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# GENETICAL STUDIES ON GRAIN YIELD AND ITS COMPONENTS IN DURUM WHEAT (Triticum turgidum var. durum ).

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## ABSTRACT

**The present study was carried out at Shandaweel Agricultural Research station, (ARC) Egypt, during 2003/04 and 2004 /05. To estimate mean performance, heterosis, general and specific combining abilities for 5 studied characters in a half diallel cross among seven selected parental durum wheat genotype.**

**Results showed significant differences among 7 parents and their 21 $F_1$ hybrids for number of spikes / plant, number of kernels / spike, 100 kernel weight, biological yield / plant and grain yield / plant. Estimates of heterosis showed great variation among all studied characters. Ten and five crosses gave positive and significant differences in heterosis as mid-parent and high parent respectively, for number of spikes / plant and biological yield/plant. As for number of kernel / spike, four and one crosses had positive and significant heterosis as both magnitudes of mid-parent and high parent, respectively. As 100-kernel weight, all $F_1$ crosses had positive and significant heterosis except one and four crosses as mid – parent and high parent, were insignificant. These results indicated that selection could be effective to develop kernel weight. Meanwhile, grain yield / plant, twelve and five crosses had positive and significant differences in heterosis values as mid – parents and high parent, respectively. These results**

**indicated that selection could be effective to produce lines with high yield ability.**

**General combing ability(GCA) was much higher than specific combining ability (SCA) for all studied traits. These findings indicated the contribution of additive and non – additive gene effects towards the genetic variability present in the material under study.**

**GCA / SCA ratio was higher than one for all studied traits, which indicate that additive gene effects play an important role in the inheritance of these characters. Sohag 1 cultivar was good combiner for number of spikes / plant, biological yield / plant and grain yield / plant. Sohag 2 appeared to be generaly good combiner for 100-kernel weight. and biological yield / plant. Sohag 3, was good combiner for number of kernels / spike. Bani-Sweif 3 was good combiner for number of spikes / plant, number of kernels / spike, 100-kernel weight, and grain yield/plant. Meanwhile, Belikh //Gedz/Bit line was good combiner for number of kernels / spike.**

**Estimates of specific combining ability effects revealed that, fourteen crosses for number of spikes/plant were positive and the highest values of SCA effects were observed in the crosses P1 x P2 and P4 x P 7. While, number of kernels/spike, nine crosses were positive for SCA effect, and the highest values were obtained from crosses P 1 x P 6, P2 x P 4, P 4 x P 5 and P 6 x P 7. In 100-kernel weight, thirteen crosses showed positive values in SCA effects. The highest values were obtained from the crosses (P 1 x P2) and (P 4 x P6). For biological yield/plants, twelve crosses had positive values in SCA effects, the highest values were in crosses (P 2 x P6), (P 4 x P6) and (P 4 x P7). In grain yield / plant, twelve and nine crosses gave positive and negative values in SCA effects, respectively, whereas, the crosses (P 1 x P 3), (P1 x P 6), (P 2 x P 6), (P 2 x P 7) and (P 4 x P 5) showed the highest positive values of SCA effects .**

## INTRODUCTION

Wheat crop is considered as one of the essential strategic cereal crop in Egypt but all over the world. The importance of durum wheat could be due to multiple usage for human consumption as bread, making macaroni and fareak in addition to that durum wheat is high in protein content. High yielding ability cultivars in durum wheat could be achieved by selection, for one or more of its major yield components. Therefore, studying the inheritance of durum productive traits is becoming of great importance of durum wheat breeding programs. Recently durum wheat importance in Egypt increased because macaroni industry increased to compensate the shortage of rice consumption (high in prices and decrease in acreage).

Heterosis or hybrid vigor's can be regarded as the converse of the deterioration that accompanies in breeding. The beneficial effect of crossing is however a more widely recognized phenomenon than inbreeding depression because it is observed in nearly all $F_1$ crosses between parents that are neither closely nor distantly related. Abul – Nass *et .al* (1981), found that heterosis in wheat (*T. durum* ), for yield and some yield components i.e.; kernel weight, no. of spikes / plant and plant height, was highly significant for mid and better parent in most crosses for all traits. Gurdev, *et. al* (1984), El- Rasas and Mitkees (1985), Gautam and Jain (1985), determined the heterosis for different traits of $F_1$ durum wheat. They concluded that average heterosis over mid – parent values were 57 % for grain yield plant, 19 % for number of spikes / plant, and 10 % for 100- kernel weight.

The results of Bedair *et. al.* (1979), revealed that variation was mainly due to a highly significant general combining ability effects for number of kernels / spike, while specific combining ability were found only for 100- kernel weight. Larrik . *et al* ( 1995 ), found that combining ability analysis indicated that a large portion of the total genetic variation for five out of eight traits was associated with gene which were additive in their effects, while non – additive gene action was strong for single plant yield. The estimates of SCA were significant for four out of eights indicating the presence of epitasis and dominate gene effects in these traits. Uma Menon and Sharma (1994) and Mann and Sharma (1995), found that significant differences for (GCA) among the parents and for ( SCA) in crosses for all the characters studied i. e., tillers / plant, grains / spike, 1000- grain weight and grain yield / plant in both $F_1$ and $F_2$ generations, revealed that both additive and dominance effects are important in the inheritance of all studied characters. Kuruvadi (1991), Mishra *et. al.* (1994), Khalifa, *et. al.* (1998), Khan and Ali ( 1998 ), Sangwan and

Chaudary (1999) and Ghanem (2001), found that general combining ability (GCA) was highly significant for, 1000- kernel weight, and number of kernels / main spike. The importance of non – additive gene action was expressed by the significance of specific combing ability (SCA) effects for all traits except number of spikes / plant. Tammam and Abd El – Gawad (1999), Abd El- Wahed (2001), Ashoush *et. al* (2001), Mahmoud (2002), Mobarek (2003) and Abd El – Majeed , *et al* (2004), found that highly significant differences in mean squares due to both of GCA and SCA of the parental genotypes and F1's, were found in general, mean square, due to GCA were higher than those of SCA; for no. of spikes / plant, no. of kernels / spike, 1000 – kernel weight and grain yield / plant.

The aim of this study was to evaluate seven parental genotypes of durum wheat and analyses biometrically in the $F_1$ hybrids for some agronomic traits. The diallel cross analysis was used for studying general and specific combining abilities, heterosis and correlation coefficients were estimates for agronomic characters.

## MATERIALS AND METHODS

The present study was carried out at Shandaweel Agricultural Res. station, Agric. Res. Center (ARC) Egypt during two successive seasons 2003/2004 and 2004/2005. Seven durum wheat varieties (*Triticum turigidum* var. durum) were used as parental lines for half diallel fashon analysis. The commercial names, pedigree and origin are presented in Table1.

**Table 1: Commercial names, pedigree and origin of parental varieties used in this study.**

| Parents | Pedigree | Source |
|---|---|---|
| P1= Sohag -1 | Gdovz 469 / 3 / jo "s" 46 / 1301/ Lds. | Egypt |
| P2= Sohag -2 | Cran"s"/ Pelicno // Cr"s"/ Gs "s". | Egypt |
| P3= Sohag3 -3 | Mexi"s"/ Mgh / 51792// Durum 6. | Egypt |
| P4= Bani – Swaif -1 | Jo "s" / AA"s" / Fg "s". | Egypt |
| P5= Bani – Sweif -2 | Ente"s" / Mexi "s" | Egypt |
| P6= Bani – Sweif -3 | Corm "s" / Rufo "s". | Egypt |
| P7= Belikh //Gediz / Bit | ACS – D – 728 –22 IZ – 17IZ – 0IZ. | ACSAD (المنظمة العربية) |

In 2003/2004 growing season , a half set of crosses involving the seven parents was carried out . In the winter of 2004/2005 season ten grains of each of the 21 $F_1$ hybrids and the parents were sown in the field in rows, spaced 40 cm. apart and 15 cm. between plant within rows. Each cross and parent were presented in one row with 1.5 m long, in a randomized complete block design (RCBD) in three replications. The borders were sown by another cultivar to avoid the border effect. The agricultural practices were applied as recommended for wheat production and weeds were controlled by hand.

The following characteristics were measured on a random sample of 5 guarded plants from the parent and $F_1$ hybrids in each replicate. The mean of the 5 plants were subjected to statistical genetic analysis; number of spikes/plant, number kernels/spike, 100 - kernel weight (g), biological yield/plant (g), and Grain yield/plant (g).

**Statistical Analysis:**

**Mean performance and analysis of variance: -**

Analysis of variance for randomized complete block design was carried out according to Snedecor and Cochran (1967).

**Heterosis:**

Heterosis of all possible 21 $F_1$ 's was estimated for both mid - parents and better/parent using the following formulas were used by Batt (1971):

Heterosis as mid parents = $\{(F_1 - MP) / MP\} x100$

Heterosis as better parent = $\{(F_1 - BP) / BP\} x100$

Where:

$F_1$ = Mean of $F_1$ cross

M.P = Mean of the respective parents

BP = Mean of the better parent.

**Significant of heterosis:**

Least significant differences (L.S.D)was used to test the significant of heterosis using the following formula:

L.S.D for heterosis as mid - parent = $t_{0.05} (Mse / 2r)^{1/2}$

L.S.D for heterosis as high parent = $t_{0.05} (2Mse / r)^{1/2}$

t= tabulated value at the degree of freedom for error.

Mse = Mean squares for pooled error.

r= number of replications.

**General and specific combining ability estimates:**

Griffing (1956) was used for estimation of general (GCA) and specific (SCA) combining ability effects.

## RESULTS AND DISCUSSIONS

**Mean performance:**

Results in Table 2 showed high significant differences among 7 parents and their 21$F_1$ hybrids for all studied characteristics except 100 - kernel weight which was insignificant for the parents.

Mean performance for 7 parents and their progenies 21 $F_1$ hybrids are presented in Table 3. For the number of spikes /plant the results showed that the average of number of spikes /plant varied from 10.08 spikes / plant of parent no. 2 (Sohag 2) to 13.70 spikes /plant for $p_1$ (Sohag - 1), with an average of 12.36 spikes / plant. For the $F_1$ hybrids number of spikes / plant, ranged from 9.97 spikes / plant for cross ($P_3$ x $P_7$) to 14.66 spikes / plant for cross ($P_1$ x $P_2$), with an average of 12.38 spikes / plant. Twelve crosses, out of the 21 hybrids were exceeded in number of spikes / plant, while eight crosses were intermediate in number of spikes / plant, except one cross ($P_3$ x $P_7$) which had lower number of spikes / plant than the mid - parents.

Concerning number of kernels / spike data in Table 3 revealed that average of number of kernels / spike for the 7 parents ranged from 62.97 kernels / spike for $P_1$ to 77.47 kernels / spike for $p_7$, with an average of 69.69 kernels / spike. Meanwhile, the average kernels / spike for the $F_1$ hybrids varied from 58.91 for ($P_4$ x $P_7$) to 79.78 kernels / spike for ($P_6$ x $P_7$). Cross. Regarding to 100 - kernel weight (g) the average of parents varied from 5.17 g. for ($P_6$) to 5.69 g. for ($P_7$) with an average of 5.33 g. Meanwhile, average of $F_1$ hybrids varied from 5.20 g. for ($P_5$ x $P_6$) cross to 6.08 gm. for ($P_4$ x $P_7$) cross with an average of 5.67 g. Results of 21 hybrids indicated that all hybrids exceeded in kernel weight as respective of parents except ($P_5$ x $P_6$)cross .

Concerning biological yield/plant (g) data obtained of seven parents and their 21$F_1$ hybrids are also presented in Table 3. The results showed that biological yield / plant of parents ranged from 64.62 g/plant for ($P_4$) to 84.82 g/plant for $P_1$ with an average of 74.95

g/plant over all parents. For the hybrids biological yield/plant, the average varied from 61.06 gm/plant for ($P_3xP_7$) cross, to 108.60 gm/plant for ($P_2$ x $P_6$) cross with an average of 80.70 gm/plant. fourteen hybrids Out of the 21 $F_1$'s passed in biological yield / plant than the respective of mean parent.

Data of grain yield / plant for seven parents and their 21$F_1$ hybrids (Table 3), show that the average of grain yield/plant of parents ranged from 21.18 g/plant for ($P_2$) to 32.39 g/plant for ($P_7$) with an average of 27.09 g/plant, while in the $F_1$'s varied from 19.82 g/plant for cross produced from crossing ($P_3$ x $P_4$) to 33.83 g/plant for ($P_1$ x $P_6$) cross with an average of 27.98 g/plant. These results indicated that 14 hybrids exceeded in grain yield / plant when compared to the average of respective parents. While seven hybrids have grain yield / plant less than the average of respective parents.

**Heterosis (H):-**

Results in Table 2, revealed that mean squares for parent vs-hybrids indicating heterosis effects over all crosses which were of appreciable magnitude for most studied characters. Heterosis expressed as the percentage deviation of $F_1$ mean performance from its mid-parents and high parents values for all studied characters are presented in Table 4. Herterosis percentage for number of spiks/plant as mid – parents ranged from – 23.15 % for cross ($p_1$ x $p_6$) to 23.31 % for cross ($p_2$ x $p_7$) and from – 25.11 to 9.46 % as high parent. Ten crosses ($P_1$ x $P_2$), ($P_1$ x $P_6$), ($P_2$ x $P_4$), ($P_2$ x $P_5$), ($P_2$ x $P_6$), ($P_2$ x $P_7$), ($P_3$ x $P_5$), ($P_4$ x $P_6$), ($P_4$ x $P_7$) and ($P_5$ x $P_6$) had positive and significant heterotic effects as mid - parents, while five crosses had positive and significant heterotic effects relative to high parent. Similar results were recorded by Abul - Nass *et. al.* (1981), Gautam and Jain (1985), Ashoush *et. al.* (2001), Mahmoud (2002), Mobarek (2003), Abd El - Majeed, *et. al.* (2004) and Azza Mohamed (2005).

**Table 2: Mean squares of general (GCA) and specific (SCA) combining abilities for ten characteristics studied in a half diallel crosses in durum wheat.**

| Source of variance | D.F. | Number of spikes/ plant | Number of kernels / spike | 100 kernel weight | Biological yield/ plant | Grain yield/ plant |
|---|---|---|---|---|---|---|
| Replicates | 2 | 2.333 | 16.438 | 0.181** | 170.929* | 3.688 |
| Genotypes | 27 | 4.918** | 66.449** | 0.225* | 384.421** | 41.823** |
| Parents | 6 | 3.905* | 96.385** | 0.099 | 148.849* | 53.250** |
| $F_1$ hybrids | 20 | 5.442** | 59.629** | 0.180** | 448.510** | 39.849** |
| Parents vs.$F_1$ hybrids | 1 | 0.534 | 23.241 | 1.869** | 516.088** | 279.636** |
| G.C.A. | 6 | 5.802** | 96.164** | 0.334** | 677.666** | 71.396** |
| S.C.A. | 20 | 4.666** | 57.960** | 0.194** | 300.637** | 33.373** |
| GCA/ SCA | | 1.244 | 1.660 | 1.725 | 2.254 | 2.139 |
| Error | 54 | 1.343 | 14.038 | 0.079 | 49.402 | 4.130 |
| C.V. % | | 9.273 | 5.448 | 5.030 | 8.869 | 7.347 |

*& ** Significant & highly significant at 0.05 & 0.01 levels of probabilities, respectively.

Heterosis percentage for number of kernels / spike, are presented in Table 4 Data revealed that heterosis percentage as mid - parents varied from -16.56 for cross ($p_4$ x $p_7$) to 10.49 % for cross ($p_4$ x $p_5$), while it varied from 23.96% for cross ($P_4$ x $P_7$) to 7.98 % for cross ($P_4$ x $P_5$) as high parent. Five crosses ($P_1$ x $p_5$), ($p_1$ x $p_6$), ($p_2$ x $p_4$), ($p_4$ x $p_5$), and ($p_6$ x $p_7$) had positive and significant heterotic values as mid - parents (6.27, 9.98, 5.98, 10.49 and 7.71 %), respectively. Only one cross ($P_4$ x $P_5$) had positive and significantly heterotic (7.98 %) as high parent. The same results were obtained by El-Rusas and Mitkees (1985), Tammam and Abd-EL Gawad (1999).

Regarding 100 - kernel weight, heterosis percentage values (Table 4) showed that all crosses had positive and significant values as mid - parents and ranged from 0.39 to 15.62 %, except cross (p5 x p6) was not significant. Seventeen crosses had positive and significant heterotic effects as high parent. One cross (P2 x P7) had negative and insignificant heterotic effects as high parent (-1.41 %). These results are in accordance with those reported by Tammam and Abd El –

Gawad (1999), Yadav and Narsinghani (2000), Abd EL - Majeed, et. al. (2004) and Azza Mohamed(2005).

**Table 3: Mean performance of 7 parents and their 21 hybrids of progenies from half diallel crosses for number of kernels/spike, 100 kernel weight, biological yield/ plant, grain yield / plant characters in durum wheat (*Triticum turgidum* var. durum).**

| Genotype | No. of spikes / plant | No. of kernels /spike | 100 – kernel weight (g) | Biolo- yield / plant (g) | Grain yield / plant (g) |
|---|---|---|---|---|---|
| P 1 | 13.70 | 62.97 | 5.20 | 84.82 | 29.61 |
| P 2 | 10.08 | 70.02 | 5.28 | 75.16 | 21.18 |
| P 3 | 11.90 | 76.17 | 5.34 | 76.33 | 29.22 |
| P4 | 12.55 | 63.74 | 5.43 | 64.62 | 22.98 |
| P 5 | 12.64 | 66.77 | 5.18 | 67.15 | 24.06 |
| P 6 | 12.63 | 70.67 | 5.17 | 76.23 | 30.22 |
| P 7 | 13.02 | 77.47 | 5.69 | 80.35 | 32.39 |
| Mean | 12.36 | 69.69 | 5.33 | 74.95 | 27.09 |
| P1 x p2 | 14.66 | 64.64 | 6.07 | 89.39 | 30.88 |
| P1 x p3 | 12.82 | 64.35 | 5.77 | 87.10 | 32.76 |
| P1 x p4 | 11.92 | 66.70 | 5.67 | 80.71 | 29.25 |
| P1 x p5 | 12.67 | 68.94 | 5.36 | 88.85 | 30.80 |
| P1 x p6 | 13.58 | 73.49 | 5.73 | 94.15 | 33.83 |
| P1 x p7 | 10.26 | 66.96 | 5.86 | 85.20 | 26.52 |
| P2 x p3 | 10.80 | 68.03 | 5.49 | 70.57 | 26.19 |
| P2 x p4 | 12.62 | 70.88 | 5.47 | 84.43 | 27.77 |
| P2 x p5 | 12.80 | 67.17 | 5.69 | 88.83 | 27.07 |
| P2 x p6 | 13.14 | 73.32 | 5.72 | 108.60 | 32.52 |
| P2 x p7 | 14.23 | 68.84 | 5.61 | 89.75 | 33.22 |
| P3 x p4 | 10.27 | 65.73 | 5.52 | 63.08 | 19.82 |
| P3 x p5 | 12.81 | 68.75 | 5.36 | 75.80 | 27.10 |
| P3 x p6 | 12.20 | 66.51 | 5.41 | 70.50 | 24.16 |
| P3 x p7 | 9.97 | 72.38 | 5.97 | 61.06 | 25.22 |
| P4 x p5 | 11.55 | 72.10 | 5.45 | 65.95 | 26.87 |
| P4 x p6 | 13.66 | 63.23 | 5.94 | 89.97 | 26.98 |
| P4 x p7 | 14.17 | 58.91 | 6.08 | 86.00 | 24.76 |
| P5 x p6 | 13.46 | 71.22 | 5.20 | 81.32 | 27.63 |
| P5 x p7 | 12.13 | 65.37 | 5.87 | 67.83 | 23.81 |
| P6 x p7 | 10.33 | 79.78 | 5.87 | 65.54 | 30.39 |
| Mean | 12.38 | 68.44 | 5.67 | 80.70 | 27.98 |
| LSD $_{0.05}$ | 1.89 | 6.12 | 0.46 | 11.48 | 3.32 |

Table 4 also shows the biological yield / plant and heterosis percentage values. The data revealed that this trait varied from - 22.06 for cross ($P_3$ x $P_7$) to 43.47 % for cross ($P_2$ x $P_6$) as mid - parent. While, varied from - 24.01 % for cross ($P_3$ x $P_6$) to 42.46 % for cross ($p_2$ x $p_6$). Ten crosses recorded 11.75, 16.93, 16.92, 20.80, 24.84, 43.47, 15.43, 27.25, 18.65, and 13.43 % for crosses ($P_1$ x $P_2$), ($p_1$ x $p_5$), ($p_1$ x $p_6$), ($p_2$ x $p_4$), ($p_2$ x $p_5$), ($p_2$ x $p_6$), ($p_2$ x $p_7$), ($p_4$ x $p_6$), ($p_4$ x $p_7$) and ($p_5$ x $p_6$), respectively as mid – parents. Meanwhile, five crosses had positive and significant or highly significant heterotic effects as high parent. These results are in line with those obtained by Khalifa and Al - Shaeal (1984), Yadav and Narsinghani (2000) and Mobarek (2003).

Results of heterosis for grain yield / plant shown in Table 4, indicate that heterotic effects as mid-parents ranged from - 27.12 % for cross ($P_3$ x $P_6$) to 46.69 % for cross ($P_2$ x $P_6$), while its varied from -31.55 % for cross ($P_3$ x $P_4$) to 24.75 % for cross ($P_2$ x $P_6$) as high parent. Twelve crosses recorded positive and highly significant heterotic effects as mid-parent, while nine crosses had negative and significant/or insignificant heterotic effects as mid-parent, As well as, six cross ($P_1$x $P_2$), ($P_1$ x $p_3$), ($P_1$ x $P_6$), ($P_2$ x $P_4$), ($P_2$x$P_6$), and ($P_4$ x $P_5$) were have positive and significant heterotic effects as high parent. These results are in agreement with those reported by Abul-Nass *et. al.* (1981), Gurdev, et. al. (1984), Khalifa and Al-Shael (1984), Kuruvadi (1991), Tammam and Abd El-Gawad (1999), Yadav and Narsinghani (2000), Ashoush *et. al.* (2001), Mahmoud (2002), Abd El-Majeed (2004) and Azza Mohamed (2005).

**Comhining ability**

**General combining ability (GCA) :-**

Analysis of variance for both magnitudes of general (GCA) and specific (SCA) combining abilities among parents and $F_1$ hybrids given in Table 3, showed that mean squares for both GCA and SCA variances were highly significant for all studied characters, indicating that additive and non - additive gene control the genetic system of studied characters. Tammam and Abd El- Gawad (1999), found similar results.. Generally, general combining ability (GCA) was much higher than specific combining ability (SCA) for all studied characters.

With respect to GCA / SCA ratio (Table 3), the ratio for all studied traits, were more than one, indicating that additive gene effects was predominated than non - additive gene effects and play major role in the inheritance of these characters. Similar results were reported by Tammam and Abd El-Gawad (1999), Mobarek (2003) and Azza Mohamed (2005).

General combining ability effects (ĝi) for all parental genotypes are presented in Tables 4 & 5. Estimates of GCA effects (ĝi) either positive or negative values would indicate a given parented genotypes much better or much poor than the average of the group involves in the diallel fashion. $P_2$ (Sohag 2 ) was good combiner for number of kernels/spike, 100 – kernel weight and biological yield / plant (Table 4). Also $p_5$ and $p_6$ (Bani – Sweif- 2 and Bani – Sweif- 3) were good combiners for number of spikes / plant, and number of kernels / spike (Table 4), $p_6$ only was the best one.

$P_3$ (Sohag 3) had positive significant values of GCA effects in the 100 – kernel weight (Table 4). Also the parental genotypes (Sohag -1 and Sohag -2) were good combiners for biological yield / plant. As well as, $p_1$ and $p_6$ had positive and significant values of (ĝi) for grain yield / plant.

Meanwhile, $p_6$ (Bani – Sweif -3) and $p_7$ (Belkh // Gedz // Bit) were good combiners for number of spikes / plant, number of kernels / spike, and grain yield / plant. It can be concluded that $p_1$ (Sohag -1) can be used in the breeding programs for producing earliness lines with high yielding ability. Also $p_6$ (Bani – Sweif -3) can be used in breeding programs for the improvement of yield and its components. These results are in line with those reported by Khalifa *et. al.* (1998), Tammam and Abd El – Gawad (1999), Ghanem (2001), Abd El – Wahed (2001), Mahmoud (2002), Mobarek (2003), Abd El – Majeed *et. al.* (2004) and Azza Mohamed (2005).

**Table 4: General combining ability (GCA) effects of 7 lines for number of spikes / plant, number of kernels / spike, 100 – kernel weight, biological yield / plant and grain yield / plant in durum wheat (*Triticum turgidum* var. durum).**

| Parents | Number of spikes / plant | Number of kernels / spike | 100 – kernel weight | Biological yield / plant (g) | Grain yield / plant (g) |
|---|---|---|---|---|---|
| Sohag 1 | 0.742 | - 20.130 | - 0.403 | 6.786 | 2.276 |
| Sohag 2 | -0.174 | 0.366 | 0.472 | 5.326 | - 0.363 |
| Sohag 3 | -0.812 | 0.941 | 0.208 | -5.910 | - 1.067 |
| Bani – Sweif 1 | -0.075 | - 2.797 | 0.024 | -3.841 | - 2.206 |
| Bani – Sweif 2 | 0.081 | - 0.345 | - 0.102 | -3.504 | - 1.097 |
| Bani – Sweif 3 | 0.185 | 2.076 | 0.173 | 3.177 | 1.631 |
| BellKH//Gedz / Bit | 0.055 | 1.888 | 0.031 | -2.034 | 0.827 |
| LSD $_{0.05}$ | 0.099 | 1.040 | 0.006 | 3.660 | 0.306 |

**Specific combining ability effects**

Specific combining ability effects (Ŝj) of all crosses are presented in Table 5. Specific combining ability effect can be defined as the magnitude of deviation exhibited by the parents line in the cross from its expected performance on the basis of its general combining ability effects (ĝi). A significant deviation from zero in any cross would indicate specially high or low SCA according to the sign whether positive or negative.

Number of spikes/plant exhibited thirteen crosses out of 21 hybrids which had positive values of SCA effects indicating that the parental lines involved in these crosses can be used in crosses to develop number of spikes / plant.

Number of kernels /spike, data showed that only nine crosses out 21 hybrids had positive SCA values effects. For 100 – kernel weight, data showed that thirteen crosses possessed positive values of SCA effects indicating that exploiting of the parental lines involved in these crosses would be valuable in breeding programs to improve kernel weight.

Biological yield / plant, data showed that twelve crosses out of 21hybrids of SCA effects had positive values. Also, with respect to grain yield / plant twelve crosses possessed positive values for SCA effects indicating that the parental lines involved in these crosses can be used in breeding programs for the development of biological yield and grain yield / plant. These results are in harmony with those obtained by Mann and Sharma (1995), Khalifa *et. al.* (1998), Khan and Ali (1998), Tammam and Abd El-Gawad (1999), Ghanem (2001), Abd El-Wahed (2201), Mahmoud (2002), Abd El-Majeed *et. al.* (2004), and Azza Mohamed (2005).

The present study revealed that not only additive but also non-additive genetic variance are important for the different characters in durum wheat. Under a situation of type, where both additive and non-additive components of genetic variance are important, it is expected that maximum grain production could be attainable with a system that can exploit both of these variances simultaneously. In order to exploit simultaneously the different types of gene actions present in a population, it is suggested that a breeding procedure which may accumulate the fixable gene effects and at the same time maintains considerable heterozygous for exploiting dominance variances also may prove the most beneficial one in improving the durum wheat populations. As such, in certain selected populations bi-parental mating as well as mating of selected plants in early segregation generations could help in developing durum wheat populations having optimum homozygous levels. Ultimately, the lines darned from such populations could be greatly expected to possess enhanced yield levels. It is, therefore, suggested that bi-parental mating among desirable plants in early segregating generations may be made to generate transgressive segregates. Further exploitation of these segregates would yield lines possessing enhanced yield ability.

**Table 5: Specific combining ability (SCA) effects of 21 hybrids of diallel crosses for grain yield and its components characters of durum wheat (*Triticum turgidum* var. durum).**

| Hybrids | Number of spikes / plant | Number of kernels / spike | 100 – kernel weight (g) | Biological yield / plant (g) | Grain yield / plant (g) |
|---|---|---|---|---|---|
| P1 x p2 | 1.600 | -2.373 | 0.472 | -1.969 | 1.306 |
| P1 x p3 | 0.392 | -3.232 | 0.208 | 6.977 | 3.884 |
| P1 x p4 | -1.248 | 2.857 | 0.024 | -1.482 | 1.526 |
| P1 x p5 | -0.644 | 2.641 | -0.102 | 6.321 | 1.963 |
| P1 x p6 | 0.159 | 4.77 | 0.173 | 4.944 | 2.265 |
| P1 x p7 | 0.305 | -1.568 | 0.031 | 1.208 | -4.238 |
| P2 x p3 | -0.713 | -1.481 | -0.043 | -8.090 | -2.041 |
| P2 x p4 | 0.370 | 4.541 | -0.138 | 3.698 | 2.682 |
| P2 x p5 | 0.398 | -1.628 | 0.256 | 7.764 | 0.876 |
| P2 x p6 | 0.627 | 2.101 | 0.198 | 20.851 | 3.591 |
| P2 x p7 | 1.854 | -2.187 | -0.181 | 7.215 | 5.095 |
| P3 x p4 | -1.334 | -1.184 | -0.055 | -0.6.413 | -4.568 |
| P3 x p5 | 1.043 | -0.619 | 0.059 | 5.966 | 1.606 |
| P3 x p6 | 0.329 | -5.284 | -0.073 | -6.014 | -4.061 |
| P3 x p7 | -1.771 | 0.778 | 0.218 | -10.237 | -2.201 |
| P4 x p5 | -0.954 | 6.465 | -0.019 | -5.949 | 2.512 |
| P4 x p6 | 1.056 | -4.826 | 0.79 | 11.394 | -0.106 |
| P4 x p7 | 1.699 | -8.960 | 0.250 | 12.635 | -1.515 |
| P5 x p6 | 0.703 | 0.719 | -0.183 | 2.403 | -0.562 |
| P5 x p7 | -0.500 | -4.946 | 0.211 | -6.326 | -3.575 |
| P6 x p7 | -2.404 | 7.040 | 0.123 | -14.843 | 0.278 |
| $S_{ij} - S_{ik}$ | 0.796 | 8.318 | 0.047 | 29.2756 | 2.447 |
| $S_{ij} - S_{ki}$ | 0.696 | 7.279 | 0.041 | 25.616 | 2.142 |

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# وراثة المحصول ومكوناته فى بعض هجن قمح الديورم

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أجريت هذه الدراسة بمحطة البحوث الزراعية بشندويل - مركز البحوث الزراعية خلال المواسم الزراعية ٢٠٠٣/٢٠٠٤ و ٢٠٠٤/٢٠٠٥ وذلك بهدف دراسة متوسط أداء الصفات المختلفة للهجن وتحليل التباين و تقدير قوة الهجين سواء بالنسبة لمتوسط الأبوين أو الأب الأعلى - تقدير القدرة العامة والخاصة علي الائتلاف للصفات تحت الدراسة.

أظهر تقدير قوة الهجين اختلافات كبيرة في قيم قوة الهجين لكل الصفات المدروسة

* **عدد السنابل / النبات** : أوضحت النتائج أن عشرة هجن وخمسة هجن كانت معنوية وموجبة في قوة الهجين بالنسبة لمتوسط الأبوين والأب الأعلى على التوالي .

- **عدد الحبوب / السنبلة :** أظهرت خمسة هجن معنوية موجبة في قوة الهجين بالنسبة لمتوسط الأبوين بينما هجين واحد فقط كان معنوياً وموجباً في قوة الهجين بالنسبة للأب الأعلى.
- **وزن ١٠٠ حبة :** أظهرت النتائج أن كل الهجن كانت ذات قيم موجبة ومعنوية في قوة الهجين ما عدا هجين واحد فقط بالنسبة لمتوسط الأبوين وأربعة هجن بالنسبة للأب الأعلى . وتشير النتائج أن الانتخاب يكون مجدياً في تحسين وزن الحبوب أو حجم الحبوب .
- **المحصول البيولوجي / النبات :** أوضحت النتائج عشرة هجن ذات قيم موجبة ومعنوية في قوة الهجين بالنسبة للأب الأعلى .
- **محصول الحبوب / النبات :** أظهرت حسابات قوة الهجين أن اثنا عشر هجيناً أعطت قوة هجين موجبة ومعنوية بالنسبة لمتوسط الأبوين وستة هجن فقط أعطت قيم موجبة ومعنوية في قوة الهجين بالنسبة للأب الأحسن . وتشير هذه النتائج إلى أن الانتخاب سوف يكون مجدياً في تحسين محصول الحبوب / النبات لإنتاج سلالات لها قدرة إنتاجية عالية .

- **القدرة العامة على الائتلاف :**

أظهرت النتائج اختلافات معنوية بين التراكيب الوراثية تحت الدراسة في القدرة العامة على الائتلاف لكل الصفات تحت الدراسة . وكانت القدرة العامة على الائتلاف اكبر من القدرة الخاصة على الائتلاف لكل الصفات تحت الدراسة. تشير هذه النتائج ألي مساهمة الجينات المضيفة والغير مضيفة في التباين الوراثي لهذه المواد تحت الدراسة .
**النسبة بين القدرة العامة على الائتلاف ألي القدرة الخاصة على الائتلاف :** كانت أعلى من الوحدة لكل الصفات تحت الدراسة . وتشير هذه النتائج ألي أن الجينات المضيفة تلعب دوراً هاماً في وراثة هذه الصفات .

الصنف سوهاج ١ كان له قدرة عالية على الائتلاف بالنسبة لصفات تاريخ طرد السنابل ، تاريخ النضج ، عدد السنابل / النبات ، المحصول البيولوجي / النبات ومحصول الحبوب / النبات . الصنف سوهاج ٢ كان له قدرة عالية على الائتلاف بالنسبة لصفات

طول النبات ، طول السنبلة ، وزن ١٠٠ حبة والمحصول البيولوجي / النبات . الصنف سوهاج ٣ اظهر قدرة عامة على الائتلاف بالنسبة لصفات طول السنبلة وعدد الحبوب / السنبلة .والصنف بنى سويف ١ له قدرة عامة على الائتلاف بالنسبة لصفات تاريخ طرد السنابل وتاريخ النضج وطول السنبلة . أما الصنف بنى سويف ٣ له قدرة ائتلافية عامة بالنسبة لصفات طول النبات ، عدد السنابل / النبات ، عدد الحبوب / السنبلة ، وزن ١٠٠ حبة ومحصول الحبوب / النبات ، بينما السلالة رقم ٧ Belikh//Gediz/Bit لها قدرة ائتلافية عامة بالنسبة لصفات تاريخ طرد السنابل وعدد الحبوب / السنبلة وهذه النتائج توضح أن هذه السلالة فقيرة في القدرة العامة على الائتلاف بالنسبة لباقي الصفات

- **القدرة الخاصة علي الائتلاف**

* **عدد السنابل / النبات** : أظهرت أربعة عشر هجينا قيما موجبة للقدرة الخاصة علي الائتلاف أعلى قيم موجبة بالنسبة للقدرة الخاصة للائتلاف كانت للهجن الناتجة من التهجين بين الآباء (١×٢) ، (٤×٧) .
* **عدد الحبوب /السنبلة** :أظهرت تسعة هجن قيما موجبة للقدرة الخاصة على الائتلاف وأعلى قيم حصل عليها من الهجن الناتجة من التهجين بين الآباء (١×٦)، (٢×٤)، (٤×٥)، (٦×٧).
* **وزن ١٠٠حبة** :اظهر ثلاثة عشر هجينا قيما موجبة بالنسبة للقدرة الخاصة على الائتلاف وأعلى قيم تم الحصول عليها من الهجن (١×٢)، (٤×٦).
* **المحصول البيولوجي / النبات** : اظهر اثنتا عشر هجينا قيما موجبة للقدرة الخاصة على الائتلاف وأعلى قيم حصل عليها من الهجن (٢×٦)،(٤×٦)،(٤×٧).
* **محصول الحبوب / النبات** : اظهر اثنتا عشر هجينا قيما موجبة وتسعة هجن قيما سالبة بالنسبة للقدرة الخاصة على الائتلاف بينما الهجن (١×٣)، (١×٦)، (٢×٦)، (٢×٧)، (٤×٥) أعطت اكبر قيما موجبة للقدرة الخاصة على الائتلاف .