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COMBINING ABILITY FOR EARLINESS, YIELD AND YIELD COMPONENTS TRAITS IN WHEAT

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ABSTRACT: *The investigation aimed to study genetic system for earliness components, grain yield and some of its components of eight parents and their crosses of wheat under three sowing dates (early, normal, and later). Eight parental verities/or lines representing wide range of variability in most of the studied traits were utilized. General and specific combining ability estimates were obtained by employing Griffing's (1956) diallel cross analysis designated as method 2 model I.*

General and specific combining ability mean squares were significant in the three sowing dates for all studied traits. GCA/SCA ratio values largely exceed the unity for most studied traits; indicating that, the largest part of the total genetic variability was associated with additive and additive by additive types of gene action.

The parental genotype P6 was the best combiner for heading date, flowering date, and maturity date. The parental genotypes P1 and P8 were the best combiners for grain filling period. The two crosses (P1xP6) and (P3xP8) for the heading date in the first and second sowing date, the cross (P1xP3) for maturity date, cross (P5xP7) for maturity filling period in the three sowing date gave high effects in SCA. The parental genotype P5 was the best combiner for spike length, number of grains per spike, 1000 kernel weight and grain yield per plant. Also, the parental genotype P2 showed high values for 1000 kernel weight. The parental genotypes P2 and P4 gave high positive GCA effects for grain yield/number of spikes/plant.

Four crosses for number of spikes/plant, and spike length, three crosses for number of spikelets per spike, two crosses for number of kernel/spike give high positive SCA effects in the all studied sowing dates. The cross (P1xP6) in the first and second sowing date and the cross (P4xP6) for grain yield per plant in the three sowing date and the crosses (P4xP5) in the normal and the late sowing date showed highly significant positive specific combining ability effects. The results indicated that the normal sowing date was the best sowing date for testing grain yield and most yield components.

Key Words: *wheat, sowing dates, combining ability, earliness and grain yield*

INTRODUCTION

Wheat (*Triticum aestivum* L.em Thell.) is the first important and strategic cereal crop for the majority of world populations. Wheat is adapted to variable climatic conditions; it exceeds in acreage and production the other grain crop (including rice, maize, etc.). Therefore, it might be considered as the most important cereal crop of the world.

In Egypt, wheat is the main cereal crop used as food for urban or rural societies and the major source of straw for animal feeding. The national consumption reached about 14 million tons in 2006/2007 season. Which mean that, wheat gap in Egypt is nearly about 6 million tons. Breeding new high yielding cultivars is an ongoing process for the National Wheat Research Program, Field Crops Research Institute (FCRI), Agricultural Research Center (ARC), to increase wheat production vertically. The potentiality of increasing wheat area is limited because of the limited natural resources especially irrigation water and limited of rains. An alternative procedure to increase wheat area is intensive crop rotation suggested by the National Wheat Research Program. One of these rotations was planting wheat prior to cotton. Wheat farmers used to grow Egyptian clover early September to October to get two cuts before cotton planting in March. Others, prefer growing vegetables in late summer with late harvesting by late December and early January , the matter that reduce the yield of the following wheat crop. In these two cases, early maturing wheat cultivars with high yield potentiality are highly needed. Although, recent cultivars are earlier than old one's, they do not meet new requirements of new intensive crop rotations. Therefore, wheat breeders in the National Wheat Research Program are trying to develop new wheat cultivars characterized by early maturity and high grain yield. Developing such type of cultivars require definite selection of parental genotypes with wide genetic base followed by making crosses to identifying genotypes with desired characteristics.

Additive gene action is evidently accounted for a large amount of the variation for days to heading (Bhatt 1972, Avey *et al.,* 1982 and Menshawy 2000 and 2005) days to maturity (Menshawy, 2000, 2005 and 2007a,b), grain filling duration (Rasyad and Van Sanford, 1992, Beiquan and Kronstad, 1994, Mou and Kronstad, 1994 and Menshawy, 2004). But dominance was also important (Crumpacker and Allard, 1962; Avey *et al.,* 1982 and Menshawy, 2005) for earliness traits, while epistasis was reported in several studies (Amaya *et al.,* 1972; Ketata *et al.,* 1976 for earliness and Przulj and Mladenov, 1999 for grain filling traits).

The concept of combining ability has become increasingly important in plant breeding. It is useful especially, to compare the performance of lines in hybrid combinations. Combining ability has been proved by many workers to be an inherited in a way that some commercial cultivars, despite of being the best in their agronomic characters, yet, they are low combiner when used as a parent. Meanwhile, because of the difficulties caused by correlation of genes in the parents, genetic interpretation of statistic should be attempted only when the parents of the diallel cross have been produced by a laborious process of random mating followed by nonselective inbreeding. Since few diallel experiments meat this requirements, most analysis should be limited for estimating general and specific combining ability mean squares and effects. The genotypic variance is to general combining ability (GCA) and specific combining in ability (SCA). General combining ability is due to additive gene action, while specific combining ability is due to non-additive gene action i.e.; dominance and epitasis (Spargue and Tatum, 1942).

The objectives of this study are:

1. To study the effect of sowing dates on earliness components, yield and yield components.
2. To estimate the magnitude of general combining ability (GCA) and specific combining ability (SCA) for earliness components, yield and yield components.

MATERIALS AND METHODS

This study was carried out at the Experimental Farm, El-Gemmeiza Agricultural Research Station, Egypt, during the two successive seasons of 2005/2006 and 2006/2007. Eight common wheat varieties and/or lines were used to establish the experimental material for this investigation. The names and pedigree for these cultivars and/or lines are presented in Table (1).

Table (1): The origin and pedigree of the parents.

No	Variety or line	Pedigree
1	P1	Bow "s"/Kvz "s"//7C/Seri 82/3/Gem # 5/4/Sids #6. CGM7912- 4GM- 2GM- 1GM- 0GM.
2	P2	C182-24/C168.3/3/CNO/7C*2//CC/Tob//Myna "s"/ Voc"s"/4/SAkha 8. CGM7905- 3GM- 2GM- 1GM- 0GM.
3	P3 (Gemmeiza 7)	CMH 74 A.630/sx//Seri 82/3/Agent: CGM 4611-2GM-3GM-1GM-0GM.
4	P4 (Gemmeiza 9)	Ald"s"/Huac"s"//CMH 74 A.630/sx: CGM 4583-5GM-1GM-0GM.
5	P5	PL1496//CM 1170 A-955*2/CNO 79/3/Bow "s"/ 4/ sids # 6. CGM7851- 3GM- 2GM- 1GM- 0GM.
6	P6	BUC//7C/ALD/5 /MayA74/ on//1160-147//3/BB/GLL/4/ Chat/6 /MYNA/VUL//CMH 74A. 630/4*sx. CGM7802- 1GM- 2GM- 1GM- 0GM.
7	P7	KAUZ/3/MYNA/VUL/BUC/FLK/4/MiLAN CMSS 94 Y 0229T-030Y-0300M-0100Y-4Y-10M-0Y.
8	P8	CHOiX/STAR/3/HEi/3* CNO 79//2 SERi CMSS 93 YO 2712T-40Y-010Y- 6M-0KBY.

In 2005/2006 season, all possible diallel crosses combinations without reciprocals were made among these eight genotypes to produce twenty eight F1 hybrid seeds. The parental genotypes and their twenty eight hybrids were sown on three sowing dates. Each sowing date was considered as an independent experiment with three replicates. These dates were 31st October, 20th November and 10th December, 2006. Each experiment was arranged in a randomized complete block design. The experimental unit consisted of one row, of 1.2 m length and 0.30 m apart. Distance among plants within rows was 10 cm.

The data for all studied traits were recorded for ten guarded plants chosen at random for each row as follows:

I.Earliness characters:

1. Days to heading: recorded as number of days from sowing to the emergence of 50% of the main spike.
2. Days to maturity: number of days from sowing to time when the peduncle of the spike turns yellow.
3. Grain filling period (GFP): number of days from anthesis to physiological maturity.

B.Yield and its components:

1.Spike length (cm): length of main stem spike.
2.Number of spiklets per spike.
3.Number of spikes per plant.
4.1000–kernels weight (g): measured as the weight of 1000 random grains.
5.Number of grains per spike for the main stem spike.
6.Grain yield/plant (g): measured as the grain weight of each individual plant.

The statistical procedure was done according to the regular analysis of variance for each sowing date as a randomized complete block design as outlines by Gomez & Gomez (1984). General and specific combining ability estimate were obtained for each seasons by employing Griffing's diallel cross analysis (1956) designated as method 2 model 1.

RESULTS AND DISCUSSION

The investigation aimed to determine the nature and magnitude of gene actions governing the inheritance of earliness components i.e.; days to heading, days to maturity, grain filling period, grain yield and its components i.e number of spikes/plant, number of kernels/spike, 1000-kernel weight and grain yield per plant, on early, normal and late sowing environments.

For better presentation and discussion of the obtained results it was divided in to two parts. The first part represented earliness components, whereas, the second presented, yield and its components.

1. Earliness measurements:

The mean performances of the eight parental lines entries of wheat in each sowing dates represented in Table (2). The parental lines (P_1) and (P_8) showed significantly the lowest grain filling period in each of the three sowing dates. Mean while parental line (P_6) was the earliest in days to heading, and days to maturity. The mean performances of F_1 crosses in each sowing date were also presented in Table (2). The mean values for days to heading, and days to maturity were within the range of parental lines.

Table (2): Mean performance for earliness traits of wheat genotypes evaluated under three sowing dates .

Genotypes	Days to heading			Days to maturity			Grain filling period (days)		
	D1	D2	D3	D1	D2	D3	D1	D2	D3
P1	99.89	102.50	99.57	151.83	157.25	140.73	46.17	43.35	34.73
P2	88.44	96.40	97.13	153.13	151.00	147.37	56.00	45.05	47.33
P3	90.72	98.60	98.96	157.25	149.33	146.00	53.82	39.00	43.33
P4	94.11	104.60	101.30	159.40	154.58	144.00	50.88	42.35	39.13
P5	84.00	92.55	94.03	153.33	147.00	141.07	58.17	45.15	42.78
P6	82.58	87.18	88.33	153.98	146.58	135.40	60.23	47.41	39.32
P7	99.11	104.10	98.16	154.94	153.87	138.33	49.28	45.18	38.29
P8	105.70	106.80	101.50	163.00	155.13	145.08	51.00	38.00	40.62
P1×P2	92.00	96.11	97.06	158.64	153.67	146.05	54.54	49.15	45.52
P1×P3	98.47	98.67	98.37	160.83	148.67	142.00	52.33	43.73	40.50
P1×P4	97.50	107.10	100.30	165.44	152.67	142.67	55.61	42.00	37.73
P1×P5	94.22	98.67	96.64	159.67	152.50	143.55	53.33	45.95	42.82
P1×P6	86.17	93.77	92.30	154.75	150.25	140.14	56.53	47.39	41.44
P1×P7	92.18	97.83	98.27	159.33	150.00	145.25	57.68	44.61	41.32
P1×P8	97.00	103.50	99.22	155.33	153.00	146.83	48.53	47.63	41.63
P2×P3	93.78	99.53	99.90	160.27	152.36	145.42	54.00	47.31	40.75
P2×P4	92.94	99.39	98.27	158.39	150.58	141.58	53.29	48.99	39.43
P2×P5	93.03	97.44	98.56	158.17	156.07	145.03	52.83	49.23	41.69
P2×P6	83.87	93.60	96.29	154.33	152.13	141.55	59.83	48.62	41.81
P2×P7	92.11	96.48	94.61	155.39	153.42	139.67	53.14	50.06	41.69
P2×P8	94.89	98.83	98.57	158.33	152.67	145.50	53.67	46.40	41.90
P3×P4	93.00	100.10	100.00	158.00	151.67	145.67	51.60	46.23	42.67
P3×P5	93.67	98.82	100.10	161.17	154.33	145.32	55.50	46.61	41.95
P3×P6	92.04	95.50	96.64	154.55	154.57	137.67	54.40	51.07	38.40
P3×P7	91.39	98.57	97.63	156.93	152.90	142.28	54.47	47.57	40.98
P3×P8	93.07	100.30	98.33	159.17	155.00	141.70	55.72	46.45	36.10
P4×P5	91.83	99.63	100.20	159.17	153.44	141.17	55.06	45.84	36.70
P4×P6	87.20	96.33	97.80	154.20	154.33	142.27	55.37	50.67	42.47
P4×P7	99.67	102.60	99.87	158.72	153.00	141.94	49.97	46.00	38.68
P4×P8	100.40	104.00	101.40	162.55	156.67	142.18	52.55	37.13	37.18
P5×P6	84.55	91.58	95.50	154.39	150.53	141.07	56.46	48.76	41.48
P5×P7	92.17	100.20	98.14	152.03	152.25	139.55	47.03	43.12	38.33
P5×P8	96.13	94.08	99.87	151.83	153.58	142.40	52.17	42.12	38.40
P6×P7	84.17	94.57	94.07	154.19	149.90	140.87	57.69	47.53	43.27
P6×P8	92.83	87.83	96.60	157.61	152.45	140.58	52.61	45.45	40.08
P7×P8	94.33	101.00	98.36	157.89	154.67	144.33	60.70	40.25	42.33
Mean	92.75	123.30	97.83	157.17	152.56	142.56	53.95	45.59	40.63
L.S.D $_{0.05}$	3.14	2.69	2.08	2.65	2.83	2.31	3.31	2.38	2.25
L.S.D $_{0.01}$	4.18	3.58	2.76	3.53	3.76	3.07	4.41	3.17	2.99

D1=Early sowing date, D2= Normal sowing date, D3 =Late sowing date

The results for general mean values overall eight parents and 28 hybrids in three sowing dates as well as the combined analysis (Table 2) indicated low values in the first sowing date(early) regarded with high values in the second sowing date (normal) for days to heading. Also, the lowest value in late sowing date and highest value in the first early sowing date were for days to maturity, and grain filling period.

The analysis of variance for combining ability as outlined by Griffing's (1956) method 2 model 1 of each sowing date for earliness traits was shown in Table (3). The mean squares of general (GCA) and (SCA) specific combining abilities were significant for all earliness traits under the three sowing dates. The relative importance of (GCA) to (SCA) exceeded unity, indicating that, additive and additive × additive gene effects were dominating the control of these traits

Table (3): Mean squares for combining ability from analysis of variance for earliness traits in each sowing date.

Source of variation	d.f.	Days to heading (days)			days to Maturity (days)			Grain filling period (days)		
		D1	D2	D3	D1	D2	D3	D1	D2	D3
Rep	2	0.409	3.266	0.108	2.334	5.651	1.109	10.11	0.758	2.485
Genotypes	35	82.8**	64.6**	21.83**	66.752**	44.354**	19.848**	34.84**	29.51**	20.07**
GCA	7	100.8**	81.75**	27.49**	68.367**	46.869**	24.857**	18.03**	19.54**	10.33**
SCA	28	9.312**	6.479**	2.225**	10.722**	6.763**	2.056**	10.01**	7.412**	5.782**
Error	70	3.7	2.714	1.619	2.426	1.711	2.248	4.12	2.127	1.892
GCA /SCA	-	10.825	12.618	12.355	6.376	6.93	12.09	1.801	2.636	1.787

** Significant at 0.01 levels of probability. D1=first sowing date, D2= second sowing date, D3 =third sowing date

Higher importance of GCA over SCA variance for studied traits was also reported by Bhatt (1972), Avey *et al.* (1982) and Menshawy (2000, 2005 and 2007) for duration to maturity, Mou and Kronstad (1994) for grain filling period. It's interesting to note that, breeding procedures that, take advantage of additive genetic variance could be recommended to improve earliness traits.

Estimates of GCA effects of the individual parent varieties/or lines for each earliness traits in the three sowing dates are presented in Table (4). Generally, combining ability effects were found significantly different from zero in all cases. High negative values for all earliness traits would be of interest except for grain filling rate where high positive effects would be useful form the breeders point of view.

Parental genotype P_6 significantly expressed negative effects for days to heading, and days to maturity in the three sowing date. P_2 Parent expressed significant negative effects in the first and second sowing date for days to heading. P_5 Parent in the first and second sowing date expressed significant negative effects for heading and days to maturity. P_7 Parent expressed significant effects for days to maturity in the first and third sowing date for days to maturity.

The results indicating that, the genotypes P_2, P_5, P_6 could be considered as good combiners for developing early genotypes. For grain filling period significant positive GCA effects were detected with (P_2) and (P_6) in three sowing dates and (P_5) in the early and late sowing dates. Therefore, the P_2 and P_6 were as the best combiners for shortening grain filling period.

Table (4): Estimation of general combining ability effects for earliness traits under the three sowing date.

Parents	Days to heading (days)			Days to Maturity (days			Grain filling period (days)		
	D1	D2	D3	D1	D2	D3	D1	D2	D3
P1	2.251**	1.600**	0.076	0.313	0.075	0.490*	-1.464**	-0.592*	-0.527*
P2	-1.530**	-1.056**	-0.297	-0.475	0.439	1.648**	0.776*	1.777**	2.176**
P3	0.206	0.399	0.845**	1.088**	-0.635*	0.899**	0.012	-0.612*	0.231
P4	1.600**	3.377**	2.001**	2.073**	1.302**	0.242	-1.033**	-0.153	-1.257**
P5	-2.120**	-1.923**	-0.333	-1.15**	-0.781*	-0.284	0.317	-0.117	0.125
P6	-5.883**	-5.718**	-3.462**	-2.26**	-1.717**	-2.81**	2.781**	2.222**	0.188
P7	0.944**	1.468**	-0.323	-1.02**	-0.064	-1.250**	-0.631	-0.358	-0.253
P8	4.532**	1.855**	1.493**	1.418**	1.380**	1.065**	-0.758*	-2.166**	-0.683**
L.S.D $_{0.05}$ (gi)	0.658	0.562	0.434	0.554	0.592	0.482	0.694	0.498	0.47
L.S.D $_{0.01}$ (gi)	0.875	0.747	0.577	0.737	0.787	0.641	0.923	0.662	0.625
L.S.D $_{0.05}$ (gi-gJ)	0.994	0.85	0.658	0.838	0.896	0.73	1.048	0.754	0.71
L.S.D $_{0.01}$ (gi-gJ)	1.322	1.131	0.875	1.115	1.192	0.971	1.394	1.003	0.944

D1=Early sowing date, D2= Normal sowing date, D3 =Late sowing date .

Estimation of the specific combining ability effects for earliness traits in the three sowing dates are presented in Table (5). Significant negative specific combining ability effects were detected in the three sowing dates. For days to heading seven, six, and three hybrids had significant negative desirable specific combining ability in the first, second and third sowing dates respectively. On the other hand, the crosses (1 x 7) and (2 x 7) were the best combination and the crosses (P_1 x P_6) and (P_3 x P_8) gave good effects in the first and second sowing dates. For days to maturity, five, two, and seven hybrids had significant negative specific combining ability effects in the first, second, and third sowing dates, respectively. The best hybrids were (P_1 x P_3) in the second and third sowing dates.

For grain filling period, six, three, and seven parental combination had significant negative specific combining ability effects in the first, second, and third sowing dates, respectively. The best combination (P_5 x P_7) was found to exhibit significant negative specific combining ability effects in the three sowing dates.

Table (5): Estimation of specific combining ability (SCA) effects for earliness traits under the three sowing dates.

crosses	Days to Heading (days)			Days to Maturity (days)			Grain filling period (days)		
	D1	D2	D3	D1	D2	D3	D1	D2	D3
P1 x P2	1.477	-2.737**	-0.553	1.635	0.431	1.351	1.283	2.064**	3.235**
P1 x P3	3.261**	-1.64	-0.386	2.261*	-3.396**	-1.951*	-0.163	-0.961	0.163
P1 x P4	0.893	3.80**	0.342	5.886**	-1.433	-0.628	4.159**	-3.153**	-1.115
P1 x P5	1.336	0.69	-0.931	3.328**	0.482	0.785	0.532	0.758	2.589**
P1 x P6	-2.958**	-0.42	-2.145**	-0.479	-0.83	-0.104	1.264	-0.138	1.143
P1 x P7	-3.774**	-3.54**	0.683	2.867**	-2.733	3.448**	5.827**	-0.334	1.464*
P1 x P8	-2.538*	1.78*	-0.177	-3.569**	-1.177	2.717**	-3.193**	4.493**	2.211**
P2 x P3	2.344*	1.88*	1.521*	2.483**	-0.167	0.308	-0.737	0.244	-2.29**
P2 x P4	0.117	-1.238	-1.268	-0.382	2.120*	-2.868**	-0.405	1.464	-2.122**
P2 x P5	3.926**	2.119*	1.356*	2.617**	3.685**	1.101	-2.209*	1.675*	-1.241
P2 x P6	-1.477	2.07*	52.215**	-0.107	0.689	0.156	2.327*	-0.274	-1.187
P2 x P7	-0.057	-2.239*	-2.601**	-0.291	0.319	-3.293**	-0.957	2.747**	-0.866
P2 x P8	-0.868	-0.27	-0.461	0.22	-1.874*	0.226	-0.3	0.891	-0.226
P3 x P4	-1.562	-1.969*	-0.668	-2.333**	-1.724	1.964*	-1.327	1.1	3.06**
P3 x P5	2.824**	2.038*	1.800**	4.053**	3.025**	2.140**	1.225	1.444	0.961
P3 x P6	4.964**	2.516**	1.429*	-1.451	4.196**	-2.983**	-2.342*	4.558**	-2.653**
P3 x P7	-2.515*	-1.603	-0.727	-0.308	0.876	0.066	1.137	2.639**	0.365
P3 x P8	-4.427**	-0.224	-1.837**	-0.511	1.532	-2.823**	2.521*	3.326**	-4.081**
P4 x P5	-0.403	-0.124	0.734	1.068	0.198	-1.354**	1.824	0.211	-2.801**
P4 x P6	-1.277	0.371	1.430*	-2.789**	2.026*	2.274**	-0.33	2.699**	2.903**
P4 x P7	4.367**	-0.515	0.357	0.494	-0.961	0.389	-2.314*	0.613	-0.446
P4 x P8	1.556	0.498	0.074	1.891*	1.262	-1.685*	0.396	3.553**	-1.537
P5 x P6	-0.201	0.921	1.464*	0.617	0.307	1.600*	-0.59	0.753	0.537
P5 x P7	0.587	2.319**	0.967	-2.981**	0.371	-1.475	-6.608**	-2.306**	-2.172**
P5 x P8	0.965	-4.152**	0.875	-5.610**	0.261	-0.943	-1.341	-1.499	-1.675*
P6 x P7	-3.65**	0.514	0.02	0.289	-1.042	2.366**	1.588	-0.229	2.698**
P6 x P8	1.428	-6.607**	0.737	1.276	0.065	-0.232	-3.362**	-0.505	-0.055
P7 x P8	-3.898**	-0.593	-0.642	0.316	0.628	1.957*	8.144**	-3.124**	2.636**
L.S.D 0.05 (sij)	2.014	1.724	1.332	1.7	1.814	1.48	2.126	1.528	1.44
L.S.D 0.01 (sij)	2.679	2.293	1.772	2.261	2.413	1.968	2.828	2.032	1.915
L.S.D 0.05 (sij-sik)	2.98	2.552	1.972	2.514	2.686	2.19	3.144	2.26	2.132
L.S.D 0.01 (sij-sik)	3.963	3.394	2.623	3.344	3.572	2.913	4.182	3.006	2.836

D1=Early sowing date, D2= Normal sowing date, D3 =Late sowing date.

2- Yield and yield components:

The mean performances of the eight parental varieties and/or lines of common wheat in the three sowing dates were given in Table (6). The parental (P_4) significantly produced the highest grain yield per plant. Also, it expressed moderate values for most studies traits.

The parental genotypes (P_2), (P_3), (P_5) and (P_6) were the best parental for the 1000-kernel weight. Parental line (P_8) was the best performing variety for number of spikes per plant in the three sowing dates.

Table (6): Mean performance for grain yield and its components traits of wheat genotypes evaluated under three sowing dates .

Genotypes	Spike length(cm)			No.of spikelets / spike			Number of spikes / plant		
	D1	D2	D3	D1	D2	D3	D1	D2	D3
P1	16.76	16.17	13.63	26.43	28.69	26.82	4.88	6.49	7.62
P2	11.24	14.25	11.13	25.53	25.29	26.06	7.99	9.16	9.20
P3	13.57	13.53	14.11	23.94	27.60	28.14	7.71	9.16	9.56
P4	11.54	14.06	10.84	23.39	27.82	26.25	10.85	12.34	9.34
P5	15.21	17.36	14.20	23.34	26.02	26.18	5.33	5.40	6.39
P6	13.05	14.19	14.71	21.11	23.08	22.78	4.95	5.93	7.16
P7	12.88	12.52	11.62	25.74	26.63	25.24	12.07	10.61	10.30
P8	11.55	10.97	9.93	24.61	26.11	25.33	14.55	14.66	11.73
P1×P2	15.76	16.02	12.96	26.33	27.05	26.78	5.68	7.99	7.11
P1×P3	15.94	14.70	12.51	26.17	26.86	27.38	6.27	9.22	8.27
P1×P4	13.92	14.42	11.46	25.96	27.78	26.85	8.40	11.15	10.72
P1×P5	18.30	17.18	14.70	24.77	27.18	26.42	2.87	5.38	4.65
P1×P6	15.04	16.50	13.00	23.28	26.25	25.80	5.90	7.08	6.33
P1×P7	11.78	12.35	11.62	24.15	25.43	26.56	10.54	10.92	9.92
P1×P8	14.32	14.80	11.60	24.62	27.05	25.83	9.08	12.62	10.53
P2×P3	12.58	14.02	12.92	25.14	27.60	26.58	7.07	12.13	8.59
P2×P4	12.62	13.63	11.40	24.15	26.93	26.49	8.20	10.40	9.41
P2×P5	15.15	15.81	13.08	25.83	27.51	26.67	5.63	5.79	10.17
P2×P6	13.65	15.20	12.72	23.56	25.29	25.33	6.17	7.31	6.76
P2×P7	11.73	15.31	12.03	24.41	25.71	25.45	10.13	10.95	8.78
P2×P8	12.38	14.74	11.99	25.29	26.20	26.27	12.14	12.58	11.97
P3×P4	13.21	12.89	14.71	25.83	27.16	28.11	8.00	11.75	8.39
P3×P5	15.16	14.81	14.72	25.39	27.62	26.61	5.69	6.68	8.24
P3×P6	14.55	15.07	12.21	24.02	26.41	26.00	6.30	7.18	9.20
P3×P7	12.64	13.50	14.72	25.12	27.70	27.67	10.17	13.03	8.98
P3×P8	12.86	14.60	12.99	25.33	26.93	26.80	12.89	10.75	10.69
P4×P5	15.65	15.81	14.10	25.17	27.69	26.39	6.81	9.63	9.08
P4×P6	14.76	14.09	13.59	23.67	26.08	25.50	7.05	8.71	10.60
P4×P7	12.99	12.71	13.06	24.81	27.91	26.13	10.22	9.46	9.30
P4×P8	11.67	13.32	12.08	25.59	26.52	26.64	12.47	12.35	9.64
P5×P6	16.52	16.22	13.96	24.71	25.52	25.84	4.66	4.80	7.69
P5×P7	15.71	13.85	14.74	24.58	26.33	26.38	7.22	11.93	9.36
P5×P8	15.82	15.61	11.60	25.08	26.54	26.44	6.13	7.22	10.01
P6×P7	12.50	12.49	10.92	23.55	24.55	24.92	6.51	10.30	8.59
P6×P8	13.00	13.78	11.73	23.58	25.73	24.58	6.79	11.31	11.17
P7×P8	11.92	11.97	12.03	23.97	26.18	25.20	13.01	16.36	12.88
Mean	13.83	14.40	12.76	24.67	26.58	26.18	8.06	9.69	9.12
L.S.D $_{0.05}$	1.00	1.09	1.34	1.20	1.35	996.00	1.32	1.61	1.58
L.S.D $_{0.01}$	1.33	1.45	1.78	1.59	1.80	1.33	1.76	2.14	2.10

D1=Early sowing date, D2= Normal sowing date, D3 =Late sowing date

Table (6 cont.): Mean performance for grain yield and its components traits of wheat genotypes evaluated under three sowing dates .

Genotypes	1000 – grain weight			No. of grains / spike			Grain yield /plant (gm)		
	D1	D2	D3	D1	D2	D3	D1	D2	D3
P1	52.91	49.79	38.16	91.94	100.70	84.83	22.85	26.41	18.52
P2	62.86	54.33	59.13	67.51	78.82	75.42	27.52	26.86	27.69
P3	54.00	61.39	46.76	63.27	77.85	73.48	24.24	24.48	27.72
P4	49.10	46.93	46.67	80.60	85.73	73.56	34.41	30.75	27.42
P5	52.18	56.41	56.83	92.34	109.00	94.37	21.41	31.18	27.08
P6	53.96	51.93	54.63	92.00	91.85	90.00	20.61	21.27	27.13
P7	47.66	43.07	40.12	75.76	77.09	69.61	25.21	27.23	24.02
P8	47.68	39.81	44.07	61.86	55.35	53.36	25.41	17.20	21.45
P1×P2	51.22	50.16	48.25	89.36	71.94	85.45	22.58	21.99	24.43
P1×P3	53.14	47.85	51.00	95.00	76.22	84.57	23.93	25.35	27.79
P1×P4	53.50	49.88	48.13	58.42	66.08	66.90	29.16	30.01	24.20
P1×P5	61.07	58.07	57.07	86.25	96.13	96.35	32.02	29.05	21.89
P1×P6	58.90	56.19	52.67	77.14	82.68	89.43	25.96	29.05	29.13
P1×P7	58.04	48.79	49.45	62.55	71.71	86.02	34.42	30.18	26.24
P1×P8	46.81	43.95	45.43	74.64	78.17	61.35	23.64	31.21	25.26
P2×P3	58.17	54.96	55.07	67.56	68.27	73.24	27.05	31.08	25.47
P2×P4	53.44	48.19	53.71	70.74	83.28	74.14	27.90	32.99	22.38
P2×P5	66.65	61.13	65.68	93.94	88.01	86.66	27.33	38.97	35.36
P2×P6	61.46	54.79	51.21	89.09	91.26	64.35	29.99	30.63	22.08
P2×P7	53.20	48.89	49.67	71.22	72.60	72.44	26.93	29.58	26.50
P2×P8	57.20	46.87	51.04	67.72	72.85	71.66	34.52	28.36	29.58
P3×P4	46.86	44.35	50.20	77.20	74.74	75.68	19.19	30.67	24.43
P3×P5	58.59	54.63	53.59	80.77	88.57	79.78	21.57	29.26	27.57
P3×P6	67.34	45.16	50.65	89.72	74.86	80.58	23.10	22.03	27.86
P3×P7	56.28	50.29	48.08	63.00	72.38	63.65	26.30	37.01	23.92
P3×P8	47.32	46.31	45.37	69.68	72.25	64.64	31.72	25.43	25.66
P4×P5	61.35	54.97	55.11	77.18	51.62	64.10	28.50	29.48	25.90
P4×P6	58.14	51.67	50.51	88.66	94.25	73.71	30.95	33.38	32.19
P4×P7	50.84	47.37	48.32	71.99	65.29	63.71	27.58	22.25	27.20
P4×P8	49.34	42.87	46.12	58.72	73.27	61.57	31.48	29.60	24.46
P5×P6	61.91	64.23	53.25	91.93	96.78	88.85	25.91	25.42	27.78
P5×P7	62.96	50.61	55.23	86.55	89.54	78.94	31.24	32.93	33.29
P5×P8	65.69	49.91	46.07	83.86	75.52	62.55	25.33	34.35	21.91
P6×P7	58.35	48.17	47.51	68.79	74.17	72.71	20.47	29.77	21.38
P6×P8	49.86	46.23	49.48	75.19	71.19	64.04	17.02	27.47	25.95
P7×P8	47.91	41.80	44.31	55.50	67.69	71.50	34.67	29.99	27.26
Mean	55.44	50.33	50.24	76.88	78.83	74.81	26.73	28.69	26.06
L.S.D $_{0.05}$	2.27	6.07	6.59	4.33	5.88	5.47	4.45	4.71	4.05
L.S.D $_{0.01}$	3.02	8.07	8.76	5.76	7.82	7.28	5.92	6.27	5.39

D1=Early sowing date, D2= Normal sowing date, D3 =Late sowing date

The mean performances of F1 crosses in the three sowing dates were presented in Table (6). With the exception of number of spikes per plant in the second and third sowing dates, spike length in first sowing date. 1000-kernel weight. and grain yield per plant, the hybrids mean values were within the range of parental lines.

The results for general mean values overall parents and hybrids for plant and yield and yield components in three sowing dates in Table (6) indicated the best mean value in the first sowing dates (early sowing) for 1000-kernel weight. Also, the best mean value in the second sowing date (normal sowing) for number of spikes per plant, spike length, number of spikelets per spike, number of kernels per spike, and grain yield per plant.

Mean values for grain yield per plant in the three sowing date (28.69, 26.73 and 26.03 gm) were descending as second, first and third sowing dates, respectively.

Regarding the general mean values for genotypes under the three sowing dates, number of spikes per plant, spike length, number of spikelets/spike and grain yield/ plant were the best desirable values under the second sowing dates (normal). However, 1000-kernel weight gave the best desirable values under the third sowing date (Table 6). The results indicated that, the normal sowing date was the best sowing date for grain yield and most yield components.

The analysis of variance for each of the three sowing dates for, number of spikes per plant, spike length, number of spikelets per spike, number of kernel per spike, 1000-kernel weight and grain yield per plant, are presented in Table (7). The mean squares due to genotypes were significant for all the studied traits indicating the wide diversity between the parental materials. Similar results were previously drawn by Eissa *et al.* (1994) and Hamada (2003).

The analysis of variance for combining ability of each sowing date for grain yield and its components traits were shown in Table (7). The mean squares associated with general (GCA) and specific (SCA) combining ability were significant for all studied traits under the three sowing dates. Both additive and non-additive gene effects were involved in determining the performance of all studied traits. Except for grain yield /plant in the third sowing date, GCA/ SCA ratios for all studied traits in all sowing date were more than unity indicating that, additive and additive x additive types of gene action were more important than non-additive gene effects controlling these trait. Similar results were previously found by El-Shamarka (1980), Mahrous (1998) and El-Morshidy *et al.* (2001), Table (7): Mean squares for combining ability from analysis of variance in each sowing date for grain yield and its components traits.

Source of variation	d.f.	Spike length(cm)			No. of spikelets / spike			No. of spikes / plant		
		D1	D2	D3	D1	D2	D3	D1	D2	D3
Rep	2	4.476	1.055	4.702	0.943	0.989	0.098	0.739	5.598	0.792
Genotypes	35	9.451**	6.559**	5.181**	3.615**	3.61**	2.954**	24.039**	23.692**	8.809**
GCA	7	11.76**	8.037**	4.89**	3.434**	4.352**	4.072**	34.61**	30.32**	9.046**
SCA	28	0.997**	0.724**	0.936**	0.648**	0.416*	0.213	1.361**	2.291**	1.409**
Error	70	0.371	0.445	0.672	0.539	0.685	0.373	0.657	0.973	0.933
GCA /SCA	-	11.795	11.101	5.222	5.30	10.462	19.117	25.431	13.235	6.420

*, ** Significant at 0.05 and 0.01 levels of probability.
D1=Early sowing date, D2= Normal sowing date, D3 =Late sowing date .

Table (7 Cont.): Mean squares for combining ability from analysis of variance in each sowing date for grain yield and its components traits.

Source of variation	d.f.	1000 – grain weight			No. of grains / spike			Grain yield /plant (gm)		
		D1	D2	D3	D1	D2	D3	D1	D2	D3
Rep	2	0.456	31.948	35.355	7.463	0.901	0.522	12.313	3.971	14.498
Genotypes	35	99.168**	98.23**	85.09**	413.2*	446.9**	336.6**	63.187**	59.041**	34.9**
GCA	7	86.301**	116.84**	98.23**	386.8**	344.2**	372.9**	27.703**	23.663**	10.731*
SCA	28	19.745**	11.717**	10.897*	75.47**	100.2**	47.02**	19.402**	18.685**	11.859**
Error	70	1.935	13.802	16.269	7.028	12.95	11.23	7.425	8.332	6.169
GCA /SCA	-	4.371	9.9	9.014	5.125	3.435	7.931	1.428	1.266	0.905

*, ** Significant at 0.05 and 0.01 levels of probability.
D1=Early sowing date, D2= Normal sowing date, D3 =Late sowing date

Estimates of GCA effects of the individuals parental lines for each studied trait in the three sowing dates were presented in Table (8). General combining ability effects were found to differ significantly from zero in all cases. High positive values would be of interest for all traits in question would be useful from the breeders point of view.

Table (8): Estimation of general combining ability effects for grain yield and its components traits under the three sowing date.

Parents	Spike length(cm)			No. of spikelets / spike			No. of spikes / plant		
	D1	D2	D3	D1	D2	D3	D1	D2	D3
P1	1.410**	0.870**	0.04	0.609**	0.574**	0.366**	-1.408**	-0.985**	-0.93**
P2	-0.814**	0.363**	-0.535**	0.374**	-0.238	0.008	-0.159	-0.171	-0.089
P3	-0.042	-0.297*	0.783**	0.286*	0.625**	0.984**	-0.078	0.184	-0.061
P4	-0.660**	-0.464**	-0.265	-0.009	0.647**	0.299**	1.026**	1.096**	0.373*
P5	1.828**	1.439**	1.058**	0.017	0.12	0.149	-2.292**	-2.495**	-1.01**
P6	0.164	0.212	0.283*	-1.34**	-1.325**	-1.207	-1.930**	-1.864**	-0.74**
P7	-0.947**	-1.240**	-0.281*	0.004	-0.216	-0.28**	1.937**	1.698**	0.633**
P8	-0.939**	-0.884**	-1.083**	0.0642	-0.187	-0.32**	2.904**	2.532**	1.828**
L.S.D 0.05 (gi)	0.208	0.228	0.28	0.25	0.282	0.208	0.276	0.336	0.33
L.S.D 0.01 (gi)	0.277	0.303	0.372	0.333	0.375	0.277	0.367	0.447	0.439
L.S.D 0.05 (gi-gj)	0.314	0.344	0.424	0.38	0.428	0.316	0.418	0.51	0.498
L.S.D 0.01 (gi-gj)	0.418	0.458	0.564	0.505	0.569	0.42	0.556	0.678	0.662

D1=Early sowing date, D2= Normal sowing date, D3 =Late sowing date.

Table (8 Cont.): Estimation of general combining ability effects for grain yield and its components traits under the three sowing date.

Parents	1000 – grain weight			No. of grains / spike			Grain yield /plant (gm)		
	D1	D2	D3	D1	D2	D3	D1	D2	D3
P1	-0.823**	0.147	-2.382**	3.530**	3.419**	6.646**	-0.313	-0.781	-1.85**
P2	3.035**	2.066**	4.076**	-0.734	-0.434	0.55	1.083*	0.985	0.666
P3	-0.102	1.334*	-0.465	-2.22**	-2.418**	-0.49	-1.92**	-0.767	0.361
P4	-2.506**	-1.982**	-0.671	-2.76**	-3.019**	-4.64**	2.305**	0.941	0.106
P5	3.685**	5.339**	4.751**	9.315**	9.396**	7.270**	-0.581	2.435**	1.334**
P6	2.715**	1.732**	1.24	7.252**	5.871**	4.035**	-2.591**	-1.718**	0.611
P7	-1.383**	-3.092**	-2.933**	-6.09**	-4.261**	-2.52**	1.15*	0.872	-0.069
P8	-4.623**	-5.544**	-3.618**	-8.30**	-8.554**	-10.9**	0.866	-1.967**	-1.15**
L.S.D $_{0.05}$ (gi)	0.476	1.268	1.378	0.906	1.228	1.144	0.93	0.986	0.848
L.S.D $_{0.01}$ (gi)	0.633	1.686	1.833	1.205	1.633	1.522	1.237	1.311	1.128
L.S.D $_{0.05}$ (gi-gj)	0.718	1.918	2.082	1.368	1.858	1.73	1.408	1.49	1.282
L.S.D $_{0.01}$ (gi-gj)	0.955	2.551	2.769	1.819	2.471	2.301	1.873	1.982	1.705

D1=Early sowing date, D2= Normal sowing date, D3 =Late sowing date.

For spike length, the parental genotype P_5 was the best general combiners for this trait. For number of spikelets per spike, the parental genotypes P_1 and P_3 expressed significant positive general combining ability effects for this trait in the three sowing dates.

As for grain yield per spike the parental genotype P_5 and P_2 in the three sowing dates, and P_1 in the first and second sowing dates, and the P_6 in the second and third sowing dates expressed significant positive general combining ability effects for this trait, the parental P_5 and P_2 were the best general combiners for these traits.

For number of kernels/spike, parental genotypes P_5, P_6 and P_1 gave significant positive combining ability effects, therefore these parents were considered as the best combiners for this trait in the three sowing dates. For 1000-kernel weight, the parental P_5 and P_2 on the three sowing dates and P_6 in the first and second sowing dates gave the highest significant positive GCA effects.

For grain yield /plant the parent P_5 gave the highest significant positive general combining ability effect in the second and third sowing dates. Also, the parental P_2, P_4 and P_7 gave the highest significant positive general combining ability effects in the first sowing date for this trait. These parents were considered as the best general combiners fore these traits.

It is worth to note that, the parental P_5 which possessed high general combining ability effects for grain yield/plant, showed the same for 1000-kernel weight, and number of kernel/spike,. Also, the parental P_2 gave high values for grain yield/plant, 1000-kernel weight, while the parental P_4 and P_2 gave the high positive GCA effects for grain yield and number of spikes/plant.

Estimates of the specific combining ability effects for grain yield and its components traits in the three sowing dates are presented in Table (9). For number of spikes/plant, five, seven, and six hybrids in the first, second, and third sowing dates respectively. The best crosses (P_7 x P_8), (P_1 x P_4), (P_1 x P_7) and (P_2 x P_8) had significant positive specific combining ability effects for this trait.

For spike length, nine, four, and six hybrids showed significant positive specific combining ability effects in the first, second, and third sowing dates respectively. The best combination were (P_2 x P_8), (P_4 x P_6), (P_4 x P_7) and (P_5 x P_7) for this trait.

For number of spikelets/ spike, four, two, and two crosses had significant positive specific combining ability effects in first, second and third sowing dates, respectively. The best combination were (P_2 x P_5) and (P_5 x P_6) for this trait. For number of kernel/spike, eleven, eight, and eight, parental combinations had significantly positive specific combining ability effects in the first, second and third sowing dates, respectively. The crosses (P_3 x P_4), (P_1 x P_3) and (P_2 x P_4) gave significant positive specific combining ability effects for this trait in the first and third sowing dates. Also, the crosses (P_4 x P_6), (P_5 x P_7) and (P_3 x P_8) in the first and second sowing dates gave the best combination for this trait.

For 1000-kernel weight, the crosses (P_1 x P_5), (P_1 x P_7) and (P_2 x P_5) in the first and third sowing dates and the cross (P_1 x P_6) in the first and second sowing dates showed highly significant positive specific combining ability effects for this trait.

Concerning grain yield per plant the cross (P_4 x P_6) in the three sowing dates, the cross (P_2 x P_5) in the second and third sowing dates, and the crosses (P_2 x P_8) and (P_5 x P_7) in the first and third sowing dates showed highly significant positive specific combining ability effects for this traits. These results indicated that, the second sowing dates, was the best sowing date for yield and most yield components.

CONCLUSION

The parental (P_6) was the best combiner for days to heading, and days to maturity while the parental P_1 and P_8 was the good combiner for grain filling period. The parental P_5 showed the best combiner for spike length, number of grain per spike, 1000-kernel weight and grain yield per plant. The parental genotype P_8 was the best combiner for number of spikes per plant and grain filling period.

The cross (P_4 x P_6) gave the highest SCA effect for grain yield per plant and most yield component in addition to their early flowering also, crosses (P_2 x P_5) and (P_2 x P_8) showed the best hybrids for grain yield and most yield components in most sowing dates. Finally the cross (P_5 x P_7) gave same results in addition to early maturity the hybrid combinations.

Table (9): Estimation of specific combining ability (SCA) effects for grain yield and its components traits under the three sowing dates.

crosses	Spike length(cm)			No. of spikelets / spike			No. of spikes / plant		
	D1	D2	D3	D1	D2	D3	D1	D2	D3
P1 x P2	1.335**	0.383	0.709	0.681	0.129	0.223	-0.818	-0.541	-0.987
P1 x P3	0.742*	-0.274	-1.059*	0.602	-0.921	-0.146	-0.309	0.332	0.138
P1 x P4	-0.660*	-0.39	-1.058*	0.686	-0.026	0.002	0.72	1.356*	2.154**
P1 x P5	1.229**	0.47	0.856	-0.539	-0.096	-0.271	-1.498**	-0.827	-2.529**
P1 x P6	-0.364	1.018**	-0.069	-0.658	0.415	0.465	1.177**	0.242	-1.113*
P1 x P7	-2.519**	-1.684**	-0.885*	-1.129**	-1.51**	0.297	1.949**	0.517	1.095*
P1 x P8	0.016	0.417	-0.107	-0.726	0.081	-0.394	-0.478	1.383**	0.512
P2 x P3	-0.394	-0.447	-0.078	-0.186	0.63	-0.587	-0.761	2.428**	-0.384
P2 x P4	0.265	-0.667	-0.55	-0.888	-0.065	0.004	-0.735	-0.216	0.009
P2 x P5	0.304	-0.396	-0.186	0.773*	1.046*	0.33	0.013	-1.232*	2.145**
P2 x P6	0.471	0.228	0.229	-0.136	0.287	0.353	0.198	-0.343	-1.528**
P2 x P7	-0.345	1.786**	0.103	-0.64	-0.415	-0.452	0.29	-0.265	-0.884
P2 x P8	0.301	0.860*	0.865*	0.179	0.046	0.398	1.333**	0.535	1.107*
P3 x P4	0.079	-0.754*	1.445**	0.887*	-0.645	0.683*	-1.013*	0.781	-1.046*
P3 x P5	-0.456	-0.733*	0.129	0.418	0.293	-0.699*	-0.005	-0.702	0.187
P3 x P6	0.598	0.754*	-1.60**	0.406	0.53	0.047	0.246	-0.833	0.88
P3 x P7	-0.208	0.635	1.018**	0.161	0.712	0.786*	0.242	1.459**	0.709
P3 x P8	0.005	1.380**	0.543	0.314	-0.091	-0.044	1.999**	-1.661**	-0.198
P4 x P5	0.653*	0.431	0.56	0.489	0.341	-0.237	0.011	1.345*	0.6
P4 x P6	1.420**	-0.062	0.822*	0.35	0.179	0.228	-0.114	-0.209	1.846**
P4 x P7	0.764*	0.009	0.863*	0.142	0.900*	-0.069	-0.805	-3.017**	-0.826
P4 x P8	-0.567	0.262	0.681	0.861*	-0.522	0.477	0.478	-0.968	-1.678**
P5 x P6	0.699*	0.168	-0.127	1.371**	0.146	0.715*	0.814	-0.529	0.32
P5 x P7	0.996**	-0.750*	1.22**	-0.11	-0.153	0.33	-0.49	3.043**	0.614
P5 x P8	1.125**	0.654	-1.119**	0.33	0.025	0.428	-2.55**	-2.501**	0.075
P6 x P7	-0.547	-0.886*	-1.831**	0.218	-0.495	0.226	-1.559**	0.778	-0.423
P6 x P8	-0.054	0.048	-0.213	0.194	0.656	-0.071	-2.246**	0.955	0.965
P7 x P8	-0.023	-0.307	0.647	-0.767	0.001	-0.375	0.104*	2.440**	1.302*
L.S.D 0.05 (S_{ij})	0.638	0.698	0.858	0.768	0.866	0.64	0.848	1.032	1.012
L.S.D 0.01 (S_{ij})	0.849	0.928	1.141	1.021	1.152	0.851	1.128	1.373	1.346
L.S.D 0.05 (S_{ij}-S_{kl})	0.944	1.034	1.27	1.138	1.282	0.946	1.256	1.528	1.496
L.S.D 0.01 (S_{ij}-S_{kl})	1.256	1.375	1.689	1.514	1.705	1.258	1.67	2.032	1.99

D1=Early sowing date. D2= Normal sowing date. D3 =Late sowing date.

Table (9 Cont.): **Estimation of specific combining ability (SCA) effects for grain yield and its components traits under the three sowing dates.**

crosses	1000 – grain weight			No. of grains / spike			Grain yield /plant (gm)		
	D1	D2	D3	D1	D2	D3	D1	D2	D3
P1 x P2	-6.18**	-2.38	-3.68	9.673**	-9.957**	3.446	-4.912**	-6.825**	-0.437
P1 x P3	-1.13	-3.96*	3.61	16.81**	-3.686	3.538*	-0.566	-1.706	3.225*
P1 x P4	1.637*	1.384	0.943	-19.18**	-13.23**	-9.913**	0.442	1.242	-0.111
P1 x P5	3.013**	2.249	4.4*	-3.483*	4.404*	7.626**	6.184**	-1.215	-3.648**
P1 x P6	1.816*	3.98*	3.571	-10.53**	-5.519**	3.941*	2.134	2.942	4.314**
P1 x P7	5.054**	1.4	4.531*	-11.78**	-6.36**	7.078**	6.857**	1.485	2.101
P1 x P8	-2.93**	-0.99	1. 19	2.517	4.394*	-9.182**	-3.639*	5.347**	2.209
P2 x P3	0.05	1.229	1.219	-6.369**	-7.79**	-1.695	1.162	2.251	-1.616
P2 x P4	-2.28**	-2.228	0.065	-2.66	7.824**	3.442	-2.21	2.46	-4.455**
P2 x P5	4.742**	3.397	6.616**	8.474**	0.143	4.035*	0.106	6.939**	7.298**
P2 x P6	0.519	0.658	-4.34*	5.684**	6.910**	-15.05**	4.776**	2.759	-5.253**
P2 x P7	-3.64**	-0.412	-1.71	1.157	-1.618	-0.4	-2.028	-0.881	-0.152
P2 x P8	3.597**	0.013	0.345	-0.139	2.929	7.224**	5.842**	0.731	4.009**
P3 x P4	-5.73**	-5.336**	1.099	5.587**	1.265	5.932**	-7.918**	1.888	-2.099
P3 x P5	-0.19	-2.377	-0.94	-3.212*	2.687	-1.876	-2.652	-1.015	-0.183
P3 x P6	9.536**	-8.236**	-0.36	7.801**	-7.501**	2.132	0.885	-4.092**	0.826
P3 x P7	2.574**	1.72	1.241	-5.579**	0.151	-8.224**	0.341	8.297**	-2.427
P3 x P8	-3.15**	0.185	-0.78	1.311*	7.311**	1.18	6.045**	-0.444	0.394
P4 x P5	4.976**	1.285	0.79	-6.273**	-33.67**	-13.34**	0.05	-2.5	-1.599
P4 x P6	2.739**	1.586	-0.3	7.271**	12.492**	-0.496	4.510**	5.546**	5.417**
P4 x P7	-0.46	2.116	1.687	3.947**	-6.336**	-4.006*	-2.601	-8.170**	1.107
P4 x P8	1.277	0.061	0.173	-7.119**	5.931**	2.325	1.58	-0.985	-0.551
P5 x P6	0.315	6.825**	-2.98	-1.528	2.601	2.736	2.356	-3.907*	-0.22
P5 x P7	5.466**	-1.966	3.175	6.431**	5.500**	-0.62	3.942**	1.019	5.963**
P5 x P8	2.439**	-0.22	-5.3*	5.955**	-4.227*	-8.60**	-1.684	5.274**	-4.325**
P6 x P7	1.823*	-0.798	-1.04	-9.262**	-6.346**	-3.622*	-4.812**	2.009	-5.221**
P6 x P8	-3.42**	-0.293	1.621	-0.652	-5:036**	-3.881*	-7.981**	2.551	0.437
P7 x P8	-1.28	0.104	0.621	-7.002**	1.596	10.13**	5.925**	2.474	2.428
L.S.D 0.05 (S_{ij})	1.456	3.89	4.224	2.776	3.768	3.508	2.854	3.022	2.6
L.S.D 0.01 (S_{ij})	1.936	5.174	5.618	3.692	5.011	4.666	3.796	4.019	3.458
L.S.D 0.05 (S_{ij}-S_{kl})	2.156	5.756	6.248	4.106	5.574	5.192	4.222	4.472	3.848
L.S.D 0.01 (S_{ij}-S_{kl})	2.867	7.6554	8.31	5.461	7.41343	6.214	5.615	5.948	5.118

D1=Early sowing date, D2= Normal sowing date, D3 =Late sowing date.

The crosses (P_4 x P_6) (P_2 x P_8), (P_2 x P_5) and (P_5 x P_7) would be of practical importance in a breeding programs for developing either hybrid wheat cultivars or pure lines since it surpassed the best performing respective parent for the trait in vie in the three sowing dates and contained one excellent combiner for this trait.

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القدرة عل التآلف لصفات التبكير ومحصول الحبوب ومكوناته فى القمح

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الملخص العربى

أجرى هذا البحث بهدف دراسة امكانية التربية للتبكير والمحصول العالى فى القمح. إستخدم لهذا الغرض ثمانية أصناف أو سلالات من القمح الربيعي (٦ سلالات اجنبية بالإضافة الى الصنفان المصريان جميزه ٧ وجميزه٩). اختيرت نظرا لتباينها الواضح فى صفات التبكير ومكونات المحصول. تم زراعة الآباء فى عروات وتم عمل الهجن التبادلية بينها خلال الموسم الزراعى ٢٠٠٥/٢٠٠٦. وفى الموسم الزراعى ٢٠٠٦/٢٠٠٧ تم زراعه الآباء الثمانية والهجن التبادلية (٢٨ هجين) فى ثلاث تجارب (الميعاد المبكر- الميعاد الامثل- الميعاد المتأخر) مصممه فى قطاعات كامله العشوائيه ذات ثلاث مكررات.

وتم اخذ صفات التبكيروهى تاريخ طرد السنابل- تاريخ النضج - فتره النضج .

وتم اخذ صفات المحصول ومكوناته وهى طول السنيله ,عدد السنيبلات فى السنبله, عدد السنابل / النبات .عدد الحبوب فى السنبله, وزن الالف حبه وزن محصول الحبوب / النبات.

اجرى تحليل التباين لكل تجربه ولكل الصفات وقدرت القدرة العامة والخاصة على التآلف. باستخدم تحليل جرفنج ١٩٥٦ حسب النموذج الأول الطريقة الثانية.

ويمكن تلخيص اهم النتائج فيما يلى :

١. كان التباين الراجع لكل من القدرة العامة والخاصة على التآلف معنويا لجميع الصفات المدروسه للتبكير والمحصول ومكوناته فى الثلاث مواعيد زراعه. وقد كانت النسبه بين التباين الراجع للقدره العامة على التآلف والقدرة الخاصة على التآلف (GCA/SCA) ذات قيمه تفوق الوحده مما يدل على ان الجزء الاكبر من الاختلافات الوراثيه المرتبط لهذ

الصفات كان راجع الى فعل الجينات من النوع المضيف (additive) والتفوق من الطراز المضيف × المضيف (additive × additive).

٢. اظهر الاب (٦) قدره عامه مرغوبة لصفات تاريخ الطرد والتزهير والنضج. كما اظهرت السلالتين رقم (١، ٨) قدره فائقة على التآلف لصفات فتره امتلاء الحبه.

٣. أظهرت التراكيب الهجينيه (١×٦) ، (٣×٨) لصفه تاريخ الطرد فى الميعاد الثانى والثالث للزراعة . (١×٢) ، (٢×٧) لصفه تاريخ التزهير لميعاد الزراعة الثانى والثالث ،(٥×٧) لصفه فتره امتلاء الحبة فى مواعيد الزراعة الثلاثة ، تاثيرات معنويه فائقة (مرغوبة) للقدرة الخاصة على التآلف.

٤. كان أحسن الآباء قدره على التآلف هى السلاله(5) لصفه المحصول ومعظم مكوناته.والسلاله (٢) لصفه وزن الألف الحبة . والسلاله رقم ٤ لصفه المحصول وعدد السنابل / النبات.

٥. اظهرت التراكيب الهجينية (٧×٨)،(١×٧) (١×٤) لصفه عدد السنابل / النبات ، (٥×٧) لصفه طول السنبله، (٢×٥)،(٢×٦)،(٥×٦) لصفه عدد السنيبلات فى السنبلة . (١×٣) ،(٢×٤) ، (٣×٤) لعدد الحبوب فى السنبله، (١×٥)، (١×٧)،(٢×٥) لصفه وزن الالف حبه . (١×٦)،(٤×٦) لصفه محصول الحبوب / النبات تاثيرات مرغوبة للقدرة العامة على التآلف لصفات المحصول ومكوناته.

٦. كانت نتائج الميعاد الثانى احسن من المواعيد الاخرى فى محصول الحبوب للنبات ومعظم مكونات المحصول الاخرى.

٧. اظهر الهجين (١x٣) قدرة خاصة على التآلف لصفتى تاريخ التزهير وعدد الحبوب و(٥x٧) لصفتى فتره امتلاء الحبة وطول السنبلة و(١x٦) لصفات تاريخ الطرد ومحصول الحبوب و(٤x٦) لصفات محصول الحبوب للنبات. وهذه الهجن يمكن استغلالها فى برنامج التربية للحصول على تراكيب وراثية تجمع بين صفات المحصول والتبكير.