6.29*	1.36*	-10.56*	-21.46*	-16.01*
P2XP3	16.09*	20.52*	18.31*	12.63*	19.23*	15.93*	17.68*	30.70*	24.19*	11.88*	27.42*	19.65*
P2XP4	-21.57*	18.64*	-1.47*	-34.18*	-3.05*	-18.62*	-1.63*	14.16*	6.27*	-22.79*	-5.13*	-13.96*
P2XP5	-2.48*	6.86*	2.19*	-16.67*	-8.92*	-12.80*	22.60*	28.92*	25.76*	-1.25*	19.10*	8.93*
P2XP6	2.76*	31.08*	16.92*	-4.49*	20.51*	8.01*	31.61*	19.31*	25.46*	14.07*	7.65*	10.86*
P3XP4	-8.24*	23.70*	7.73*	-21.01*	1.94*	-9.54*	0.40*	27.47*	13.94*	-13.49*	8.16*	-2.67*
P3XP5	12.52*	20.57*	16.55*	-1.32*	3.69*	1.19*	25.56*	33.75*	29.66*	11.47*	26.57*	19.02*
P3XP6	5.19*	4.54*	4.87*	0.64*	-2.93*	-1.15*	22.48*	8.90*	15.69*	18.26*	0.57*	9.42*
P4XP5	4.01*	10.79*	7.40*	1.77*	5.26*	3.52*	6.86*	14.66*	10.76*	3.26*	2.10*	2.68*
P4XP6	3.25*	11.36*	7.31*	-7.59*	-2.22*	-4.91*	3.40*	2.56*	2.98*	-8.14*	-6.53*	-7.34*
P5XP6	3.48*	6.35*	4.92*	-5.56*	-2.15*	-3.86*	4.22*	16.86*	10.54*	-4.49*	13.88*	4.70*
L.S.D 5%	0.62	0.63	0.44	0.71	0.73	0.50	0.67	0.68	0.48	0.78	0.79	0.55

* Significant at 5% level of probability, respectively .

N1, N2 and Comb.: First, second nitrogen levels and the combined data, respectively.

Table (7) : Cont.

Genotypes	Grain weight /Plant (gm.)						Total yield /Plant (gm.)					
	M.P			B.P			M.P			B.P		
	N1	N2	Comb.	N1	N2	Comb.	N1	N2	Comb.	N1	N2	Comb.
P1XP2	28.71*	30.14*	29.43*	3.39	5.07	4.23	-3.65	10.79	3.57	-10.27	5.95	-2.16
P1XP3	6.33	69.31*	37.82*	-12.72*	60.17*	23.73*	-12.6	0.34	-6.13	-20.52	-6.39	-13.46
P1XP4	32.07*	-5.15	13.46*	5.06	-28.28*	-11.61*	-12.58	-18.66	-15.62	-19.92	-26.15	-23.04
P1XP5	-8.86	12.10*	1.62	-30.96*	-13.56*	-22.26*	-6.03	-4.25	-5.14	-12.43	-10.63	-11.53
P1XP6	60.09*	14.88*	37.49*	42.70*	-12.65	15.03*	5.15	-6.08	-0.465	1.28	-8.66	-3.69
P2XP3	-4.13	15.94*	5.91	-6.76	-2.08	-4.42	-10.50	-6.24	-8.37	-12.77	-16.08	-14.43
P2XP4	-26.5*	10.56	-7.97*	-27.44*	1.35	-13.05*	-3.23	-8.61	-5.92	-4.95	-13.45	-9.20
P2XP5	-22.13*	6.00	-8.07*	-27.99*	-0.26	-14.13*	-2.98	11.57	4.295	-3.04	8.77	2.87
P2XP6	14.03*	17.79*	15.91*	1.19	8.78	4.99	22.57	8.57	15.57	10.26	6.70	8.48
P3XP4	-14.6*	19.07*	2.24	-17.96*	-6.27	-12.12*	-9.02	-4.92	-6.97	-9.74	-18.88	-14.31
P3XP5	11.59*	21.38*	16.49*	0.59	-2.43	-0.92	-2.52	4.78	1.13	-5.06	-8.30	-6.68
P3XP6	11.84*	20.47*	16.16*	1.75	-4.61	-1.43	-15.55	18.03	1.24	-25.75	7.31	-9.22
P4XP5	-11.51*	0.94	-5.29	-17.19*	-1.83	-9.51*	-3.66	3.35	-0.155	-5.44	0.32	-2.56
P4XP6	11.16*	30.21*	20.69*	-2.46	29.17*	13.36*	3.86	16.92	10.39	-8.05	8.92	0.44
P5XP6	6.81	0.08	3.45	-11.45	-1.91	-6.68	9.29	6.41	7.85	-1.63	2.00	0.19
L.S.D 5%	9.95	11.46	7.51	11.49	13.23	8.67	22.76	28.21	17.94	26.28	32.58	20.72

* Significant at 5% level of probability, respectively .

N1, N2 and Comb.: First, second nitrogen levels and the combined data, respectively.

heterotic effects relative to better parent in the three respective cases. However, the single cross P_3 X P_5 (Sakha 93 X Gemmiza 9) expressed the most desirable heterotic effects for flag leaf area relative to mid – parent (27.50%) and better parent (22.43%) in the combined data of both nitrogen levels . Positive heterotic effects for flag leaf area were also found by EL- Shamarka (1980), Mekhamer (1995) and Safan (2001) .

Concerning **plant height**, significant and positive mid- parent heterotic effects were detected by two crosses, namely P_1 X P_3 (6.80%) and P2 X P_3 (5.09%) in the first nitrogen level. Also, seven out of fifteen crosses exhibited significant and positive heterotic effects relative to mid- parent in the second nitrogen level. Six crosses, i.e., P1 X P_3 (6.14%), P_1 X P_6 (4.15%), P_2 X P_3 (4.51%), and P_2X P_6 (3.81%) manifested desirable heterosis relative to mid- parent in the combined analysis of both nitrogen levels. On the other hand , one cross namely P_1XP_6 (4.52%), (3.31%) expressed significant and positive heterotic effects relative to better parent in the second nitrogen level and the combined data respectively (Table 7) . Several investigators reported positive and significant heterotic effects for plant height. Among those are EL- Rassas and Mitkees (1985), Abd EL-Rahman (1991), Moshref (1996), Ghanem (2001) and Safan (2001).

Regarding **number of spikes / plant**, seven, four and five single crosses expressed significant and positive heterotic effects relative to mid- parent in the first and second nitrogen levels and the combined data respectively. However, the most desirable heterotic effects relative to mid– parent were detected for the cross P1 X P_5 being 34.94, 24.71 and 29.83% in the respective studied cases. Most of studied crosses expressed significant and negative better parent heterosis in both nitrogen levels and the combined data.

For **spike length**, six, five and seven crosses exhibited significantly positive mid – parent heterosis in the first, second nitrogen levels and the combined analysis. Also, three, two and two crosses expressed significant and positive better parent heterosis in the same order. However, the most desirable mid – parent and better parent heterosis was detected for the cross P_5 X P_6 (4.41%) and (3.00%) respectively in the combined data. Similar results were recorded by Mitkess (1981), Mossad *et al.* (1990), EL-Shami *et al* (1996), Hassan (1998), Ghanem (2001) and Safan (2001)

For **number of spikelets / spike**, two crosses combinations namely P_1XP_3 and P2 X P_3 exhibited significant and positive mid – parent heterosis in the first nitrogen level. Also , seven crosses had desirable heterosis ranging from 2.00 % for the crosses P_4 X P_6 and P_5 X P_6 to 5.26 % for the cross P_2 X P_6 in the second nitrogen level . In the combined data the best mid – parent heterosis effects were detected in four crosses namely P_1 X P_3 (2.85 %), P_1 X P_6 (1.11 %), P_2 X P_3 (2.74%) and P_2 X P_6 (3.16%). Significant and positive better parent heterosis effects for number of spikelets / spike were obtained in one, two, and two crosses in the first, second nitrogen levels and the combined data, respectively. However, the best better parent heterosis was recorded for the cross P_2 X P_6 in the second nitrogen level (4.17%) and P_1X P_3 in the combined data (2.28%).

Regarding **number of grains / spike** , significant and positive heterotic effects relative to mid – parent heterosis were detected only for the cross P_2 X P_3 (10.33 %) in the first nitrogen level, P_1 X P_2 (16.15 %) in the second nitrogen level and P_2 X P_3. (5.56%)

in the combined data (Table 7). However, no desirable better parent heterosis effects were detected for number of grains / spike in both nitrogen levels and combined data where most crosses expressed significant and negative heterosis values.

For **grains weight / spike**, seven, ten and nine crosses expressed significant and positive mid – parent heterosis effects in the first, second nitrogen level as well as combined data, respectively. However, the best heterosis value for this trait was detected for the crosses P_2 X P_3 (16.09 %) , P_2 X P_6 (31.08 %) and P_2 X P_3 (18.11 %)in the respective cases . Also, two, five and four crosses recorded desirable better parent heterosis in the first, second nitrogen levels and the combined data, respectively. Furthermore, single cross P2 XP_3 gave the highest significant better parent heterosis for this trait in the first nitrogen level (12.63%), and in the combined data (15.83%). Similar results were reported by Hendawy (1990) , Hassan (1998) and Ghanem (2001) .

Concerning **100 – grains weight** , most studied crosses exhibited significant and positive heterotic effects either relative to mid –parent or better parent in each nitrogen level and combined data (Table 7) . However, the most desirable heterotic effects were obtained for the cross P_3 X P_5 (29.66 %) relative to mid – parent and the cross P_2 X P_3 (19.65%) relative to better parent in the combined analysis. In this connection EL- Sayed (1997), Hamada *et al.* (1997), and Ghanem (2001) found positive and significant useful heterosis in 100 –grain weight.

For **grains weight / plant**, seven crosses expressed significant and positive mid – parent heterosis effects ranging from 11.16% (P_4XP_6) to 60.09 % (P_1 X P_6) in the first nitrogen level. Ten crosses exhibited desirable mid – parent heterosis ranging from

12.10% (P_1X P_5) to 69.31% (P_1 X P_3) in the second nitrogen level. Also, eight crosses manifested desirable mid – parent heterosis with the highest value of 36.29% recorded by the cross P1 X P_6 in the combined data. Furthermore, significant and positive better parent heterosis effects for grain yield/plant were detected for the crosses P_1 X P_6 (42.70%) in the first nitrogen level; P_1 X P_3 (60.17 %) and P_4 X P_6 (29.17%) in the second nitrogen level; and P_1 X P_3 (15.26 %) in the combined data. From such results it could be concluded that single crosses P_1 X P_3 and P_1 X P_6 exhibited a great potential for commercial hybrid wheat production. Similar results were found by Khan *et al.* (1995), Deshpende and Nayeem (1999), Ghanem (2001) and Safan (2001).

Concerning total yield / plant, none of the studied crosses exhibited significant heterotic effects either to mid – parent or better parent in each nitrogen level as well as the combined data (Table 7).

3- Combining ability analysis:

Analysis of variance for combining ability as outlined by Griffing's (1956) method 2 model 1 in each nitrogen level and combined data for all studied traits is presented in (Table 8). Results indicated that mean squares associated with general (G.C.A) and specific (S.C.A) combining ability were significant for all studied traits except G.C.A for grain weight / plant in first nitrogen level and S.C.A for number of spikelets / spike and total yield / plant in the first , second nitrogen level and combined data ; heading date, number of spikes /plant in both nitrogen levels, grain weight / plant in the second nitrogen level and combined data and 100- grain weight in the second nitrogen

Table(8) : Observed mean squares from general and specific combining abilities from diallel cross analysis for all studied traits in each nitrogen level and combined data

Source of variation	Degrees 0f freedom		Heading date			Maturity date			Flag leaf area (cm^2)		
	S	C	N1	N2	Comb.	N1	N2	Comb.	N1	N2	Comb.
G.C.A	5	5	129.38**	117.21**	246.09**	107.53**	128.82**	234.65**	149.27**	214.66**	358.07**
S.C.A	15	15	1.17	1.68	1.94*	11.02**	11.08**	20.79**	20.7**	24.78**	34.11**
GCAXN		5			0.51			1.70			5.86
SCAXN		15			0.91			1.30			11.36
Error	60	120	0.74	1.01	0.88	1.33	1.05	1.18	4.88	8.7	6.78
GCA/SCA					126.63	9.76	11.63	11.28	7.21	8.66	10.5

* and ** Significant at 0.05 and 0.01 levels of probability, respectively.
N1, N2 and Comb. : First, second and the combined analysis, respectively

Table(8) : Cont.

Source of variation	Degrees 0f freedom		Plant height (cm)			No. of Spikes/plant			Spike length (cm)		
	S	C	N1	N2	Comb.	N1	N2	Comb.	N1	N2	Comb.
G.C.A	5	5	97.83**	92.28**	189.67**	51.32**	67.82**	116.10**	5.5**	6.24**	11.68**
S.C.A	15	15	4.87*	3.94**	7.12**	2.27	2.96	4.15**	0.23*	0.25**	0.41**
GCAXN		5			0.44			3.04			0.05
SCAXN		15			1.69			1.08			0.07
Error	60	120	2.39	1.2	1.78	1.65	1.7	1.68	0.11	0.07	0.08
GCA/SCA			20.08	23.41	26.63	22.65	22.89	27.97	24.04	24.72	28.6

* and ** Significant at 0.05 and 0.01 levels of probability, respectively.
N1, N2 and Comb. : First, second and the combined analysis, respectively.

Table(8) : Cont.

Source of variation	Degrees 0f freedom		No. of Spikelets/spike			No. of Grains/spike			Grain weight/spike (gm)		
	S	C	N1	N2	Comb.	N1	N2	Comb.	N1	N2	Comb.
G.C.A	5	5	6.98**	8.13**	14.84**	204.48**	203.99**	391.18**	1.29**	1.23**	2.48**
S.C.A	15	15	0.22	0.26	0.26	126.05**	78.72**	190.58**	0.34**	0.22**	0.44
GCAXN		5			0.27			17.29			0.04
SCAXN		15			0.21			14.19			0.13*
Error	60	120	0.23	0.27	0.26	9.3	9.34	9.32	0.06	0.07	0.06
GCA/SCA						1.62	2.59	2.05	3.76	5.54	

* and ** Significant at 0.05 and 0.01 levels of probability, respectively.
N1, N2 and Comb. : First, second and the combined analysis, respectively.

Table(8) : Cont.

Source of variation	Degrees 0f freedom		100- Grains weight (gm)			Grains weight/plant (gm)			Total yield/plant (gm)		
	S	C	N1	N2	Comb.	N1	N2	Comb.	N1	N2	Comb.
G.C.A	5	5	0.86**	0.76**	1.58**	27.4	114.05**	102.54**	292.14**	571.03**	741.91**
S.C.A	15	15	0.14*	0.16	0.17*	37.35*	23.95	32.82	115.61	138.8	145.94
GCAXN		5			0.03			38.91			228.82*
SCAXN		15			0.13			28.48			117.81
Error	60	120	0.08	0.16	0.12	16.49	21.89	19.20	86.31	132.66	109.48
GCA/SCA			6.13		9.11						

* and ** Significant at 0.05 and 0.01 levels of probability, respectively.
N1, N2 and Comb. : First, second and the combined analysis, respectively.

level. Such results indicated that additive and non- additive types of gene action were important in the inheritance of studied traits. For the exceptional cases, additive gene action seemed to be more important than non- additive gene action. High G.C.A/S.C.A ratios which largely exceeded the unity were detected for all studied traits in both nitrogen levels as well as the combined data except grain weight per plant in the first nitrogen level. Such results indicated that additive and additive X additive types of gene action were important than non- additive gene action in controlling these traits.

The importance of additive genetic variance in controlling yield and yield attributes in wheat was reported by several investigators. Among those are:

EL- Shamarka (1980), Hassaballa *et al.*(1984), Mitkess and EL- Rassas (1986), Singh (1990), AL-Koddoussi and Hassan (1991), Nassar (1992), Hendaawy (1994-b), AL- Koddoussi (1996), EL- Shami (1996), Hewezi (1996), Mahmoud (1999), EL- Sayed *et al.* (2000), Abdel-Wahed (2001) **for number of spikes/ plant;** Abul- Nass *et al.*(1986), Abdel- Sabour *et al.*(1990), Darwish (1992), Zaied (1995), EL- Sayed (1997), Hassan (1998) and Hendawy (1998) **for number of grains/spike**; AL-Koddoussi and Hassan (1991), Hewezi (1996), and Hendawy (1998) **for grains weight /spike;** Bashir *et al.*(1984), Tamam (1989), Abdel- Sabour *et al.*(1990), Zaied (1995), Hassan (1998) and EL- Sayed *et al.* (2000) **for100-grains weight;** EL.Shamarka (1980), Abul- Nass *et al.*(1986), Mitkess and EL- Rassas (1986), AL- Kaddoussi (1989), Singh (1990), Lonc and Zalewski (1991), Zaied (1995), Abdel- Shafi (1999), Mahmoud (1999) and EL- Sayed *et al.* (2000) **for grain weight /plant .**

On the other hand, several investigators reported that non-additive gene action was responsible for the inheritance of wheat grain yield and its attributes (Hassaballa *et al.*(1984), Abul- Nass *et al.*(1986), Barakat and Shehab EL-Din (1993), Rajara and Maheshwari (1996), Abdel- Shafi (1999), EL- Sayed *et al.* (2000),), Ghanem (2001) and Abdel- Hameed (2002) .

Also, results in (Table 8) indicated that the interaction between G.C.A X nitrogen levels was significant for total yield/plant while the interaction between S.C.A X nitrogen levels was significant for grain weight/spike indicating that the magnitude of additive and non- additive types of gene action varied from one nitrogen level to another for both traits.

General combining ability effects:

General combining ability effects were computed for the parent when the trait showing significant G.C.A means squares. Estimates of G.C.A effects ($\hat{g}_i$) for individual parental genotype in each trait for each nitrogen level as well as the combined data are presented in (Table 9). Results indicated that parent P_1 (Sids 4) expressed highly significant negative ($\hat{g}_i$) effects for heading date and maturity dates in the two nitrogen levels as well as the combined data . Such results indicated that the parental line P1 (Sids 4) could be considered as excellent combiner for developing early heading and maturity genotypes. This particular parent (P_1) exhibited significant positive ($\hat{g}_i$) effects for each of spike length , number of grains / spike , grain weight / spike , and 100-grain weight under the two nitrogen levels as well as their combined data . This means that P1 (Sids4) was considered the best general combiner for the four previously mentioned traits in

Table(9): Estimates of general combining ability effects for all studied traits .

Parents	Heading date			Maturity date			Flag leaf area (cm^2)		
	N1	N2	Comb.	N1	N2	Comb.	N1	N2	Comb.
P1	-7.03**	-6.45**	-6.74**	-7.18**	-8.00**	-7.59**	3.20**	4.12**	3.66**
P2	0.22	0.15	0.18	1.39**	1.28**	1.33**	-4.88**	-5.60**	-5.24**
P3	-0.38	-0.89**	-0.63**	-0.12	0.31	0.10	-3.06**	-4.6**	-3.83**
P4	1.50**	1.65**	1.57**	1.17**	1.28**	1.22**	6.85**	7.91**	7.38**
P5	5.38**	5.3**	5.34**	3.14**	2.56**	2.85**	-1.67*	-0.43	-1.05
P6	0.31	0.24	0.28	1.6**	2.56**	2.08**	-0.44	-1.40	-0.92
LSD5% (gi)	0.556	0.649	0.423	0.744	0.661	0.493	1.427	1.903	1.177
LSD1% (gi)	0.739	0.863	0.559	0.990	0.879	0.652	1.897	2.532	1.558
LSD 5% (gi - gj)	0.861	1.005	0.655	1.153	1.024	0.763	2.21	2.949	1.824
LSD 1% (gi –gj)	1.145	1.337	0.867	1.533	1.362	1.010	2.939	3.922	2.414

* and ** Denote significant differences from zero at 0.05 and 0.01 levels of probability, respectively.
N1, N2 and Comb. : First, second and the combined analysis, respectively .

Table(9) Cont.

Parents	Plant height (cm)			No. Of Spikes/plant			Spike length (cm)		
	N1	N2	Comb.	N1	N2	Comb.	N1	N2	Comb.
P1	-1.80**	-1.18**	-1.49**	-4.27**	-5.03**	-4.65**	1.44**	1.54**	1.49**
P2	0.95	0.91*	0.93**	3.07**	3.56**	3.32**	-0.88**	-0.82**	-0.85**
P3	-5.43**	-5.46**	-5.45**	1.29**	0.03	0.66*	-0.53**	-0.73**	-0.63**
P4	4.29**	3.97**	4.13**	-1.33**	-0.75	-1.04**	0.44**	0.42**	0.43**
P5	2.89**	2.91**	2.90**	0.32	0.25	0.29	-0.31**	-0.36**	-0.33**
P6	-0.90	-1.15**	-1.02**	0.92*	1.94	1.43**	-0.15	-0.06	-0.10
LSD5%(gi)	0.998	0.707	0.605	0.828	0.842	0.585	0.210	0.172	0.134
LSD1%(gi)	1.327	0.940	0.801	1.101	1.120	0.774	0.279	0.228	0.177
LSD5%(gi-gj)	1.546	1.095	0.938	1.283	1.304	0.906	0.325	0.266	0.208
LSD1%(gi-gj)	2.056	1.457	1.241	1.706	1.735	1.198	0.432	0.353	0.275

* and ** Denote significant differences from zero at 0.05 and 0.01 levels of probability, respectively.
N1, N2 and Comb. : First, second and the combined analysis, respectively .

Table(9):- Cont.

Parents	No. Of Spikelets/spike			No. of Grains /spike			Grain weight/spike (gm)		
	N1	N2	Comb.	N1	N2	Comb.	N1	N2	Comb.
P1	-1.15**	-1.19**	-1.17**	8.24**	8.73**	8.48**	0.65**	0.64**	0.65**
P2	-0.33*	0.06	-0.14	-6.92**	-3.90**	-5.41**	-0.48**	-0.34**	-0.41**
P3	-0.71**	-1.13**	-0.92**	-2.92**	-5.93**	-4.42**	-0.31**	-0.36**	-0.33**
P4	1.1**	1.06**	1.08**	-0.54	-0.05	-0.3	0.17*	0.25**	-0.21**
P5	1.1**	1.13**	1.12**	0.37	0.98	0.67	0.1	0.03	0.06
P6	-0.02	0.06	0.02	1.77	0.17	0.97	-0.13	-0.23**	-1.18**
LSD5%(gi)	0.307	0.338	0.226	1.968	1.973	1.379	0.161	0.166	0.114
LSD1%(gi)	0.408	0.45	0.299	2.618	2.624	1.825	0.214	0.221	0.151
LSD5%(gi-gj)	0.475	0.524	0.35	3.049	3.056	2.137	0.249	0.257	0.177
LSD1%(gi-gj)	0.632	0.696	0.463	4.055	4.064	2.828	0.332	0.342	0.235

* and ** Denote significant differences from zero at 0.05 and 0.01 levels of probability, respectively.
N1, N2 and Comb. : First, second and the combined analysis, respectively .

Table(9): Cont.

Parents	100- Grains weight (gm)			Grains weight/plant (gm)			Total yield /plant (gm)		
	N1	N2	Comb.	N1	N2	Comb.	N1	N2	Comb.
P1	0.57**	0.47**	0.52**	-	-5.66**	-4.31**	-9.57**	-8.9*	-9.24**
P2	-0.32**	-0.36**	-0.34**	-	0.41	-0.01	5.66	2.77	4.22
P3	-0.22*	-0.15	-0.18**	-	-3.23*	-1.49	0.62	-12.37**	-5.88*
P4	0.12	0.26**	0.19**	-	3.29*	1.74	3.84	6.14	4.99*
P5	0.06	-0.04	0.01	-	1.1	1.97	4.39	7.41	5.9*
P6	-0.21*	-0.19*	-0.2**	-	4.08**	2.09*	-4.94	4.95	0.01
LSD5%(gi)	0.177	0.179	0.125	-	3.02	1.98	5.997	7.435	4.728
LSD1%(gi)	0.236	0.238	0.165	-	4.017	2.619	7.976	9.89	6.256
LSD5%(gi-gj)	0.275	0.278	0.193	-	4.679	3.067	9.29	11.52	7.325
LSD1%(gi-gj)	0.365	0.369	0.256	-	6.223	4.058	12.356	15.32	9.692

* and ** Denote significant differences from zero at 0.05 and 0.01 levels of probability, respectively.
N1, N2 and Comb. : First, second and the combined analysis, respectively .

addition to flowering date .Therefore, parent P_1 could be considered as an excellent parent in breeding programs towards releasing new wheat varieties characterized by early maturity and higher values of yield components .

On the other hand, the parent P1 expressed significant negative ($\hat{g}_i$) effects for plant height revealing the possibility of utilizing this parent to release short wheat varieties.

Parental variety P2 (Sakha 69) expressed significant positive ($\hat{g}_i$) effects for number of spikes / plant in the three studied cases revealing that this parent was best combiner for this trait

Parent P_3(Sakha 93) seemed to be the best general combiner for plant height since it expressed significant and negative ($\hat{g}_i$) effects suggesting that this genotype could be considered good combiner for short stature in wheat. Also, parent P3 ranked the second best combiner for heading date especially in the second nitrogen level and the combined data.

Parent P4 (Gemmiza 7) expressed significant positive ($\hat{g}_i$) effects for flag leaf area and plant height in both nitrogen levels and their combined data. Moreover, it occupied the second best combiner for spike length and number of spikelets / spike in the first, second nitrogen levels and the combined data as well as total yield per plant in the combined data.

Parental variety P5 (Gemmiza 9) seemed to be the best general combiner for number of spikelets / spike under all nitrogen levels as well as total yield per plant in the combined analysis (Table 9).

Parent P6 (Giza 168) expressed significant positive ($\hat{g}_i$) effects for grain weight per plant in the second nitrogen level and the combined data. This means that this parent could be considered the best combiner for grain weight / plant. Meantime, this parent P6 (Giza 168) ranked the second best general combiner for number of spikes per plant since it expressed significant positive ($\hat{g}_i$) effects for this trait.

Specific combining ability effects:

Specific combining ability effects of the fifteen studied crosses were estimated for eight traits in the two nitrogen levels as well as combined data (Table 10).

None of the studied crosses exhibited significant negative Sij effects for **maturity date** under both nitrogen levels and their combined data.

However, high negative Sij effects were detected for the crosses P_3XP_4, P3 X P_6, and P4X P_5 in the first, second nitrogen levels and the combined data, respectively. Other crosses exhibited either positive or non significant Sij effects for this trait.

For **flag leaf area**, three, three and four crosses expressed significant and positive Sij effects in the first, second nitrogen levels as well as the combined data, respectively. However, the most desirable Sij effects for this trait were obtained for the crosses P_3XP_5 (5.85**), P_4XP_6 (9.53**) and P3 X P_5 (6.98**) for the respective cases. It is clear that the two crosses P3 X P_5 and P_4XP_6 are the promising in practical breeding programs to produce broader flag leaf area genotypes

Concerning **plant height**, significant and negative Sij effects for plant height were detected for the cross P_3 X P_5 with the value of (-2.98**) in the second nitrogen level and (-2.25**) in the combined data. On the other hand, the cross P1X P_3 exhibited the highest significant and positive Sij effects in the first, second nitrogen levels and the combined data recording

Table (10) : Estimates of specific combining ability effects for crosses studies in each nitrogen levels as well as the combined data

Crosses	Maturity date			Flag leaf area (cm^2)		
	N1	N2	Comb.	N1	N2	Comb.
1x2	4.09**	1.47	2.78**	-2.83	-4.01	-3.42*
1x3	2.34*	2.44**	2.39**	-4.44*	2.81	-0.82
1x4	3.31**	4.72**	4.01**	-7.44**	-3.48	-5.46**
1x5	5.34**	5.94**	5.64**	-2.37	-0.88	-1.63
1x6	2.12	2.44**	2.28**	1.39	1.41	1.40
2x3	1.28	-1.34	-0.03	4.11*	2.68	3.39*
2x4	-0.50	-0.31	-0.41	-0.70	-1.93	-1.31
2x5	-1.22	-0.59	-0.91	1.58	6.03*	3.81*
2x6	1.31	2.41*	1.86**	-0.42	-0.75	-0.59
3x4	-2.00	1.16	-0.42	-0.90	1.13	0.12
3x5	-0.22	-0.13	-0.17	5.85**	8.11**	6.98**
3x6	-0.94	-1.38	-1.16	0.42	-4.84	-2.21
4x5	-1.50	-1.09	-1.30	5.43**	0.56	3.00
4x6	0.78	-0.34	0.22	-1.02	9.53**	4.25*
5x6	0.56	-0.88	-0.16	3.19	0.94	2.06
LSD5%(sij)	2.044	1.815	1.353	3.918	5.228	3.234
LSD1%(sij)	2.719	2.414	1.79	5.211	6.953	4.279
LSD5%(sij-sik)	3.051	2.709	2.019	5.847	7.802	4.826
LSD1%(sij-sik)	4.057	3.603	2.672	7.777	10.376	6.386
LSD5%(sij-skl)	2.824	2.508	1.87	5.413	7.223	4.468
LSD1%(sij-skl)	3.756	3.335	2.474	7.20	9.606	5.912

and ** Denote significant differences from zero at 0.05 and 0.01 levels of probability, respectively.
N1, N2 and Comb. : First, second and combined analysis ,respectively

Table (10): Cont.

Crosses	Plant height (cm)			Spike length (cm)		
	N1	N2	Comb.	N1	N2	Comb.
1x2	-0.21	1.24	0.52	-0.56	-0.44	-0.50**
1x3	4.17**	2.62**	3.39**	-0.65*	0.02	-0.32
1x4	0.95	0.68	0.82	-0.13	-0.41	-0.27
1x5	-1.64	0.99	-0.33	0.61*	-0.81**	-0.71**
1x6	1.14	1.55	1.35	-0.27	-0.58	-0.42*
2x3	3.17*	1.77	2.47**	0.49	0.01	0.25
2x4	-2.05	0.09	-0.98	-0.08	-0.47	-0.27
2x5	0.86	0.15	0.50	0.26	0.21	0.24
2x6	1.14	1.96*	1.55	-0.05	0.03	-0.01
3x4	-1.17	0.46	-0.36	-0.13	-0.21	-0.17
3x5	-1.52	-2.98**	-2.25**	0.46	0.09	0.28
3x6	-1.24	0.34	-0.45	0.05	0.07	0.06
4x5	-2.24	0.34	-0.95	-0.24	0.24	0.00
4x6	2.30	0.40	1.35	0.03	0.72**	0.37*
5x6	0.20	1.21	0.71	0.5	0.34	0.42*
LSD5%(sij)	2.741	1.942	1.663	0.576	0.471	0.368
LSD1%(sij)	3.645	2.583	2.2	0.766	0.627	0.487
LSD5%(sij-sik)	4.09	2.898	2.481	0.859	0.703	0.55
LSD1%(sij-sik)	5.44	3.854	3.283	1.143	0.935	0.727
LSD5%(sij-skl)	3.787	2.683	2.297	0.796	0.651	0.509
LSD1%(sij-skl)	5.037	3.568	3.04	1.058	0.866	0.673

and ** Denote significant differences from zero at 0.05 and 0.01 levels of probability, respectively.
N1, N2 and Comb. : First, second and combined analysis, respectively

Table (10): Cont.

Crosses	No. of Grains/spike			Grains weight/spike (gm)		
	N1	N2	Comb.	N1	N2	Comb.
1x2	-5.87*	-3.46	-4.67*	-0.41	-0.24	-0.33*
1x3	-16.62**	-9.18**	-12.9**	-1.05**	-0.42	-0.73**
1x4	-9.25**	-13.56**	-11.4**	0.14	-0.7**	-0.28
1x5	-18.15**	-11.84**	-15.0**	-1.08**	-0.36	-0.72**
1x6	-6.06*	-9.28**	-7.67**	-0.16	-0.43	-0.30
2x3	10.29**	1.44	5.86**	0.52*	0.17	0.34*
2x4	-5.59*	2.07	-1.76	-0.57*	0.27	-0.15
2x5	-4.00	0.04	-1.98	0.05	-0.04	0.00
2x6	1.10	4.10	2.60	0.10	0.54*	0.32*
3x4	-5.84*	0.10	-2.87	-0.22	0.47*	0.12
3x5	3.50	2.07	2.79	0.46*	0.39	0.42**
3x6	-0.40	-2.37	-1.39	0.07	-0.08	-0.01
4x5	3.63	3.19	3.41	0.27	0.20	0.24
4x6	2.47	4.75	3.61	0.12	0.18	0.15
5x6	1.57	-1.78	-0.11	0.11	0.06	0.09
LSD5%(sij)	5.405	5.418	3.788	0.442	0.456	0.314
LSD1%(sij)	7.189	7.205	5.013	0.588	0.607	0.416
LSD5%(sij-sik)	8.067	8.085	5.654	0.66	0.681	0.469
LSD1%(sij-sik)	10.729	10.754	7.481	0.878	0.905	0.621
LSD5%(sij-skl)	7.469	7.486	5.234	0.611	0.63	0.434
LSD1%(sij-skl).	9.933	9.956	6.926	0.813	0.838	0.575

and ** Denote significant differences from zero at 0.05 and 0.01 levels of probability, respectively.
N1, N2 and Comb. : First, second and combined analysis, respectively

Table (10): Cont.

Crosses	100-Grains weight (gm)			Grains weight/plant (gm)		
	N1	N2	Comb.	N1	N2	Comb.
1x2	-0.23	-0.33	-0.28	6.75	4.21	5.48*
1x3	-0.25	0.32	0.04	-2.37	9.67*	3.65
1x4	0.71**	-0.31	0.20	7.92*	-5.25	1.33
1x5	-0.47	-0.05	-0.26	-5.45	1.08	-2.19
1x6	0.24	-0.19	0.02	9.13*	-0.13	4.50
2x3	0.32	0.31	0.32	-0.57	-0.70	-0.63
2x4	-0.56*	0.17	-0.20	-8.1*	0.97	-3.56
2x5	0.15	0.39	0.27	-6.58	0.21	-3.18
2x6	0.27	0.34	0.30	2.8	2.53	2.67
3x4	-0.27	0.52*	0.13	-4.84	1.45	-1.70
3x5	0.56*	0.42	0.49**	6.35	3.01	4.68
3x6	0.23	-0.13	0.05	0.11	0.72	0.42
4x5	0.19	0.15	0.17	-2.06	-1.04	-1.55
4x6	-0.03	-0.07	-0.05	1.75	8.82*	5.28
5x6	0.09	0.24	0.08	0.78	-2.51	-0.87
LSD 5% (sij)	0.487	0.492	0.343	7.199	8.295	5.437
LSD 1% (sij)	0.648	0.655	0.454	9.574	11.032	7.194
LSD5%(sij-sik)	0.727	0.735	0.511	10.744	12.379	8.114
LSD1%(sij-sik)	0.966	0.977	0.677	14.289	16.464	10.736
LSD5%(sij-skl)	0.673	0.68	0.474	9.947	11.461	7.512
LSD1%(sij-skl)	0.895	0.905	0.627	13.229	15.243	9.94

and ** Denote significant differences from zero at 0.05 and 0.01 levels of probability, respectively.
N1, N2 and Comb. : First, second and combined analysis, respectively

(4.17**), (2.62**) and (3.39**), respectively.

Regarding **spike length**, the cross P1 X P_5 (0.61*) exhibited significant positive Sij effects in the first nitrogen level. However, this cross expressed significant negative Sij effects in the second nitrogen level and combined data. Such results indicated that the genetic behavior fluctuated from one environment to another. Meantime, the most desirable Sij effect for spike length was detected for the cross P_4 X P_6 (0.72*) in the second nitrogen level. In the combined data, the highest significant and positive Sij effect for this trait was detected for the cross P_5 X P_6 (0.42*) followed by the cross P4X P_6 (0.37*).

The cross combination P_2 X P_3 expressed the most desirable Sij effects for **number of grains per spike** in the first nitrogen level (10.29**) and the combined data (5.86**). None of the studied crosses exhibited significant and positive Sij effects for this trait in the second nitrogen level.

For **grain weight per spike**, two, two and three crosses exhibited significant and positive Sij effects in the first, second nitrogen levels and the combined data, respectively. However, the best Sij effects were detected for the crosses P2X P_3 (0.52*), P_2 X P_6 (0.54*) and P_3 X P_5 (0.42**) for the respective cases.

Regarding **100 – grain weight**, two crosses namely P_1 X P_4 (0.71**) and P_3X P_5 (0.56*) gave the highest desirable Sij effects in the first nitrogen level. Cross P_3 X P_4 (0.52*) expressed significant and positive Sij effects for this trait in the second nitrogen level. Also, the single cross P3 X P5 exhibited the best Sij effects being (0.49**) in the combined data.

For **grain weight per plant**, two, two and one crosses expressed significant and positive Sij effects in the first, second nitrogen levels and the combined data, respectively. However, the most desirable Sij effects were recorded for the crosses P1 X P_6 (9.13*), P_1 X P_3 (9.67*) and P_1 X P_2 (5.48*) in the respective cases. The two crosses P_1 X P_4 (7.92*) and P_4 X P_6 (8.82*) ranked the second best for Sij effects in the first and second nitrogen levels, respectively.

Genetic components:

The estimation of genetic components for studied traits depends upon several assumptions necessary for the validity of the analysis. These assumptions are homozygous parents, diploid segregation, no reciprocal differences, no genotype environmental interaction, no epistasis, no multi allelism and uncorrelated gene distribution. Moreover, the validity of these assumptions must be tested before estimating the genetic components. Two tests were used in this concern the first test was t^2 value which is expected to be insignificant if all the assumptions are valid. The second test was the analysis of wr, vr regression. All the assumptions are valid if the regression (b) coefficients differ significantly from zero but not from unity. Significant regressions were detected for heading date, maturity date, spike length, plant height, no. of spikes/plant, no. of spikelets/spike, no. of grains/spike, grains weight/spike and 100-grain weight under the first level of nitrogen except flag leaf area, grain weight/plant and total yield/plant as well as the second level of nitrogen for heading date, maturity date, spike length, plant height, no. of spikes/plant, no. of spikelets/spike, no. of grains/spike, grains weight/spike and 100- grain weight flag leaf area except grain weight/plant and total yield/plant and the slope of regression did not deviate significantly from unity for heading date, maturity date, spike length, plant height, no. of spikes/plant, no. of spikelets/spike, no. of grains/spike, grains weight/spike, 100- grain weight, flag leaf area and grain weight/plant under the first nitrogen level except total yield/plant as well as the second nitrogen level for all traits proving the importance of additive effects for these traits . In the other cases where regression coefficients were not significant, the assumption of no gene interaction was not satisfied.

Data were also subjected to the diallel analysis proposed by Hayman (1954 b) to get more information about the traits under study in each nitrogen level. The computed parameters are presented in (Table-11). It is clear that assumptions required for this analysis were valid for all traits except total yield/plant. Results indicated that the additive component ($\hat{D}$) was significant for all studied traits except total yield/plant under both nitrogen levels as well as combined data. Such results are in harmony with those previously obtained by means of G.C.A analysis (Table 8).

Meantime, the dominance component (H_1) was significant for all traits except heading date, number of spikelets /spike and total yield /plant in both nitrogen levels as well as number of spikes /plant and grain weight /plant in the second nitrogen level. However, the magnitude of ($\hat{D}$) was much higher than (H_1) for all traits except number of grains /spike and total yield /plant in both nitrogen levels and grain weight /plant in the first nitrogen level. Such results confirmed the importance of additive genetic variance in controlling the studied traits. Again, these results are in accordance with those obtained in combining ability analysis (Table-8). For number of grains /spike and total yield/plant the values of ($\hat{D}$) were smaller in magnitude than the respective (H_1) ones indicating the importance of non- additive variance in the inheritance of both traits. Such result contradicted with that obtained from combining ability analysis. This contradiction between both types of analysis may be due to non- allelic interaction which inflated the ratios of H_1 to $\hat{D}$ (Hayman, 1954 b, and Mather and Jinks, 1971).

Also, the genetic component (H_2) was significant for most studied traits. However, the magnitude of (H_2) was smaller than that of (H_1) for all traits except heading date in second nitrogen level, no. of spikes/plant and spike length in the first nitrogen level . This indicates that the positive U and V alleles frequency at the loci of these traits are not equal in proportion in the parents

The component $\hat{F}$ refers to covariance of additive and non- additive gene effects. It can be used to determine the relative frequencies of dominant and recessive alleles in the parental population and the variation in the dominance level over loci. Results indicated significant and positive values of this component for all traits except heading date and grain weight/plant in the second nitrogen level, and total yield /plant in both nitrogen levels. These results indicate an excess of dominant alleles in the parental populations. For the exceptional cases, insignificant F values were detected, where dominant and recessive alleles of loci were equally distributed among the parents . Similar results were reported by Salem *et. al.*(2000) and Ghanem (2001).

The overall dominance effects of heterozygous loci (h_2) were significant for 8 out of 24 traits indicating that the effect of dominance was due to heterozygosity and that dominance was unidirectional. These results are in general agreement with those reported by Abul- Naas *et.al.*(1986), Abdel- Nour (1995) and Ghanem (2001) .

Table (11) : Estimate of genetic components of variation in diallel crosses for the studied traits .

Components	Heading date		Maturity date		Flag leaf area (cm^2)		Plant height (cm)	
	N1	N2	N1	N2	N1	N2	N1	N2
D	66.55**± 0.46	55.23**± 0.74	102.34**± 2.60	118.01**± 3.51	144.84**± 8.54	126.41**± 6.35	69.26**± 2.28	52.48**± 1.46
H_1	1.57± 1.18	3.97± 1.86	42.37**± 6.60	43.44**± 8.90	87.27**± 21.67	94.32**± 16.13	15.35**± 5.78	10.22*± 3.69
H_2	1.83± 1.05	4.24*± 1.67	25.88**± 5.88	27.93*± 7.95	47.75*± 19.36	72.04**± 14.41	11.16*± 5.16	7.89*± 3.30
h^2	0.67± 0.71	0.66± 1.12	31.71** ± 3.96	31.04**± 5.35	-3.10 ± 13.03	27.78*± 9.70	0.86 ± 3.47	16.78**± 2.22
F	2.87*± 1.13	-4.20± 1.80	78.06**± 6.34	83.78**± 8.57	126.49** ± 20.86	42.95*± 15.52	31.52**± 5.56	10.98*± 3.56
E	1.19	1.02	1.86	1.36	6.51	8.64	2.50	1.58
(H1/D)½	0.15	0.27	0.64	0.61	0.78	0.86	0.47	0.44
(H2/4H1)	0.25	0.25	0.15	0.16	0.14	0.19	0.18	0.19
(KD/KR)	1.33	0.75	3.91	3.82	3.57	1.49	2.87	1.62
h(ns)	0.95	0.93	0.71	0.75	0.61	0.66	0.80	0.86
r	-0.669	-0.728	-0.99	-0.969	0.34	0.192	0.143	0.077

and ** Denote significant differences from zero at 0.05 and 0.01 levels of probability, respectively.
N1, N2 and Comb. : First, second and combined analysis,respectively.

Table (11) : Cont.

Components	No. spikes/plant		Spike length (cm)		No. spikelets/spike		No. grains/spike	
	N1	N2	N1	N2	N1	N2	N1	N2
D	37.59**± 0.73	48.81**± 1.68	4.35**± 0.11	4.46**± 0.10	4.05**± 0.15	4.72** ± 0.12	368.63** ± 39.94	331.85**± 20.86
H_1	6.05**± 1.85	5.24 ± 4.26	0.73*± 0.27	0.95*± 0.27	0.34 ± 0.38	0.27 ± 0.31	504.77** ± 101.39	333.40** ± 52.94
H_2	3.18 ± 1.66	2.14 ± 3.81	0.38 ± 0.24	0.59*± 0.24	0.33 ± 0.34	0.26 ± 0.27	328.14* ± 90.57	191.97** ± 47.30
h^2	-0.89 ± 1.12	-9.28 ± 2.56	0.04 ± 0.16	0.17± 0.16	-0.09 ± 0.23	-0.14 ± 0.18	326.75**± 60.96	166.49** ± 31.83
F	19.01**± 1.79	23.88** ± 4.10	2.47**± 0.26	2.11**± 0.26	0.87* ± 0.37	1.04** ± 0.29	487.24 * ± 97.57	417.42** ± 50.95
E	1.89	3.37	0.14	0.09	0.23	0.33	10.46	9.75
(H1/D)½	0.40	0.33	0.41	0.46	0.29	0.24	1.17	1.01
(H2/4H1)	0.13	0.10	0.13	0.15	0.24	0.24	0.16	0.14
(KD/KR)	4.41	6.89	5.53	3.09	2.17	2.70	3.60	4.37
h(ns)	0.80	0.78	0.82	0.85	0.84	0.83	0.24	0.33
r	-0.882	-0.693	0.967	0.915	0.893	-0.341	0.936	0.91

* and ** Denote significant differences from zero at 0.05 and 0.01 levels of probability, respectively.
N1, N2 and Comb. : First, second and combined analysis,respectively.

Table (11) : Cont.

Components	Grains weight/spike (gm)		100-grains weight (gm)		Grain weight/plant (gm)		Total yield/plant (gm)	
	N1	N2	N1	N2	N1	N2	N1	N2
D	1.49**± 0.17	1.44**± 0.07	0.52**± 0.04	0.70**± 0.04	43.68* ± 14.61	37.53** ± 9.12	137.02 ± 73.84	19.22 ± 56.79
H_1	1.37**± 0.44	0.90**± 0.18	0.27*± 0.11	0.39**± 0.1	112.05* ± 37.09	-23.21 ± 23.15	290.35 ± 187.45	85.49 ± 144.17
H_2	0.95*± 0.39	0.46* ± 0.16	0.21**± 0.09	0.24**± 0.09	77.62* ± 33.14	-5.00 ± 20.68	201.92 ± 167.45	15.17 ± 128.79
h^2	0.33± 0.27	-3.56 ± 0.11	0.04 ± 0.07	0.42**± 0.06	-5.60 ± 22.30	57.34**± 13.92	0.75 ± 112.71	122.17 ± 86.69
F	1.45**± 0.43	1.50**± 0.17	0.32* ± 0.11	0.60**± 0.09	77.29* ± 35.70	-19.04 ± 22.28	98.76 ± 180.39	330.07 ± 138.74
E	6.22	7.22	0.09	0.11	22.92	41.21	89.02	257.97
$(H1/D)^{1/2}$	0.96	0.79	0.72	0.75	1.6	0.0	1.46	2.11
(H2/4H1)	0.17	0.13	0.19	0.15	0.17	0.25	0.17	0.04
(KD/KR)	3.06	4.90	2.48	3.67	3.47	0.0	1.66	-0.61
h(ns)	0.43	0.50	0.49	0.43	9.57	0.32	0.31	0.32
r	0.925	0.794	0.263	0.135	-0.293	0.211	0.493	0.656

* and ** Denote significant differences from zero at 0.05 and 0.01 levels of probability, respectively.
N1, N2 and Comb. : First, second and combined analysis,respectively.

The ratio $(H_1/D)^{½}$ that refers to a weighed measure of average degree of dominance at each locus was computed for all traits . Results indicated that the values of $(H_1/D)^{½}$ were less than unity for all traits except grains weight /plant in first nitrogen level, number of grains/spike and, total yield /plant in both nitrogen levels . Such results showed the presence of partial dominance for these traits. Absence of dominance was detected for grain weight/plant in the second nitrogen level since the $(H_1/D)^{½}$ value was equal to zero . For number of grains /spike in the second nitrogen level complete dominance was obtained. Over dominance was detected for number of grains and grain weight/plant in the first nitrogen level and total yield /plant in both nitrogen levels.

The ratio $(H_2 / 4H_1)$ refers to the average frequency of negative vs positive alleles in parental populations. It was below the maximum value of 0.25 for all traits except heading date in both nitrogen levels and grain weight per plant in the second nitrogen level indicating that the positive and negative alleles were not equally distributed among the parents for the studied traits . For the exceptional cases, the ratio $(H_2/4H_1)$ was equal to 0.25 indicating that the positive and negative alleles were equally distributed among the parents. The same conclusion could be drawn from the corresponding proportion

$[(4DH1)^{½} + F] / [(4DH1)^{½} - F)]$.

Heritability in narrow sense was estimated for all studied traits and the results are presented in Table (11). High to moderate heritability values were detected for most studied traits in both nitrogen levels. Therefore, the genetic system controlling these traits might be attributed to additive effects of genes.

Consequently, a pedigree selection program for these traits might be quite promising .These results agree with those reported by Verma *et .al.*(1984), Abdel- Nour (1995) and Ghanem (2001) .

The correlation coefficient values between parental mean (Yr) and (Wr +Vr) for each array were significant and negative for heading date, maturity date and number of spikes /plant, in both nitrogen levels, grain weight/plant in the first nitrogen level, and no of spikelets/spike in the second nitrogen level, revealing that increaser genes were dominant than decreaser ones . However, (r) values were positive for flag leaf area, plant height, spike length, number of grains /spike grains weight /spike, 100-grains weight and total yield/plant in both nitrogen levels and number of spikelets /spike in first nitrogen level and grains weight /plant in the second nitrogen level, revealing that decreaser genes were dominant than increaser ones .