Egypt. J. Plant Breed. 14(1): 261-285 (2010)

PERFORMANCE AND COMBINING ABILITY FOR GRAIN YIELD AND ITS COMPONENTS IN DIALLEL CROSSES OF BREAD WHEAT UNDER DIFFERENT SOWING DATES

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ABSTRACT

This investigation aimed to study the effect of sowing dates on performance of six parents of bread wheat and their F_1's and on general and specific combining abilities for yield and its components. The parents included three local cvs. namely; Giza 168 (P1) ,Sakha 94 (P2) and Gemmeiza 10 (P6) and three Syrian cvs. namely; Cham 8 (P3), Bohouth 6 (P4) and Cham 4 (P5) .The parents were crossed in all possible combinations, excluding reciprocals, to obtain a total of 15 hybrids. In 2008/ 2009 season, the six parents along with their 15 F_1's were evaluated for the various traits at three sowing dates, i.e. 23rd of Oct. (early sowing), 16th of Nov.(recommended sowing) and 13th of Dec. (late sowing). A field experiment was devoted for each sowing date. The results indicated that mean squares due to sowing dates, genotypes and genotypes x sowing dates interaction were significant, revealing the presence of sufficient genetic variability among genotypes and different their responses at different sowing dates for the traits studied. Delaying sowing date to Dec. caused substantial decreases in grain yield and its components, i. e. no. of spikes / plant , no. of spikelets / spike , no. of kernels / spike and 1000- kernel weight, comparing with early and recommended sowing. Meantime grain yield / plant, no. of spikes / plant and no. of kernels per spike significantly increased on early sowing than on recommended sowing. However, the two local cvs. Giza 168 and Sakha 94 appeared to be more suitable for growth on early sowing than other cvs. . Also the crosses; P1 x P2, P1 x P3 and P2 x P3 were superior in grain yield and most of its components under different sowing dates. General (GCA) and specific (SCA) combining ability mean squares were found to be highly significant for all traits studied at each sowing date and combined analysis except mean squares of SCA for no. of spikelets /spike at the recommended sowing date was insignificant, indicating the importance of both additive and non-additive gene effects in the inheritance of the traits studied. The ratios of GCA/SCA variances were greater than unity for no. of kernels/spike and 1000-kernel weight at the three sowing dates and combined data , indicating that additive and additive x additive types of gene action were of greater importance in the inheritance of both traits. Also, it is evident that additive type of gene action was the most important part of total genetic variability for no.of spikelets /spike on Nov. sowing. For the traits; no. of spikes/ plant, no. of spikelets / spike and grain yield / plant the ratios of GCA / SCA were inconsistent across different sowing dates and combined data. The two cvs. Sakha 94 and Cham 4 proved to be good general combiners for no. of spikes/ plant while the three cvs. Giza 168, Sakha 94 and Cham 8 are considered to be good general combiners for no. of spikelets /spike no. of kernels/spike 1000-kernel weight and grain yield per plant. The crosses; P1 x P2 ,P1 x P4, P1 x P3 and P2 x P3 are considered to be the best F_1 cross combinations for most of the studied traits

combinations for most of the studied traits at different sowing dates, which can be used in hybridization programs for improving grain yield of wheat at target sowing dates.

Key words: ***Bread wheat*, *Triticum aestivum*, *Sowing date*, *Combining ability*.**

INTRODUCTION

Increasing wheat production is considered an important national goal to face the increasing food needs of Egyptian population. This increase could be achieved through maximizing production per unit area (vertical expansion) and /or cultivating more land to wheat (horizontal expansion). However, increasing production per unit area seems to be the most appropriate approach to minimize the gap between total local production and consumption. This can be attained via developing high yielding varieties and simultaneously, implementing suitable cultural practices.

One of the most important cultural practices is sowing date. It has an active role for growth, yield and its components. The suitable date for wheat sowing mainly depends on many factors such as weather conditions and the previous crop (Esmail 2006). Kumar *et al* (1995) demonstrated that the wheat crop sown at different dates witnesses vast differences with respect to abiotic factors like temperature, light and humidity. The genotypes interact differently to abiotic factors, especially temperature and light according to their photo thermal responses, and several morphological and productivity traits are affected. Therefore, there is need to develop varieties capable of facing the vagaries of environment effectively. The progress of breeding efforts in this direction will depend on the amount of variability present in the germplasm. Ibrahim *et al* (19^6) showed that optimum sowing date for a wheat cultivar is the period between 5th and 20th November. And either early sowing (October) or lately sowing (December) resulted in lowering grain yield. Several investigators as EL-Morshidy *et al* (1998), EL-Marakby *et al* (2002), Esmail (2006), Mahguob and Amin (2006), EL- Marakby *et al* (2007a), Menshawy (2007) and Ahmed and Mohamed (2009) found reduction in grain yield and its contributors owing to delay sowing by the end of November or during December. On the other hand, Menshawy (2005) pointed out that early sowing has increased since the mid-nineties when high-yielding late flowering cultivars became commercially available. Therefore, knowledge of the effect of sowing date on development is also necessary to develop wheat cultivars adapted to early sowing. In Egypt, increasing area of early sowing of wheat after harvesting early maturing rice cultivars starting from the last two weeks of September i.e. about 4 weeks earlier than currently recommend dates of (3rd wk of Nov.) which may cause several problems such as agents yield reduction and increasing possibility of rusts attacks. Samre *et al* (1989), in India, found insignificant

Estimation of the types of gene action involved in the expression of traits, the level of additive effects and the degree of dominance are very important in developing a breeding method for the trait of interest. Combining ability analysis of **Griffing (1956)** is most widely used as biometrical tool for identifying parental lines in terms of their ability to combine in hybrid combinations. With this method, the resulting total genetic variation is partitioned into the variance effects of general combining ability as a measure of additive and additive × additive gene action and specific combining ability as a measure of non-additive gene action. In this respect **Dawwam *et al* (2007), Abd EL-Rahman (2008), Ahmed and Mohamed (2009), El-Shamarka *et al* (2009) and Sedek *et al* (2009)** indicated the preponderance of additive gene action in the inheritance of number of spikes/plant, number of spikelets/ spike, number of grains/spike, 1000- kernel weight and grain yield/plant , while **EL-Shami *et al* (1996) and Motawea (2006)** revealed the preponderance of non-additive gene action (dominance and epitasis) in the inheritance of these traits.

Therefore, the major objectives of this work were :

1- Evaluating performance of six parents of bread wheat and their F_1 crosses on three sowing dates to identify the best performing genotypes at each sowing date or across sowing dates
2- Estimating general and specific combining ability to identify the best combiner-parents and SCA effects of their crosses on the basis of their general and specific combining ability and their interactions with the different sowing dates for grain yield and its components.

MATERIALS AND METHODS

The field experimental work of the present investigation was carried out during the two successive growing seasons; 2007/2008 and 2008/2009. Three local and three Syrian bread wheat cultivars (*Triticum aestivum*, L.) widely differed in some agronomic traits were chosen to establish this investigation. The three local cultivars namely; Giza 168, Sakha 94 and Gemmeiza 10 were obtained from wheat Dept. Agric. Res. Cent., Giza, Egypt, while the three Syrian cultivars namely: Cham 4, Cham8 and Bohouth 6 were obtained from wheat Dept. Agric. Res. Cent., Syria. The names and pedigree of these parents are presented in Table (1). A half diallel set of crosses was achieved among the six parents in 2007/2008 growing season at the Agricultural Experiment Station of the Faculty of Agriculture, Ain Shams University, at Shalakan, Kalubia Governorate and 15 F_1 crosses were obtained. The seeds of the F_1 hybrids and their respective parents were sown in 2008/2009 season at the same station at three sowing dates, i.e., 23rdof October (early sowing date), 16th of November (recommended sowing date) and 13th of December (late sowing date).

Table 1. Names, pedigree and / or selection history of the six bread wheat parents used in the study.

Name		origin	Pedigree and / or selection history
Giza 168	(P1)	Egypt	MRL/Buc//Seri CM93046-8M-oY-oM-2Y-oB
Sakha-94	(P2)	Egypt	OPATA / RAYON // KAUZ
Cham 8	(P3)	Syria	JOPATICOCM67458-F-73/BLUEAY/VEE`S`-T-81
Bohouth 6	(P4)	Syria	Crow`s` CM 40457
Cham 4	(P5)	Syria	Flk`s`- Hork CM39816 -1S – 1AP -0AP
Gemmeiza 10 (P6)		Egypt	MAYA74`s`/ ON// 1160-14713/BB/GLL/4/ CHAT`s`/ 5 / CROW`s`

Temperature and relative humidity of the experimental site are shown in Table (2).

A field experiment was devoted for each sowing date and laid out in a randomized complete blocks design with three replicates. The experimental plot consisted of 2 rows and each row was 2.5 m in length and 25 cm apart. Seeds were spaced at 15 cm within row and one plant was left per hill after about 3 weeks of sowing.

Table 2. The average monthly degrees of maximum and minimum temperature (^{0}C) and relative humidity (R.H %) in the experimental area during 2008/2009 season.

Month	Max temp.	Min temp.	Max. R.H	Min. R.H
Oct.	28.00	19.22	80.12	41.35
Nov.	26.50	16.00	73.00	42.00
Dec.	21.45	12.61	75.80	40.35
Jan.	19.83	11.32	70.45	35.12
Feb.	21.07	12.00	66.85	28.53
Mar.	22.35	12.32	68.35	30.12
Apr.	27.53	16.13	73.23	28.30
May	30.03	18.32	69.74	27.12

The soil of the experiment was clay in texture with PH (7.98 and 7.98), EC (2.39 and 2.88 dsm^{-1}) and total N (0.50 and 0.15 %) at the two depths of 0-15 and 15-30 cm, respectively. according to the Central Laboratory, Division of Micro Analysis, Faculty of Agriculture, Ain Shams Univ., Egypt. The cultural practices were followed as recommended for wheat production in the experimental region and the preceding summer crop was corn.

At harvest (10th, 15th and 20th of May for early, normal and late sowing date, respectively) ten plants were randomly taken from each plot and were used for recording data of the following traits: number of spikes per plant, number of spikelets per the main stem spike, number of kernels per spike, 1000-kernel weight (g) and grain yield per plant (g). Statistical analysis was made for each sowing date as well as combined analysis over the three sowing dates according to **Gomez and Gomez (1984)**. L.S.D. was computed to compare differences among means at 5% level. All factors used in this study were assumed as fixed factors. The variation among parents and F_1 crosses was partitioned into general (GCA) and specific (SCA) combining ability as illustrated by **Griffing (1956),** method (2), model 1, and mean squares and effects of both GCA and SCA were estimated at each sowing date and their combined data.

RESULTS AND DISCUSSION

Analysis of Variance

Mean squares of analysis of variance of each sowing date and the combined data over the three sowing dates for the studied traits of 21 wheat genotypes (6 parents and 15 F_1 hybrids) are given in Table (3). Results illustrated that differences among genotypes (G) as well as parents (P) and crosses (C) are highly significant within each sowing date and over the three sowing dates for all studied traits. These results revealed presence of sufficient genetic variability among genotypes regarding the studied traits.

Consequently, various comparisons suggested to be done are valid and should be conducted to fulfill the objectives of the present study. Mean squares of sowing dates (D) as main source of variation were highly significant for all studied traits, suggesting that most traits were markedly affected by different sowing dates as main factor affecting growth and yield in wheat. However, the interaction between sowing dates (environments) and each of genotypes, parents and crosses are also highly significant for all traits except the interaction of G x D for 1000- kernel weight ; P x D for no. of spikes / plant and no. of spikelets / spike and C x D for no. of kernels / spike. The 1000 -kernel weight and grain yield / plant were not significant indicating that performance and ranks of wheat genotypes are greatly affected by sowing dates for most traits investigated in the present study. Other studies found significant interaction between wheat genotypes

Table 3. Mean squares of single and combined analysis of variance over three sowing dates for the traits studied in bread wheat genotypes

Source of variation	d. f.		No. of spikes / plant				No. of spikelets / spike			
	S	Com.	D1	D2	D3	Comdined	D1	D2	D3	Comdined
Rep/s	2	6	40.43	24.10	21.92	20.33	0.78	1.44	0.78	0.77
Sowing dates (D)		2				160.59**				10.42**
Genotypes (G)	20	20	23.25**	9.96**	7.52**	14.91**	8.46**	7.29**	5.11**	17.11**
Parents (P)	5	5	18.48**	14.99**	17.57**	29.78**	16.36**	8.00**	9.82**	31.62**
Crosses (C)	14	14	23.02**	5.57**	4.31*	10.63**	5.09**	7.57**	3.79**	12.80**
P vs C	1	1	50.29**	46.41**	2.17	0.47	16.20**	0.02*	0.00	4.97*
G x D		40				12.89**				1.23**
P X D		10				10.63				1.28
C x D		28				11.13**				1.82*
P vs C x D		2				49.20**				5.62**
GCA	5	5	10.64**	4.90**	12.65**	17.43**	25.56**	18.90**	18.87**	16.88**
SCA	15	15	27.44**	11.63**	5.80**	14.08**	1.28**	0.76	2.06**	1.30**
GCA x D		10				5.37**				0.73**
SCA x D		30				15.39**				1.40**
Error	40	120	1.67	1.42	0.76	0.39	0.06	0.59	0.45	0.10
GCA/ SCA			0.04	1.13	0.29	0.15	4.58	0.59	1.43	6.43

Table 3. Cont.

Source of variation	d. f. S	d. f. Com.	No. of kernels / spike D1	D2	D3	Combined	1000-kernel weight (g) D1	D2	D3	Combined
Rep/s	2	6	4.44	34.48	23.35	25.4	55.1	0.58	6.22	18.09
Sowing dates(D)		2				143.37**				889.69**
Genotypes (G)	20	20	71.00**	60.37**	96.11**	198.43**	48.19**	48.34**	25.49**	109.07**
Parents (P)	5	5	216..63**	105..73**	172..53**	455.68**	75..32**	81.80**	37.41**	174.00**
Crosses (C)	14	14	23.61*	48.48**	71.33**	120.05**	41.7**	39.85**	22.55**	93.65**
P vs C	1	1	6.3	0.001	60.97**	9.35	3.51	0.002	7.22	0.24
G x D		40				14.53*				6.48
P X D		10				19.51*				10.27*
C x D		28				11.68				5.22
P vs C x D		2				28.95				5.24
GCA	5	5	213.63**	209.75**	291.46**	697.90**	145.73**	196.14**	1.19	376.08**
SCA	15	15	23.44**	9.59**	31.00**	31.95**	15.68**	8.11**	1.48	20.06**
GCA x D		10				8.24**				8.75**
SCA x D		30				16.62**				5.72**
Error	40	120	3.24	3.45	1.92	0.93	3.28	1.88	1.19	0.69
GCA/ SCA			1.3	3.19	1.24	2.8	1.43	1.71	1.48	2.42

Table 3. Cont.

Source of variation	d. f. S	d. f. Comb.	plant (g) / Grain yield D1	D2	D3	Combined
Rep/s	2	6	14.50	38.15	20.70	22.8
Sowing dates(D)	2					1675.41**
Genotypes (G)	20	20	50.87**	25.77**	18.52**	79.51**
Parents (P)	5	5	28.09**	30.04*	13.72**	135.16**
Crosses (C)	14	14	39.84**	40.24**	25.12**	61.91**
P vs C	1	1	39.57*	134.39**	20.81*	47.61**
G x D	40					9.08**
P X D	10					15.07**
C x D	28					3.05
P vs C x D	2					38.40**
GCA	5	5	154.28**	70.02**	57.84**	265.05**
SCA	15	15	21.99**	11.02**	5.39**	19.87**
GCA x D	10					8.54**
SCA x D	30					9.27*
Error	40	120	1.17	0.88	0.79	0.29
GCA/ SCA			0.92	0.67	1.55	1.69

D1, D2 and D3: Early, normal and late sowing dates, respectively.
* , ** : significant at 0.05 and 0.01 levels of probability , respectively

and sowing dates for one or more of our studied traits as **Chaudhry *et al* (1992), Khalifa *et al* (1998), Hassan and Gaballah (1999), Hamada (2003), Swelam and Hassan (2007), Menshawy (2007) and Ahmed and Mohamed (2009).**

Performance of wheat genotypes

Data of grain yield / plant and its components , i.e. number of spikes / plant, number of spikelets / spike, number of kernels /spike and 1000 – kernel weight (seed index) measured for 21 wheat genotypes at three sowing dates and their combined data are recorded in Table (4). As shown in this table delaying sowing date caused significant reduction in grain yield/plant and its components. Therefore, either early sowing on Oct.23 or recommended sowing on Nov.16 produced higher number of spikes / plant on the basis of general mean which exceeded by 3.16 and 1.17 spikes than late sowing on Dec.13,respectively.However, significant increase amounted to 1.99 spikes /plant occurred on early sowing compared with normal sowing. For no. of spikelets /spike, significant reduction was occurred at late sowing by 1.57 spikelets than recommended sowing, while it was not influenced at early sowing comparing with normal sowing ,where averages were approximately equal. On the other hand, the early sowing produced the highest means for no. of kernels / spike and grain yield / plant, which significantly exceeded by 1.48 and 4.06 kernels for no. of kernels / spike and by 7.90 and 10.31 g for grain yield/ plant than normal and late sowing, respectively. Meantime, significant differences amounted to 2.58 grains and 2.41 g were found between normal and late sowing dates for the two traits, respectively. However, 1000- kernel weight was significantly heavier in early sowing by 6.48 g than late sowing, but it did not significantly differ from recommended sowing. These observed variations among the genotypes in grain yield/ plant and its components may, partially, reflect their different genetic background. The significant reduction occurred in grain yield/ plant and its component traits by delaying sowing date was mainly due to rise in temperature, in April (Table 2) during reproductive growth phase, which affected the pollen grain viability and consequently no. of grains development and resulted in immature and shriveled grains on the late sowing. Moreover, the exposure to hot wind, even for a short time, could drastically reduce spike fertility and grain filling **(Fischer and Maurer 1978).** On the other hand, high temperature accelerates organ production in few days without any increase in net photosynthesis and assimilates resulting in smaller biomass **(Fischer 1985 and Shpiler and Blum 1986).** Several investigators as **Kheiralla and Sherif (1992), EL-Morshidy *et al* (1998), Tammam and Tawfelis (2004), Mahguob and Amin (2006), Haj *et al* (2007) , Menshawy (2007) and Ahmed and Mohamed (2009)** also obtained variant reduction in grain yield/plant and its components when sowing date of wheat delayed to Dec.. Generally the above results showed that wheat sown on early sowing (in Oct.) was significantly better compared to recommended (in Nov.) and late (in Dec.) sowing for grain yield / plant and its components.

According to the performance of the 21 wheat genotypes at different sowing dates and combined analysis, general means of genotypes were 15.65, 13.69 and 12.23 spikes with an average of 13.85 spikes for no. of spikes /plant at early, normal and late sowing dates and overall sowing dates, respectively. The cross P5 × P6 gave the highest mean value of 20.33 spikes / plant at normal sowing date while the crosses; P3 × P4, P3 × P6 and P4 × P6 recorded similar lowest mean value of 10.67 spikes on late sowing as well as some other genotypes at different sowing dates without significant differences among them.

Across the 21 wheat genotypes, no. of spikelets / spike gave general mean values of 20.74, 20.85 and 19.28 with an average of 20.29 spikelets at early, normal and late sowing dates and overall sowing dates, respectively. The two local cvs.; Giza 168 at different sowing dates and overall sowing dates and Sakha 94 at normal and late sowing date as well as the crosses; P1 × P2 and P1 ×P3 at different sowing dates and overall sowing date, P1 P5 and P1 x P3 at early sowing date, P1 x P6, P21 x P3 and P2 x P6 at normal sowing date and P1 x P5, P2 x P6 and P3 x P6 at late sowing date, recorded the highet no. of spikelets / spike. Mean values ranging form 20 spikelets for the cross P2 × P6 at late sowing date to 23.67 spikelets for the cross P1 × P2 at early sowing date. On the other hand, the two Syrian cvs. Bohouth 6 at different sowing dates and overall sowing dates and Cham 4 at normal and late sowing dates and overall sowing dates as well as the cross P4× P6 at early sowing date and the cross P4× P5 at early or late sowing date and overall sowing dates recorded lowest mean values for no. of spikelets / spike which ranged form 16.33 spikelets for the cv. Bohouth 6 and the cross P4 × P5 at late sowing date to 18.33 spikelets for the cv. Bohouth 6 at early sowing date.

General means of no. of kernels / spike across different sowing dates were 68.03, 66.55 and 63.97 with an average of 66.19 grains at early, normal and late sowing dates and overall sowing dates, respectively. The higher means of no. of grains / spike across different sowing dates ranged from 70.00 grains for the cv. Sakha 94 and the cross P2 × P3 at late sowing date to 80.00 grains for the cv. Giza 168 at early sowing date. On the other hand, the lowest values of no. of grains / spike across different sowing dates ranged from 56.67 grains for Gemmeiza 10 at late sowing date to 62.33 grains for the cross P5 × P6 at normal sowing date.

For 1000-kernel weight, general means of all genotypes were 44.98, 45.03 and 38.50 g with an average of 42.84 g at early, normal and late sowing dates and overall sowing dates, respectively. The two cvs. ; Giza 168 and Sakha 94 and the crosses; P1× P2, P1× P3 and P2 × P3 at different sowing dates and overall sowing dates as well as the cross P3× P6 at early sowing date recorded the heaviest grains weight ranging from 41.67 g for the cross P2× P3 at late sowing date to 51.91 g for the cross P1× P3 at early sowing date. On other hand, the two cvs.; Bohouth 6 and Cham 4 and the cross P4 × P5 at different sowing dates and overall sowing dates as well as the cv. Gemmeiza 10 and the crosses; P2× P4, P2× P5, P2× P6, P3× P4, P3× P5, P3× P6, P4× P6 and P5× P6 at late sowing date recorded the lightest grains weight which ranged from 35.04 g for the cv. Cham 4 at late sowing date to 39.67 g for the cv. Cham 4 at early sowing date . Although the cross P1× P3 was earlier in heading and anthesis dates, the heaviest of its grains weight was attributable ,in part, to high grain filling rate (0.41 g / day) at early sowing date

As indicated before, the effects of sowing dates on grain yield / plant varied among genotypes in the present study, therefore general means for this trait were 32.19, 24.29 and 21.88 g with an average of 25.98 g at early, normal and late sowing dates and overall sowing dates, respectively. Overall sowing dates the average of grain yield / plant was greater, in general, in the F_1 hybrids than in their parental genotypes, because of the effect of heterosis in F_1 generation. The three crosses; P1 x P2, P1 x P3 and P2 x P3 at different sowing dates and overall sowing dates as well as the cv. Sakha 94

Table 4. Mean grain yield and its components of 21 wheat genotypes at three sowing dates and their combined data.

Genotype		No. of spikes/ plant				no. of spikelets/ spike			
		D1	D2	D3	Combined	D1	D2	D3	Combined
Giza 168	P1	14.33	12.33	12.33	12.99	23.33	23	21.33	22.55
Sakha 94	P2	17	15.67	14.67	15.78	21	22.33	20.33	21.22
Cham 8	P3	14.67	13.33	12	13.33	20.67	21	19.67	20.45
Bohouth 6	P4	12	12.33	12.33	12.22	18.33	18.33	16.33	17.66
Cham 4	P5	16.67	17.33	16	16.66	19.67	19	16.67	18.45
Gemmeiza10	P6	11	16.33	11.67	13.00	20	20.33	19.33	19.89
Parents mean		14.27	14.55	13.16	13.99	20.5	20.66	18.94	20.03
P1 x P2		15	12.67	13.00	13.55	23.67	22.67	20.33	22.22
P1 x P3		15.67	16.33	13.33	15.11	22.67	23	21.33	22.33
P1 x P4		17.67	15.00	11.67	14.78	21.33	20.33	20.67	20.78
P1 x P5		14.33	14.33	11.67	13.44	22.33	21	20	21.11
P1 x P6		13.67	13.33	12.33	13.11	21	22.33	19	20.78
P2 x P3		18.33	15.67	11.33	15.11	22.33	22.33	19.33	21.33
P2 x P4		16	11.33	13.33	13.55	19.67	19.33	19	19.33
P2 x P5		13	11.33	12.67	12.33	20.67	20.45	19.33	20.15
P2x P6		19	14.00	11.00	14.66	21	21.33	20	20.77
P3 x P4		15	11.67	10.67	12.44	19.67	20	19	19.56
P3 x P5		18.67	12.67	11.67	14.33	20.33	20.67	19.33	20.11
P3 x P6		13.67	10.80	10.67	11.68	21.67	20.67	20.67	21.00
P4 x P5		15.67	14	11.33	13.66	17.67	19.67	16.33	17.89
P4 x P6		18.33	12.67	10.67	13.89	19	20	18	19.00
P5 x P6		20.33	13.67	11.67	15.22	19.67	20.33	19.33	19.77
Crosses mean		16.28	13.29	11.80	13.79	20.85	20.94	19.44	20.41
General mean		15.65	13.69	12.23	13.85	20.74	20.85	19.28	20.29
Range value		8.33	5.66	4	4.98	5.34	4.67	5.00	4.89
LSD 5 %									
D					0.75				0.35
G		3.69	3.04	2.49	1.98	1.79	1.78	1.36	0.94
DG					3.43				1.62

Table 4.Cont.

Genotype		No .of kernels/ spike D1	D2	D3	Combined	1000- kernel weight (g) D1	D2	D3	Combined
Giza 168	P1	80.00	72.00	77.33	76.44	51.44	50.79	42.15	48.13
Sakha 94	P2	73.00	71.67	71.00	71.89	49.55	50.74	43.92	48.07
Cham 8	P3	71.33	67.33	70.00	69.56	42.30	47.46	39.91	43.22
Bohouth 6	P4	59.67	58.00	60.00	59.22	39.65	40.01	36.61	38.76
Cham 4	P5	60.00	63.00	67.00	63.33	39.67	40.13	35.04	38.28
Gemmeiza10	P6	61.00	60.00	56.67	59.22	45.04	41.1	36.56	40.9
Parents mean		67.5	65.33	67.00	66.61	44.60	45.03	39.03	42.89
P1 x P2		71.00	70.67	73.67	71.78	49.40	50.17	44.42	48.00
P1 x P3		72.33	71.33	71.67	71.78	51.91	51.71	42.90	48.84
P1 x P4		65.33	62.67	60.00	62.67	45.41	46.47	38.81	43.56
P1 x P5		67.67	66.67	64.33	66.22	45.97	45.84	38.29	43.37
P1 x P6		67.67	68.67	67.33	67.89	44.46	44.63	39.12	42.74
P2 x P3		72.00	72.00	70.00	71.33	51.03	50.92	41.67	47.87
P2 x P4		66.33	66.00	62.67	65.00	43.16	44.66	35.87	41.23
P2 x P5		71.00	62.33	67.33	66.89	44.50	44.35	37.47	42.11
P2x P6		70.67	65.33	68.33	68.11	43.82	44.28	35.68	41.26
P3 x P4		67.67	64.33	64.67	65.56	45.36	44.24	36.90	42.17
P3 x P5		66.67	64.33	64.33	65.11	42.54	41.94	36.69	40.39
P3 x P6		68.33	64.00	60.00	64.11	46.37	42.11	37.52	42.00
P4 x P5		62.00	57.33	57.33	58.89	36.65	38.03	35.58	36.75
P4 x P6		66.33	62.00	62.33	63.56	42.62	42.57	37.84	41.01
P5 x P6		68.00	62.33	58.33	62.89	43.80	43.43	35.47	40.90
Crosses mean		68.20	65.33	64.82	66.11	45.13	45.02	38.28	42.81
General mean		68.00	65.33	65.44	66.26	44.98	45.03	38.5	42.84
Range value		20.33	14.67	20.66	17.55	12..26	13.68	8.84	12.09
LSD 5 %									
D					1.08				0.91
G		5.18	5.11	3.96	2.87	5.18	3.74	3.12	2.41
DG					4.97				ns

Table 4. Cont.

Genotype		Grain yield / plant (g) D1	D2	D3	Combined
Giza 168	P1	37.36	27.19	24.05	29.54
Sakha 94	P2	35.05	28.51	24.27	29.28
Cham 8	P3	32.77	24.33	23.23	26.78
Bohouth 6	P4	22.57	21.38	17.32	20.43
Cham 4	P5	24.78	23.72	20.41	22.97
Gemmeiza 10	P6	24.93	21.41	20.05	22.13
Parents mean		29.57	24.42	21.55	25.18
P1 x P2		36.75	28.91	25.60	30.42
P1 x P3		37.46	29.66	27.47	31.53
P1 x P4		32.92	25.82	23.20	27.31
P1 x P5		34.01	22.34	21.08	25.81
P1 x P6		30.27	25.29	21.25	25.60
P2 x P3		37.19	28.44	25.4	30.34
P2 x P4		30.72	20.96	19.93	23.87
P2 x P5		31.7	22.59	20.17	24.82
P2x P6		31.42	24.04	20.99	25.48
P3 x P4		34.01	25.42	22.45	27.29
P3 x P5		31.95	22.87	21.6	25.47
P3 x P6		35.68	23.25	22.15	25.44
P4 x P5		26.94	20.86	20.48	23.25
P4 x P6		32.79	23.62	19.26	24.88
P5 x P6		29.90	19.46	19.09	22.93
Crosses mean		32.91	24.23	22.00	26.29
General mean		32.19	24.29	21.88	25.98
Range value		14.89	10.20	10.15	11.10
LSD 5 %					
D					0.62
G		3.09	2.35	2.54	1.65
DG					2.85

D1, D2 and D3: Early, normal and late sowing dates, respectively.

at early and recommended sowing date and the cv.Giza 168 and the cross P3 x P6 at early sowing date had the highest grain yield / plant giving values ranged from 25.40 g for the cross P2 x P3 at late sowing date to 37.46 for the cross P1 x P3 at early sowing date.

These genotypes were always superior in most of grain yield components at different sowing dates .The results pointed out that the two cvs. Giza 168 and Sakha 94 are more suitable for growing early than other cvs. used in the present study. Also the three crosses; P1 x P2, P1 x P3 and P2 x P3 may be used by plant breeders to develop high yielding strains under different sowing dates. However, the lowest mean values registered for grain yield / plant across different sowing dates ranged from 17.32 g for Bohouth 6 at late sowing date to 24.93 g for the cv. Gemmeiza 10 at the early sowing date

General and specific combining ability variances

Partitioning of the genetic variance to GCA and SCA variances for each trait is given in Table (3). General and specific combining ability mean squares were found to be highly significant for all traits studied at each sowing date and combined analysis except mean squares of SCA for no. of spikelets/spike at normal sowing date which was insignificant, indicating the importance of both additive and non-additive gene effects in the inheritance of the traits studied. In this connection **Salama (2000), Hamada *et al* (2002), Abdel- Nour (2005), Ahmed *et al* (2005), Motawea (2006) , Dawwam *et al* (2007), EL- Marakby *et al* (2007), Salama (2007), Ahmed and Mohamed (2009) and El-Shamarka *et al* (2009)** also found that both general and specific combining ability variances were significant for some of the studied traits in wheat.

The ratios of GCA/SCA variances were greater than unity for no. of kernels/spike and 1000-kernel weight at the three sowing dates and combined data , indicating that additive and additive × additive types of gene action were of greater importance in the inheritance of both traits. Also, it is evident that additive type of gene action was the most important part of total genetic variability for no.of spikelets/spike on normal sowing. For the rest traits; i.e. no. of spikes/ plant, no. of spikelets / spike and grain yield / plant the ratios of GCA / SCA were inconsistent across different sowing dates and combined data. In this respect **Ahmed (1999), El- Hindi *at el* (2005), Koumber and EL-Beially (2005), Dawwam *et al* (2007), Abd EL-Rahman (2008), Ahmed and Mohamed (2009), El-Shamarka *et al* (2009) and Sedek *et al* (2009)** indicated the preponderance of additive gene action in the inheritance of number of spikes/plant, number of spikelets/ spike, number of grains/spike, 1000- Kernel weight, and grain yield/plant, while **EL-Shami *et al* (1996) and Motawea (2006)** revealed the preponderance of non-additive gene action (dominance and epitasis) in the inheritance of these traits .

Interactions of GCA and SCA with sowing dates were highly significant for all studied traits except interaction of SCA × sowing dates was significant for grain yield / plant. Such results revealed that nature and the magnitude of both types of gene action varied from one sowing date to another illustrating importance of sowing dates as effective factor in declared GCA and SCA variances. Generally, the magnitude of GCA x environments interactions was less as compared to SCA x environments interactions for most studied traits suggesting a low sensitivity of GCA to environments than that of SCA for these characters. In this connection **Ahmed (1999), Hamada (2003), Salama and Salem (2006), Dawwam *et al* (2007) and EL- Marakby *et al* (2007)** indicated that the interaction of both GCA and SCA with sowing dates was significant for number of spikes/plant, number of kernels/spike, 1000-kernel weight and grain yield/plant.

General and specific combining ability effects

Estimates of GCA and SCA effects for grain yield /plant and its components at each sowing date and combined data are presented in Tables (٥ and 6).For GCA effects of no. of spikes / plant, the cv. Cham 4 at early and normal sowing date and combined data as well as the two cvs. Sakha 94 and Cham 8 at late sowing date gave significant positive GCA effects, therefore they are considered good general combiners which have favorable genes for improving this trait through hybridization programs. On the other hand, the cvs.; Giza 168 at early sowing date, Bohouth 6 at late sowing date and combined data and Gemmeiza 10 at late sowing date proved to be poor general combiners for no. of spikes / plant which they attained negative and significant GCA effects. Estimates of SCA effects for no. of spikes/plant showed that four crosses out of 15 F_1,s namely; P1× P3, P1× P4, P4 × P6 and P5 × P6 manifested significant positive SCA values. Among these 4 crosses the cross P1×P4 is considered as the best cross combination since it gave significant positive effects at early and normal sowing dates and combined analysis, although it involved low×low general combiner parents for this trait. On the other hand, the cross P2×P5 across different sowing dates and combined data as well as the cross P1×P5 on normal sowing and P3×P5 on late sowing were only the three crosses among 15 F_1,s recorded significant negative SCA effects and considered as poor F_1-cross combinations for this trait.

For number of spikelets / spike the cvs.; Giza 168, Sakha 94 and Cham 8 at each sowing date and combined data gave highly significant positive GCA effects. Therefore these cvs. are to be considered as good general combiners for this trait at different sowing dates. On the other hand, the two cvs. ; Bohouth 6, and Cham 4 at each sowing date and combined analysis as well as the cv. Gemmeiza 10 at early and late sowing date exhibited negative and highly significant GCA effects and they were considered as poor general combiners. For specific combining ability effects of this trait, only two crosses out of 15 F_1,s exhibited significant positive SCA values. The first cross was P1× P2 on early sowing giving value of 0.85 which included good× good general combiner parents and the other cross was P1× P4 on late sowing giving value of 1.43 but included good × poor general combiner parents. On the other hand, the cross P1× P6 on early and late sowing and combined data as well as the two crosses; P3× P6 and P4× P5 on early sowing gave significant negative SCA values ranging from -1.48 on late sowing to -0.76 at combined data for the cross P1× P6. These crosses involved either good× poor or poor× poor general combiner parents.

Regarding number of kernels /spike, the cvs.; Giza 168, Sakha 94 and Cham 8 gave highly significant positive GCA values towards increasing no. of kernels / spike at each sowing date and combined data. Therefore, they can be considering as good general combiners for improving this trait at such sowing dates. On the other hand, the cvs. ; Bohouth 6, Cham 4 and Gemmeiza 10 at all sowing dates and combined data attained negative and highly significant GCA effects and were considered as poor general combiners. The effects of SCA for this trait showed that the cross P4 × P6 appeared to be the best F_1.cross combination among all F_1,s studied which gave highest significant positive SCA values of 3.58, 4.33 and 3.36 on early and late sowing and combined data, respectively, although it involved poor × poor general combiner parents. This cross followed by the cross P5×P6 on early sowing and the cross P2 × P6 on late sowing giving SCA values of 4.21 and 3.21,respectively, are also considered as good general combiners for this trait. On the other side, five crosses at certain environments exhibited significant negative SCA values ranging from -5.75 for the cross P1 × P4 to -2.67 for the cross P4 × P5 on late sowing which they considered as poor F_1 cross combinations.

For 1000 – kernel weight, the cvs. Giza 168, Sakha 94 and Cham 8 gave highly significant positive GCA effects for this trait at each sowing date and combined data except effect of the cv. Cham 8 was insignificant at early sowing date. These cvs. could be considered good general combiners at such sowing dates.. On the other hand, the cvs. ; Bohouth 6, Cham 4 and Gemmeiza 10 exhibited negative and highly significant GCA effects at each sowing date and combined data except insignificant effect for Gemmeiza 10 at early sowing date which proved to be poor general combiner for this trait. SCA effects for 1000-kernel weight demonstrated that, the two crosses; P1× P3 and P2× P3 at early sowing date and combined data, as well as the cross P4 × P6 at late sowing date and combined data and the cross P5 × P6 at normal sowing date and combined data exhibited significant positive SCA values for this trait ranging from 1.64 for the cross P4 × P6 at combined data to 3.17 for the cross P2 × P4 at

Table 5. Estimates of general combining ability effects for grain yield and its components in six-parent diallel crosses of bread wheat on three sowing dates and their combined data.

		No.of spikes/plant				No.of spikelets/spike				No.of kernels / spike			
Parent		D1	D2	D3	Combined	D1	D2	D3	Combined	D1	D2	D3	Combined
Giza 168	P1	-0.88*	0.05	-0.43	-0.42	1.55**	1.16**	1.11**	1.27**	3.50**	3.34**	4.19**	3.68**
Sakha 9	P2	0.54	-0.19	0.82*	0.39	0.51**	0.59**	0.44**	0.51**	2.63**	2.79**	3.24**	2.88**
Cham 8	P3	0.08	-0.40	0.74*	0.14	0.34**	0.32**	0.48**	0.38**	1.71**	1.67**	1.57**	1.65**
Bohouth 6	P4	-0.54	-0.32	-0.72*	-0.53*	-1.40**	-1.25**	-1.18**	-1.27**	-3.63**	-3.63**	-3.89**	-3.71**
Cham 4	P5	0.92*	0.85*	0.36	0.71**	-0.65**	-0.73**	-0.93**	-0.77**	-2.58**	-2.29**	-1.56**	-2.14**
Gemmeiza 10	P6	-0.13	0.01	-0.76**	-0.29	-0.36**	-0.08	0.06	-0.12*	-1.63**	-1.88**	-3.56**	-2.35**
S.E(gi)		0.42	0.34	0.28	0.23	0.18	0.18	0.17	0.10	0.58	0.58	0.45	0.33
LSD (gi-gj)	0.05	1.30	1.07	0.88	0.70	0.28	0.45	0.41	0.33	1.83	1.81	1.40	1.01
	0.01	1.74	1.44	1.17	0.93	0.88	0.76	0.86	0.74	2.45	2.41	1.87	1.34

Table 5. Cont

Parent		1000- kernels weight D1	D2	D3	Combined	Grain yield / plant D1	D2	D3	Combined
Giza 168	P1	3.14**	3.15**	2.30**	2.86**	2.80**	2.05**	1.69**	2.24**
Sakha 94	P2	2.02**	2.58**	1.68**	2.09**	1.77**	1.49**	0.94**	1.45**
Cham 8	P3	0.87	1.33**	0.75*	0.98**	2.26**	1.03**	1.55**	1.47**
Bohouth 6	P4	-2.80**	-2.40**	-1.41**	-2.20**	-2.65**	-1.32**	-1.65**	-1.80**
Cham 4	P5	-2.76**	-2.67**	-1.99**	-2.47**	-2.46**	-1.81**	-1.24**	-1.70**
Gemmeiza 10	P6	-0.47	-2.00**	-1.34**	-1.27**	-1.73**	-1.44**	-1.29**	-1.66**
S.E(gi)		0.58	0.42	0.35	0.28	0.35	0.26	0.29	0.19
LSD (gi-gj)	0.05	1.83	1.32	1.10	0.85	1.09	0.83	0.73	0.58
	0.01	2.45	1.76	1.47	1.13	1.46	1.11	0.97	0.77

D1, D2 and D3: Early, normal and late sowing dates, respectively.

* and ** : denote significant at 0.05 and 0.01 levels of probability , respectively

Table 6. Estimates of specific combining ability effects for grain yield and its components in six-parent diallel crosses of bread wheat on three sowing dates and their combined data.

		No.of spikes/plant				No.of spikelets/spike				No.of kernels / spike			
Crosses		D1	D2	D3	Combined	D1	D2	D3	Combined	D1	D2	D3	Combined
P1 x P2		-0.52	0.11	-1.26	-0.56	0.85*	0.05	-0.52	0.12	-3.13	-0.79	0.8	-1.04
P1 x P3		-0.4	0.98	2.15**	0.92	0.02	0.64	0.43	0.36	-0.88	1.00	0.46	0.20
P1 x P4		3.23**	2.57**	-1.05	1.58*	0.43	-0.43	1.43**	0.48	-2.55	-2.37	-5.75**	-3.55**
P1 x P5		-1.57	-2.27*	0.87	-1.00	0.68	-0.28	0.5	0.3	-1.25	0.29	-3.75**	-1.57
P1 x P6		-1.19	-0.44	0.65	-0.33	-0.94*	0.39	-1.48**	-0.67*	-2.21	1.88	1.25	0.31
P2 x P3		1.85	1.57	-0.10	1.11	0.72	0.54	-0.9	0.12	-0.33	2.21	-0.25	0.54
P2 x P4		0.14	-0.86	-0.64	-0.45	-0.18	-0.86	0.43	-0.2	-0.67	1.50	-2.12	-0.43
P2 x P5		-4.32**	-2.02*	-2.39**	-2.91**	0.06	-0.26	0.51	0.1	2.96	-3.50*	0.21	-0.11
P2x P6		2.73	-1.52	0.07	0.43	0.1	-0.03	0.18	0.07	1.67	-0.92	3.21*	1.32
P3 x P4		-0.40	-1.31	0.78	-0.31	-0.02	0.06	0.39	0.14	1.59	0.96	1.54	1.36
P3 x P5		1.81	-0.47	-2.30**	-0.32	-0.11	0.21	0.47	0.19	-0.46	-0.38	-1.13	-0.65
P3 x P6		-2.15	-1.64	0.15	-1.21	-0.93*	-0.43	0.81	0.43	0.25	-1.12	-3.46**	-1.45
P4 x P5		-0.56	0.77	0.82	0.35	-1.0**	0.8	-0.85	-0.35	0.21	-2.09	-2.67*	-1.51
P4 x P6		3.14**	-1.72	0.28	0.57	0.01	0.48	-0.18	0.1	3.58*	2.17	4.33**	3.36**
P5 x P6		6.68**	-1.89	0.20	1.66**	-0.06	0.29	0.89	0.36	4.21*	1.16	-2	1.13
S.E(sij)		1.14	0.94	0.77	0.63	0.42	0.51	0.51	0.29	1.61	1.58	1.23	0.91
LSD (sij-sik)	0.05	3.45	2.84	2.32	1.85	0.30	0.12	0.44	0.11	4.84	4.78	3.70	2.68
	0.01	4.61	3.80	3.11	2.45	0.85	0.45	0.08	0.41	6.47	6.39	4.95	3.55
LSD (sij-skl)	0.05	3.19	2.63	2.15	1.72	0.42	0.23	0.24	0.23	4.48	4.42	3.43	2.48
	0.01	4.27	3.52	2.88	2.27	0.81	0.88	0.52	0.47	5.99	5.91	4.58	3.29

Table 6. Cont.

Crosses		1000- kernels weight D1	D2	D3	Combined	Grain yield / plant D1	D2	D3	Combined
P1 x P2		-0.74	-0.59	1.94	0.20	0.22	1.08	1.09	0.75
P1 x P3		2.92*	2.20	1.35	2.16**	0.44	2.29**	2.35**	1.84**
P1 x P4		0.08	0.69	-0.58	0.06	0.81	0.81	1.28	0.89
P1 x P5		0.6	0.33	-0.52	0.14	1.71	-2.19**	-1.25	-0.70
P1 x P6		-3.20**	-1.55	-0.33	-1.69*	-2.77**	0.40	-1.03	-0.96
P2 x P3		3.17**	1.98	0.74	1.96**	1.20	1.62*	1.04	1.43**
P2 x P4		-1.04	-0.55	-2.90**	-1.50	-0.36	-3.50**	-1.23	-1.76**
P2 x P5		0.26	-0.59	-0.72	-0.35	0.43	-1.38	-1.40	-0.91
P2x P6		-2.71*	-1.33	-3.16**	-2.40**	-0.58	-0.30	-0.53	-0.3
P3 x P4		2.31	0.28	-0.94	0.55	2.44*	1.42	0.67	1.64**
P3 x P5		-0.55	-1.75	-0.57	-0.96	0.18	-0.65	-0.59	-0.28
P3 x P6		0.99	-2.25	-0.39	-0.55	3.18**	-0.63	0.01	-0.35
P4 x P5		-2.78*	-1.93	0.48	-1.41	0.09	-0.30	1.49	0.77
P4 x P6		0.9	1.94	2.09*	1.64*	5.21**	2.10**	0.32	2.36**
P5 x P6		2.04	3.07*	0.3	1.80*	2.12*	-1.58*	-0.26	0.31
S.E(sij)		1.61	1.16	0.97	0.76	0.96	0.73	0.79	0.52
LSD (sij-sik)	0.05	4.84	3.49	2.91	2.26	2.89	2.19	2.37	1.54
0.01		6.47	4.67	3.90	2.99	3.87	2.93	3.17	2.04
LSD (sij-skl)	0.05	4.48	3.23	2.70	2.09	2.68	2.03	2.20	1.43
0.01		5.99	4.32	3.61	2.76	3.58	2.72	2.94	1.89

D1, D2 and D3: Early, normal and late sowing dates, respectively.

* and ** : denote significant at 0.05 and 0.01 levels of probability , respectively

P1(Giza 168),P2(Sakha 94), P3(Cham 8), P4 (Bohouth 6), P5 (Cham 4) and P6(Gemmeiza 10).

early sowing date. The first two crosses may be considered the best F_1-cross combinations, since they gave high SCA effects and involved two good general combiner parents. Meantime, the other two crosses involved good× poor general combiner parents. On the other hand, five crosses namely; P1× P6, P2 × P4, P2 × P6, P3 × P6 and P4 × P5 at certain environments exhibited significant negative SCA values ranging from -3.20 on early sowing to -1.69 at the combined data for the cross P1 × P6 which they considered as poor F_1-cross combinations for this trait.

With respect to grain yield / plant, the cvs. Giza 168, Sakha 94 and Cham 8 gave highly significant positive GCA effects for grain yield / plant at each sowing date and combined data. This finding indicated that these cvs. could be considered as good general combiners for high grain yield / plant at different sowing dates. On the other hand, the cvs. ; Bohouth 6, Cham 4 and Gemmeiza 10 exhibited negative and highly significant GCA effects at each sowing date and combined data and are considered as poor general combiners for grain yield / plant. Data of SCA effects for this trait showed that six out of 15 F_1,s crosses namely; P1×P3 on normal and late sowing and combined data, P4×P6 on early and normal sowing and combined data, P2×P3 on normal sowing and combined data, P3 × P4 on early sowing and combined data and P3× P6 and P5×P6 on early sowing exhibited significant positive SCA effects which considered as good F_1-hybrids for this traits. However, the two crosses; P1×P3 and P4×P6 appeared to be the best F_1-cross combinations, since they gave high SCA effects and involved good × good and poor × poor general combiner parents, respectively, therefore, they can be used in wheat breeding programs for grain yield improvement. The cross P1×P3 gave the highest grain yield / plant overall sowing dates compared to other crosses. On the other hand, four crosses namely; P1× P5, P1× P6, P2 × P4 and P5 × P6 at certain environments exhibited significant negative SCA effects, which they considered as poor F_1-cross combinations for this trait.

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الاداء و القدرة على الائتلاف للمحصول و مكوناته في تهجينات دائرية من قمح الخبز تحت مواعيد زراعة مختلفة

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يهدف البحث لدراسة تأثير مواعيد الزراعة على سلوك ست أباء من قمح الخبز و هجنها الفردية و على القدرة العامة و الخاصة على الائتلاف للمحصول و مكوناته حيث تمثل مواعيد الزراعة بيئات حرارية و ضوئية طبيعية تؤثر في انتاجية محصول القمح بوحدة المساحة. اشتملت الأباء المستخدمة في الدراسة على ٣ أصناف مصرية هي : جيزة ١٦٨ (P1) , سخا ٩٤(P2) , جميزة ١٠ (P6) و ٣ أصناف سورية هي :شام ٨(P3) , بحوث ٦ (P4) , شام ٤(P5) تم عمل التهجينات الممكنة بين هذه الاباء دون العكسية في موسم ٢٠٠٧ / ٢٠٠٨ و قيمت الأباء و هجنها (١٥ هجين فردي) في موسم ٢٠٠٨/ ٢٠٠٩ في ثلاث مواعيد زراعة مختلفة هي ٢٣ اكتوبر (ميعاد مبكر) و ١٦ نوفمبر (ميعاد مناسب) و ١٣ ديسمبر (ميعاد متأخر). خصصت تجربة مستقلة لكل ميعاد زراعة و صممت كل منها في قطاعات كاملة عشوائية في ٣ مكررات و ذلك في محطة البحوث و التجارب الزراعية بشلقان- محافظة القليوبية- و بعد الحصاد تم تسجيل بيانات محصول الحبوب للنبات الفردي و مكوناته و هي : عدد السنابل لكل نبات و عدد السنيبلات لكل سنبلة و عدد الحبوب بالسنبلة و وزن الألف حبة، وقد حللت البيانات احصائيا ، كما تم تقدير القدرة العامة و الخاصة على الائتلاف بطريقة Griffing (1956) الطريقة الثانية- النموذج الاول.

و تتلخص أهم نتائج الدراسة بما يلي :

١- كان التباين الراجع الى التراكيب الوراثية الابوية و هجنها الفردية (٢١ تركيب وراثي) عالي المعنوية لجميع الصفات المدروسة تحت مواعيد الزراعة المختلفة و في التحليل التجميعي مما يوضح وجود اختلافات وراثية واضحة بين هذه التراكيب الوراثية مع اختلاف استجابتها تحت مواعيد الزراعة المختلفة بالنسبة للصفات المدروسة.

٢- ادى التأخير في ميعاد الزراعة الى ديسمبر الى حدوث نقص معنوي في محصول الحبوب و مكوناته مقارنة بالميعادين المبكر في اكتوبر والموصى به في نوفمبر، كما تفوق محصول الحبوب و عدد السنابل/نبات و عدد الحبوب/ سنبلة معنويا في ميعاد المبكر مقارنة بالميعاد الموصى به.

٣- أوضحت الدراسة ملائمة الصنفين المحليين جيزة ١٦٨ و سخا ٩٤ للزراعة في الميعاد المبكر عن الاصناف الاخرى بالاضافة الى تفوق الهجن P1 x P3, P1 x P2 P2 x P3 في المحصول ومعظم مكوناته تحت مواعيد الزراعة المختلفة والتي يمكن الاستفادة منها في استنباط سلالات من القمح عالية المحصول.

٤- كانت نتائج تحليل تباين القدرة العامة و الخاصة على الائتلاف و تفاعلاتها مع مواعيد الزراعة معنوية لجميع الصفات المدروسة فيما عدا تباين القدرة الخاصة على الائتلاف لصفة عدد سنيبلات/سنبلة كان غير معنويا في ميعاد الزراعة الموصى به مما يوضح اهمية كلا من التأثيرات المضيفة و غير المضيفة للجينات في وراثة هذه الصفات، كما اشارت النتائج ان تأثير الجينات المضيفة كان أكثر أهمية في وراثة صفتي عدد الحبوب/سنبلة و وزن الألف حبة في مواعيد الزراعة المختلفة، بينما كانت الأهمية النسبية لكل من الفعل الجيني الاضافي و غير الاضافي غير ثابت تحت المواعيد المختلفة للصفات عدد السنابل/نبات، عدد السنيبلات/سنبلة و محصول الحبوب للنبات الفردي.

٥- اظهر الصنفين سخا ٩٤ و شام ٤ قدرة عامة عالية على الائتلاف لصفة عدد السنابل/نبات كما اظهرت الأصناف جيزة ١٦٨ و سخا ٩٤ و شام ٨ قدرة عامة عالية على الأئتلاف للصفات عدد السنيبلات/سنبلة، عدد الحبوب/سنبلة، وزن الألف حبة، و محصول الحبوب للنبات الفردي و بذلك يمكن استخدام تلك الأصناف كآباء في التهجينات لتحسين تلك الصفات في مواعيد الزراعة المستهدفة.

٦- كما اظهرت النتائج أن الهجن التي تمثل أهمية كبيرة في انتخاب سلالات متفوقة في الاجيال الانعزالية هي تلك التي تميزت بقدرة خاصة عالية على الائتلاف في معظم الصفات والبيئات (مواعيد الزراعة) و التي تتضمن على الأقل أب ذو قدرة عالية على الائتلاف و هذه الهجن هي : P1 x P4, P1 x P2 لعدد السنيبلات / سنبلة و P2 x P3, P1 x P3 لوزن الألف حبة و P1 x P3 لمحصول الحبوب للنبات الفردي .