TABLE OF CONTENTS

CONTENTS	Page

LIST OF TABLES

5- SUMMARY

This study was carried out at Etay El-Baroud Agricultural Research Station during the two successive wheat-growing seasons, 2009/10 and 2010/11, using eight diverse common wheat genotypes (*Triticum aestivum,* L.). These genotypes were; Sahel 1 (P_1), Sakha 8 (P_2), Sakha 93 (P_3), Gemmeiza 9 (P_4), Misr 1 (P_5), Sham 6 (P_6), Line 1 (P_7) and Line 2 (P_8). All possible cross combinations excluding reciprocals were made among the eight genotypes to produce their twenty eight F_1 crosses. In 2010/11 season the eight parents and their twenty eight F_1 hybrid seeds were sown in 25th of November in two separate irrigation regime experiments. The first experiment (normal conditions, N) was irrigated four times after sowing irrigation i.e.; five irrigations were given through the whole season. The second experiment (water stress conditions, S) was given one surface-irrigation 29 days after the establishment at the tillering stage (only two irrigations were given through the whole season). In each experiment, the genotypes were grown in a randomized complete block design (RCBD) with three replicates. Each experiment was surrounded by a wide border (12 m) to minimize the underground water permeability.

The weather conditions such as monthly mean air temperature at (C°), relative humidity (RH %), and rainfall (mm/month) in winter season, 2010 / 11 at Etay EL-Baroud site were estimated. Data for the studied traits were recorded on 10 individual guarded plants chosen from each genotype in each of the three replications for the two experiments. Measurements recorded were: days to heading (HD), days to anthesis (AD), days to physiological maturity (MD), grain filling period (GFP), grain filling rate (GFR), flag leaf area (FLA), plant height (PH), peduncle length (Ped.L); spike length (SL), number of spikelets / spike (Sps/S), number of spikes / plant (S/P), number of kernels / spike (K/S), 1000-kernels weight (1000-Kwt), grain yield / plant (GY/P), biological yield / plant (Bio.Y/P); straw yield / Plant, harvest index (HI) and drought sensitivity index (SI). An ordinary analysis of variance and heterosis were performed for F_1 diallel set by **Mather** and **Jinks (1982)**. The data were analyzed using **Griffing (1956)** method 2 model 1 to estimate general combining ability (GCA) and specific combining ability (SCA) effects. Simple correlation coefficients (r) among all the studied traits in each F_1 population were estimated according to **Snedecor** and **Cochran (1967).**

The obtained results could be summarized as follows:

1- Analysis of variance:

Highly significant genotypes mean squares were detected for all studied traits, providing evidence for presence of large amount of genetic variability, which considered adequate for further biometrical assessment. Results also, showed that the mean squares due to parents were highly significant for all the studied traits under both normal and water stress conditions. These findings indicate that the parental varieties genotypes differ in their mean performance in all traits under study. Meanwhile, significant or highly significant differences of crosses mean squares were detected for all traits under both conditions, reflecting the diversity of the parents for these studied traits and that this diversity could be transmitted to their progenies. However, mean squares of parents vs. crosses showed highly significant differences for all studied characters under both conditions except days to physiological maturity under water stress conditions, indicating the presence of hybrid vigor for the studied wheat genotypes.

2- Mean performance:

The water stress treatment decreased the means of HD, AD, MD, GFP, PH, Ped.L, S/P, Sps/S, K/S, 1000-Kwt, GY/P, Biol.Y/P and Stw.Y/P for parents and their hybrids, meanwhile GFR increased due to the decline in GFP. Harvest index (HI) was insignificantly decreased

These results indicated that the parental Line 2 (P_8) possessed genes controlling earliness of days to heading, while Gemmeiza 9 has genes for lateness.

Days to anthesis trait (AD) behaved in the same trend as days to heading (HD).

The parental genotypes Line 2 followed by Misr 1 under both conditions in addition to Sakha 8 under water stress condition were the earliest in maturity.

The earliest crosses for (MD) were (Sahel 1 x Line 2), (Sakha 8 x Line 2), (Sakha 93 x Line 2), (Misr 1 x Line 2) and (Line 1 x Line 2). Under both normal and water stress conditions, the earliness of these crosses could be attributed to the earliness of Line 2 which may possessed the genes controlling earliness to its off spring.

The parental genotype Sham 6 was the shortest one for GFP under both conditions although it was the latest parent regarding HD and MD.

The parental Line 2 (P_8) ranked the first for (GFR) under both conditions, the parent Sakha 8 (P_2) ranked second in GFR. The crosses (Gemmeiza 9 x Line 2), (Gemmeiza 9 x Misr 1) and (Sakha 8 x Line 2), respectively had the highest values.

The parental genotype Line 2 exhibited the highest values for FLA followed by Sham 6 under both normal and water stress conditions. Gemmeiza 9 was the lowest one for this trait. The crosses (Sakha 93 x Sham 6), (Gemmeiza 9 x Sham 6), (Misr 1 x Line 2), (Sham 6 x Line 1) and (Sham 6 x Line 2) had the highest values for FLA under normal conditions. The latest three crosses in addition to (Sakha 93 x Line 2) and (Line 1 x Line 2) exhibited the highest values under stress conditions. The superiority of these crosses for this trait could be attributed to the superiority of the two parents Line 2 and Sham 6.

The tallest parents were Sham 6 and Sahel 1 under normal condition, Sakha 8 and Sham 6 were the tallest under stress conditions. While the shortest one was Sakha 93 under both conditions and Line 1 under water stress condition. The tallest crosses were (Gemmeiza 9 x Sham 6), (Sham 6 x Line 2), (Gemmeiza 9 x Line 2), (Gemmeiza 9 x Line 1) and (Sakha 8 x Gemmeiza 9), respectively under normal conditions. The crosses (Sahel 1 x Gemmeiza 9), (Sakha 8 x Sham 6) and (Sahel 1 x Sham 6), respectively were the tallest under stress conditions. Meanwhile, the crosses (Sahel 1 x Sakha 93), (Sakha 93 x Misr 1) and (Sakha 93 x Line 1) had the shortest plants under both normal and stress conditions.

The high estimates of number of spikes / plant under both conditions belonged to Sakha 8 followed by Sham 6 and Misr 1 while the lowest one belonged to Line 2 (P_8), it was the poorest one for this trait under both normal and stress conditions.

The three crosses (Sakha 8 x Sakha 93), (Sakha 93 x Misr 1) and (Sahel 1 x Sakha 8), respectively showed the highest number of spikes/plant under the two conditions. While, the lowest S/P belonged to (Sahel 1 x Line 2), (Sakha 8 x Line 2), (Gemmeiza 9 x Line 2), (Misr 1 x Line 2), (Sham 6 x Line 2) and (Line 1 x Line 2). Such results indicated that the parental Line 2 was the prevailing in inheriting the lowest number of spikes / plant to his off spring.

The parental Line 2 was the superior parent while, the parental cultivar Sakha 8 ranked the last for spike length under both normal and stress conditions. The cross (Sham 6 x Line 2) had the tallest spike under normal conditions

The parental cultivar Gemmeiza 9 ranked the first for number of spikelets / spike under both normal and stress conditions followed by Sahel 1 under normal conditions and Line 2 under both conditions.

All the crosses which the parental cultivar Gemmeiza 9 take apart in (except the cross Gemmeiza 9 x Misr 1) exhibited the highest values for number of spikelets / spike under both normal and stress conditions.

Under both conditions, the parental Line 2 and Sakha 8 showed the highest and lowest number of kernels/spike, respectively. The cross (Sahel 1 x Line 2) ranked first for K/S trait followed by the two crosses (Sakha 8 x Line 2) and (Misr 1 x Line 2) under both conditions. The high number of kernels / spike in those three crosses could be attributed to long spike they owned.

The heaviest Kwt belonged to Line 2 (P_8) under both normal and stress conditions.

All the seven crosses which the parental Line 2 take apart in i.e., (Sahel 1 x Line 2), (Sakha 8 x Line 2), (Sakha 93 x Line 2), (Gemmeiza 9 x Line 2), (Misr 1 x Line 2), (Sham 6 x Line 2) and (Line 1 x Line 2) in addition to the cross (Gemmeiza 9 x Misr 1) had the heaviest kernel weight (Kwt) under both normal and stress conditions, the cross (Gemmeiza 9 x Line 2) ranked the first. The superiority of theses crosses could be attributed to superiority of the parental Line 2 in this trait.

Both parental genotypes Misr 1 (P_5) and Sakha 8 (P_2) were the highest parents for grain yield at normal and water stress conditions, respectively. They own high number of spikes / plant.

The parental Line 2 (P_8) was the lowest one for grain yield/plant in spite of its superiority in no. of kernels / spike (K/S) and1000-kernel weight. This performance is clearly attributed to its poorness in number of spikes/plant.

The crosses (Sahel 1 x Sakha 8), (Sahel 1 x Gemmeiza 9), (Sahel 1 x Line 1), (Sakha 8 x Sakha 93) and (Sham 6 x Line 1) yielded more than the other crosses under normal conditions. The crosses (Sahel 1 x Sakha 8), (Sakha 8 x Sakha 93), (Sakha 8 x Gemmeiza 9), (Sakha 8 x Line 2) and (Sakha 93 x Gemmeiza 9) yielded high under stress conditions. The cross (Sahel 1 x Sakha 8) was the superior one under both normal and water stress conditions, since it was superior in number of spikes / plant and biological yield.

The parental genotype Sham 6 (P_6) showed the highest values for both biological yield / plant and straw yield / plant under both normal and water stress conditions. Meanwhile, the parental Line 2 (P_8) was the lowest one for these two traits since it had fewest number of spikes / plant under both normal and stress conditions.

The cross (Sakha 8 x Gemmeiza 9) followed by (Gemmeiza 9 x Line 1), (Sakha8 x Sakha 93), (Sahel 1 x Sakha 8), (Sahel 1 x Gemmeiza 9) and (Sakha 93 x Misr 1), respectively exhibited the highest values for biological yield under normal conditions. Meanwhile, the crosses (Sakha 8 x Sakha 93) and (Sakha 8 x Gemmeiza 9) were the highest for biological yield / plant under water stress conditions.

With respect to harvest index (H.I %), Line 2 (P_8), Sakha 8 (P_2) and Sahel 1 (P_1), respectively were the best under water stress conditions. The best cross for (H.I %) under the two conditions was (Sahel 1 x Line 2) followed by three crosses i.e., (Sakha 8 x Line 1), (Misr 1 x Line 2) and (Sham 6 x Line 1) under normal conditions, and followed by the cross (Sahel 1 x Sakha 8) under both normal and water stress conditions.

3- Heterosis percentages:

The cross (Sahel 1 x Sham 6) is considered the best cross concerning heterosis for earliness since it kept highly significant negative desirable heterotic effects relative to mid-parents and better parent for earliness characteristics (days to heading, days to anthesis and days to physiological maturity) under both conditions.

The cross (Sakha 93 x Line 2) was the only one which didn’t express desirable negative significant heterotic effects relative to either mid-parents or better parent for days to heading, days to anthesis and days to physiological maturity under normal and water stress conditions, therefore it was considered the worst cross in this concern.

Concerning grain filling period (GFP), none of the crosses exhibited significant negative heterotic effects relative to mid and better parents under normal irrigation conditions. Meanwhile, seven crosses i.e., (Sakha 93 x Misr 1), (Gemmeiza 9 x Misr 1), (Gemmeiza 9 x

Line 1), (Gemmeiza 9 x Line 2), (Misr 1 x Line 1), (Misr 1 x Line 2) and (Line 1 x Line 2) showed negative significant and highly significant heterosis relative to mid-parents under water stress conditions. The cross (Line 1 x Line 2) had the highest value of negative heterosis relative to mid-parents for GFP, and it was the only cross which exhibited significant negative heterotic effect relative to better parent for (GFP) under water stress conditions.

Regarding plant height, four crosses *viz.,* (Sakha 8 x Gemmeiza 9), (Gemmeiza 9 x Line 1), (Gemmeiza 9 x Line 2) and (Misr 1 x Line 1) showed significant positive heterotic effects relative to mid and better parent under both conditions. On the other hand, the cross (Sahel 1 x Sham 6) manifested significant negative heterosis relative to both mid and better parent under normal irrigation conditions, while the crosses (Sahel 1 x Sakha 93) and (Sakha 93 x Sham 6) showed significant estimates of negative heterosis relative to better parent under normal irrigation and also under water stress conditions.

For peduncle length, none of the tested crosses exhibited significant negative heterotic effects relative to mid and better parent under both normal and water stress conditions.

Concerning number of spikes per plant, under normal irrigation conditions the desirable positive significant heterosis effects relative to mid-parents ranged from 13.47% for (Gemmeiza 9 x Sham 6) to 53.06% for (Gemmeiza 9 x Line 2) and the heterosis effects relative to better parent ranged from 12.68% for (Sham 6 x Line 1) to 47.31% for (Sahel 1 x Sakha 93). Four crosses i.e., (Sahel 1 x Sakha 93), (Sakha 8 x Sakha 93), (Sakha 93 x Misr 1) and (Gemmeiza 9 x Line 2) exhibited highly significant positive values of heterosis over mid parents exceeded 50%. These four crosses kept their superiority for heterosis relative to better parent, except the cross (Gemmeiza 9 x Line 2) which showed insignificant heterosis effect relative to better parent, this may be due to the very poorness of the parental Line 2 (P_8) for no. of spikes / plant (S/P).

Five crosses i.e., (Sahel 1 x Sakha 8), (Sahel 1 x Sakha 93), (Sahel 1 x Gemmeiza 9), (Sakha 8 x Sakha 93) and (Sakha 93 x Gemmeiza 9) exhibited highly significant positive values of heterosis over mid and better parents under both normal and water stress conditions due to over-dominance for number of spikes / plant.

Regarding spike length the two crosses (Sahel 1 x Sakha 93) and (Sahel 1 x Misr 1) kept significant and highly significant positive heterotic effect relative to mid and better parents under both normal irrigation and water stress conditions.

For number of spikelets / spike, the cross (Sakha 8 x Misr 1) was the only cross who showed highly significant heterotic effects relative to both mid-parents and better parent under both normal and water stress conditions.

Concerning number of kernels / spike (K/S), under normal irrigation conditions only two crosses i.e., (Sakha 93 x Line 1) and (Sham 6 x Line 1) manifested significant positive heterotic effects relative to better parent due to over-dominance (7.38% and 5.78%), respectively. Meanwhile, under water stress conditions three crosses *viz.,* (Sahel 1 x Line 2), (Sakha 8 x Gemmeiza 9) and (Sakha 8 x Line 2) showed highly significant positive heterotic effects relative to mid-parents. The second cross (Sakha 8 x Gemmeiza 9) had the highest estimate and it was the only cross which showed significant positive heterotic effects (5.44%) relative to better parent under water stress conditions.

Concerning 1000-kernel weight, under normal irrigation conditions four crosses namely; (Sahel 1 x Line 2), (Sakha 93 x Line 2), (Gemmeiza 9 x Line 2) and (Misr 1 x Line 2) showed significant positive heterotic effects relative to both mid and better parent, the cross (Sahel 1 x Line 2) had the highest heterotic effects estimates relative to both mid-parents and better parent (23.23% and 9.49% respectively). Meanwhile, fifteen crosses expressed significant positive heterotic effect reparative to both mid and better parents under water stress conditions. The cross (Gemmeiza 9 x Misr 1) showed the highest heterotic effects relative to mid and better parents (25.34% and 19.01%, respectively).

Regarding flag leaf area, under normal irrigation conditions the two crosses (Sahel 1 x Sham 6) and (Sakha 8 x Misr 1) manifested the highest significant positive heterosis values relative to both mid-parents and better parent (38.97% and 31.92% for the first) and (32.74% and 30.38% for the second). Meanwhile, the cross (Sahel 1 x Misr 1) manifested the highest significant positive heterotic effects relative to both mid and better parents (45.50% and 40.45% respectively) under water stress conditions.

Concerning biological yield, the four crosses *viz.,* (Sahel 1 x Sakha 8), (Sahel 1 x Sakha 93), (Sakha 8 x Sakha 93) and (Sakha 93 x Line 2) manifested the highest significant positive heterotic effects relative to both mid-parents and better parent under normal irrigation conditions. Meanwhile, under water stress conditions (Sahel 1 x Gemmeiza 9), (Sahel 1 x Misr 1), (Sakha 8 x Gemmeiza 9) and (Sakha 93 x Gemmeiza 9) had the highest significant positive heterotic effects relative to both mid-parents and better parent.

Regarding grain yield / plant, under normal irrigation conditions the crosses (Sahel 1 x Sakha 8), (Sahel 1 x Line 1), (Sahel 1 x Line 2) and (Sakha 93 x Line 2) manifested significant positive heterotic effects greater than 60% relative to mid-parents and greater than 50% relative to better parent, except the first cross. While, the crosses (Sahel 1 x Sakha 8), (Sahel 1 x Misr 1), (Sahel 1 x Line 2), (Sakha 8 x Sakha 93), (Sakha 93 x Gemmeiza 9) and (Sakha 93 x Line 2) had the highest values of heterotic effects relative to both mid and better parents under water stress conditions.

For straw yield, Eight crosses i.e., (Sahel 1 x Sakha 8), (Sahel 1 x Gemmeiza 9), (Sahel 1 x Misr 1), (Sahel 1 x Line 1), (Sakha 8 x Sakha 93), (Sakha 8 x Gemmeiza 9), (Sakha 8 x Line 2) and (Sakha 93 x Gemmeiza 9) exhibited significant and highly significant positive heterotic effects relative to mid and better parent under both normal and stress conditions.

Concerning harvest index, under normal irrigation conditions five crosses showed significant positive heterosis relative to mid-parents and better parent, these crosses are (Sahel 1 x Gemmeiza 9), (Sahel 1 x Sham 6), (Sahel 1 x Line 1), (Sahel 1 x Line 2) and (Sham 6 x Line 1), the latest cross had the highest values of heterosis relative to mid and better parent (37.01% and 36.54%) respectively. While, only three crosses i.e., (Sakha 93 x Misr 1), (Sakha 93 x Sham 6) and (Sham 6 x Line 1) showed significant positive heterosis relative to mid-parents and better parent under water stress conditions. the cross (Sham 6 x Line 1) was the only cross which exhibited highly significant positive heterosis relative to mid and better parent under both conditions.

Regarding grain filling rate, three crosses *viz.,* (Sahel 1 x Misr 1), (Gemmeiza 9 x Misr 1) and (Gemmeiza 9 x Line 2) manifested significant positive heterotic effects relative to mid-parents and better parent values under both normal and water stress conditions.

4- Combining ability effects:

The mean squares associated with general and specific combining ability were found to be highly significant for all traits studied under normal and water stress conditions. Values for δ^2GCA/δ^2SCA exceeded the unity were detected for all traits under both conditions, except for grain yield / plant under normal irrigation conditions.

a- General combining ability (GCA) effects:

The parental genotype Line 2 (P_8) was considered as the best combiner for all earliness attributes i.e., days to heading, days to anthesis and days to physiological maturity under both normal and water stress conditions, while the two parental genotypes Sakha 93 (P_3) and Line 1 (P_7) were considered as good combiners for HD and AD under both normal and water stress conditions and the parental genotype Misr 1 (P_5) was considered as good combiner for AD and MD under both normal and water stress conditions. Meanwhile, the two parental genotypes Gemmeiza 9 (P_4) and Sham 6 (P_6) were considered as the worst combiners for all earliness attributes i.e., (HD, AD and MD). The parental genotypes; Sahel 1 (P_1), Gemmeiza 9 (P_4), Misr 1 (P_5) and Sham 6 (P_6) were considered as good combiners for short grain filling period under both conditions. Meanwhile, the parental genotype Sakha 93 had the highest ($\hat{g}_i$) effects for stretched grain filling period under both conditions.

The three parental genotypes Gemmeiza 9, Sham 6 and Line 2 had significant ($\hat{g}_i$) effects in desirable direction under all conditions for plant height. Meanwhile, the parental genotypes Sahel 1, Sakha 93 and Gemmeiza 9 exhibited desirable ($\hat{g}_i$) effects for peduncle length.

The parental genotypes; Sakha 8 (P_2), Sakha 93 (P_3) and Line 1 (P_7) were considered as good combiners for number of spikes / plant under both normal and water stress conditions. Misr 1 and Sham 6 had significant ($\hat{g}_i$) effects for S/P under normal conditions and also Sahel 1 under water stress conditions. Sakha 8 was the best combiner for increasing number of spikes / plant followed by the parental cultivar Sakha 93. On the other hand Line 2 (P_8) appeared to be bad combiner for this trait, since it expressed highly significant negative GCA effects under both normal and stress conditions.

The parental genotype Line 2 (P_8) was considered as the best combiner for all the following traits i.e., spike length, number of kernels / spike, 1000-Kernel weight and flag leaf area under normal and water stress conditions, since it expressed the highest significant positive GCA effects for these traits under all conditions. Meanwhile, the parental genotype Gemmeiza 9 (P_4) exhibited the highest desirable ($\hat{g}_i$) effects for under of spikelets / spike under both normal and water stress conditions.

The parental genotype Gemmeiza 9 could be considered as the best combiner for biological yield under normal conditions and for straw yield under both normal and water stress conditions. Also, Sakha 8 and Sakha 93 were considered as god combiners for both biological yield and straw yield under water stress conditions.

Concerning grain yield per plant, two parental genotypes i.e., Sahel 1 (P_1) and Sakha 8 (P_2) exhibited significant desirable ($\hat{g}_i$) effects under both normal and water stress conditions. The parental genotypes Sakha 93 (P_3) showed desirable ($\hat{g}_i$) effects under water stress conditions and Gemmeiza 9 (P_4) under normal irrigation conditions. The parental genotype Sakha 8 (P_2) was considered as the best combiner for grain yield per plant, since it expressed highest significant positive GCA effects for these traits under all conditions.

The three parental genotypes Sahel 1, Sakha 8 and Line 2 showed significant positive GCA effects for harvest index under normal and water stress conditions, the latest one (Line 2) was considered as the best combiner for this trait under both conditions.

The three parental genotypes Gemmeiza 9, Misr 1 and Line 2 manifested significant positive GCA effects for grain filling period under normal and water stress conditions and the parental genotype Sham 6 under normal irrigation conditions, the parental genotype Line 2 (P_8) was considered as the best combiner for GFR under all conditions.

b- Specific combining ability (SCA) effects:

The two crosses (Sahel 1 x Sham 6) and (Gemmeiza 9 x Sham 6) exhibited significant desirable ($\hat{s}_{ij}$) effects for days to heading, days to anthesis and days to physiological maturity under both normal and water stress conditions. Four crosses i.e., (Sahel 1 x Misr 1), (Sakha 8 x Sham 6), (Sakha 8 x Line 1) and (Sakha 93 x Gemmeiza 9) showed significant desirable ($\hat{s}_{ij}$) effects for HD and AD under both normal and water stress conditions and for MD under normal irrigation conditions. The cross (Sakha 93 x Misr 1) showed the highest desirable SCA effect for days to physiological maturity under water stress conditions (-3.34^{**}).

Concerning grain filling period, two crosses i.e., (Gemmeiza 9 x Misr 1) and (Gemmeiza 9 x Line 2) exhibited significant negative SCA effects under both conditions. Also as in days to physiological maturity, the cross (Sakha 93 x Misr 1) showed the highest significant negative ($\hat{s}_{ij}$) effect for grain filling period under water stress conditions (-3.96^{**}).

Concerning plant height, three crosses i.e., (Gemmeiza 9 x Line 1), (Misr 1 x Sham 6) and (Misr 1 x Line 2) showed significant positive ($\hat{s}_{ij}$) effects under both conditions, the highest significant and positive ($\hat{s}_{ij}$) effects were detected by (Sakha 8 x Sakha 93) and (Sakha 8 x Gemmeiza 9) under normal and water stress conditions, respectively (5.56^{**} and 6.82^{**}). On the other side, the cross (Sahel 1 x Sakha 93) exhibited significant negative SCA effects under both conditions. The highest significant and negative ($\hat{s}_{ij}$) effects for plant height were detected by (Sakha 8 x Line 2) and (Gemmeiza 9 x Misr 1) under normal irrigation and water stress conditions, respectively (-4.78^{**} and -3.54^{**}).

Two crosses i.e., (Sakha 8 x Sham 6) and (Gemmeiza 9 x Sham 6) and three crosses *viz.,* (Sahel 1 x Sakha 8), (Gemmeiza 9 x Misr 1) and (Sham 6 x Line 1) exhibited significant desirable negative SCA effects for peduncle length under normal irrigation and water stress conditions, respectively.

Three crosses i.e., (Sahel 1x Sakha 8), (Sakha 8 x Sakha 93) and (Sakha 8 x Gemmeiza 9) exhibited significant desirable positive ($\hat{s}_{ij}$) effects for number of Sikes/plant under normal irrigation and water stress conditions, the cross (Sakha 93 x Misr 1) had the highest ($\hat{s}_{ij}$) effect under normal irrigation conditions (5.05^{**}) Meanwhile, the cross (Sakha 93 x Sham 6) showed undesirable significant SCA effects for S/P under both conditions.

The two crosses (Sahel 1 x Misr 1) and (Misr 1 x Line 2) exhibited significant positive ($\hat{s}_{ij}$) effects for spike length under normal irrigation and water stress conditions. Meanwhile the four crosses (Sakha 8 x Gemmeiza 9), (Sakha 8 x Misr 1), (Sakha 8 x line 2) and (Misr 1 x Line 2) expressed significant positive SCA effects for number of spikelets/spike under both conditions.

Five crosses *viz.,* (Sahel 1 x Line 2), (Sakha 8 x Gemmeiza 9), (Sakha 8 x Line 2), (Sakha 93 x Gemmeiza 9) and (Sakha 93 x Line 1) exhibited significant desirable ($\hat{s}_{ij}$) effects for number of kernels/spike under normal irrigation and water stress conditions.

Concerning 1000-kernel weight, three crosses i.e., (Sahel 1 x Sakha 8), (Sakha 93 x Line 2) and (Gemmeiza 9 x Line 2) exhibited significant positive SCA effects under both normal irrigation and water stress conditions. The cross (Sahel 1 x Line 2) had the highest value under normal irrigation conditions (6.79^{**}) meanwhile, the cross (Gemmeiza 9 x Misr 1) had the highest value under water stress conditions (5.48^{**}).

Seven crosses *viz.,* (Sahel 1 x Sakha 93), (Sahel 1 x Sham 6), (Sakha 8 x Misr 1), (Sakha 8 x Sham 6), (Gemmeiza 9 x Sham 6), (Gemmeiza 9 x Line 2) and (Line 1 x Line 2) exhibited significant positive ($\hat{s}_{ij}$) effects for flag leaf area under normal irrigation and water stress conditions, the two crosses (Sahel 1 x Sham 6) and (Line 1 x Line 2) had the highest values under normal irrigation conditions, while the crosses (Sahel 1 x Misr 1) and (Sham 6 x Line 1) had the highest values under water stress conditions.

The four crosses (Sahel 1 x Line 1), (Sakha 8 x Sakha 93), (Sakha 8 x Gemmeiza 9) and (Sakha 8 x Line 2) exhibited significant positive SCA effects for both biological yield and straw yield under normal irrigation and water stress conditions. For biological yield, the highest ($\hat{s}_{ij}$) effects belonged to the crosses (Sahel 1 x Sakha 8) and (Sakha 93 x Gemmeiza 9) under both normal and water stress conditions, respectively. While, regarding straw yield, the highest ($\hat{s}_{ij}$) effects belonged to the crosses (Sakha 93 x Misr 1) and (Sahel 1 x Sham 6) under both normal and water stress conditions, respectively

Regarding grain yield / plant (GY/P), six crosses *viz.,* (Sahel 1 x Sakha 8), (Sahel 1 x Line 2), (Sakha 8 x Sakha 93), (Sakha 8 x Line 2), (Sakha 93 x Gemmeiza 9) and (Sakha 93 x Line 2) exhibited significant desirable positive ($\hat{s}_{ij}$) effects under both conditions. The highest SCA effects belonged to the cross (Sahel 1 x Sakha 8) under both normal irrigation conditions (15.28^{**}), while under water stress conditions the cross (Sakha 93 x Gemmeiza 9) had the highest ($\hat{s}_{ij}$) effects for GY/P (9.40^{**}).

Three crosses i.e., (Sahel 1 x Sakha 8), (Sahel 1 x Line 2) and (Sham 6 x Line 1) showed significant positive SCA effects for harvest index under both conditions, the latest cross had the highest significant positive ($\hat{s}_{ij}$) effects (7.54^{**} and 5.37^{**}) under normal and water stress conditions, respectively. On the other hand, the two crosses (Sakha 8 x Sham 6) and (Sakha 8 x Line 2) expressed significant negative ($\hat{s}_{ij}$) effects for harvest index under both normal irrigation and water stress conditions.

Concerning grain filling rate, four crosses *viz.,* (Sahel 1 x Sakha 8), (Gemmeiza 9 x Misr 1), (Gemmeiza 9 x Line 2) and (Misr 1 x Line 1) exhibited significant positive ($\hat{s}_{ij}$) effects under both conditions, and the highest SCA effects values belonged to the two latest crosses (0.125^{**} and 0.217^{**} for Gemmeiza 9 x Line 2 and 0.124^{**}, 0.215^{**} for Misr 1 x Line 1) under normal and water stress conditions, respectively. While the three crosses (Sakha 8 x Sakha 93), (Sakha 8 x Misr 1) and (Gemmeiza 9 x Sham 6) exhibited significant negative SCA effects under both normal and water stress conditions.

5- Stress sensitivity index (SI):

Results cleared that Sakha 93 had SI less than one ($SI<1$) for all the studied traits (except for 1000-kernel weight). The same matter ($SI<1$) was found for the parental genotype Line 2 (except for grain filling rate). Also the parental Line 1(P_7) possessed $SI<1$ for most important traits, especially grain yield / plant.

Results cleared that Gemmeiza 9 had SI greater than one ($SI>1$) for all the studied traits (except for 1000-kernel weight). The parental genotype; Misr 1 possessed ($SI>1$) for all traits, except for days to heading, grain filling rate and spike length.

It is of great interest to note that the crosses; (Sahel 1 x Sakha 8), (Sahel 1 x Misr 1), (Sahel 1 x Line 2), (Sakha 8 x Sakha 93), (Sakha 8 x Misr 1), (Sakha 8 x Sham 6), (Sakha 93 x Gemmeiza 9), (Sakha 93 x Sham 6), (Sakha 93 x Line 2) and (Misr 1 x Line 2) were tolerant for water stress for most studied traits. In addition, (Gemmeiza 9 x Sham 6), (Gemmeiza 9 x Line 2) and (sham 6 x Line 2) were more sensitive combinations for most traits, especially for grain yield.

6- Correlation studies:

Highly significant positive correlation coefficients were observed between days to heading (HD) and each of days to anthesis (AD) and days to physiological maturity (MD) under both normal and water stress conditions. Significant and negative correlation coefficients were detected between HD and each of grain filling period (GFP), flag leaf area (FLA), peduncle length (Ped.L), spike length (SL) and no. of kernels / spike (K/S) under water stress condition and with grain yield / plant (GY/P) and Harvest index (HI) under normal and water stress conditions.

Significant and positive correlation coefficients were found between FLA and each of peduncle length, SL, 1000-Kwt under both conditions and with K/S under normal irrigation conditions.

Significant and positive correlation coefficients were found between no. of spikes / plant (S/P) and each of biological yield / plant, Straw yield / plant and grain yield / plant under both conditions. Meanwhile, significant and negative correlation coefficients were found between S/P and each of SL, K/S and 1000-Kwt under both normal and water stress conditions.

6- CONCLUSION

Results of this study cleared that, each of Sahel 1 (P_1), Sakha 8 (P_2), Sakha 93 (P_3), Line 1 (P_7) and Line 2 (P_8) considered as water stress tolerant genotypes for most of the studied traits, therefore these genotypes could be used in breeding programs aims to improving bread wheat, especially under water stress conditions. The progeny of the crosses (Sahel 1 x Sakha 8), (Sakha 8 x Sakha 93), (Sakha 93 x Gemmeiza 9) and (Sakha 93 x Line 2) could be used for improve bread wheat crop *via* creating line(s) with high yielding ability under both normal and water stress conditions.

The parental Line 2 (P_8) could be used in breeding programs aims to releasing bread wheat line(s) characterized by early mature, it could be used in improving most of yield attributes in wheat. since this parental line (P_8) considered as an excellent combiner for earliness characters, spike length, flag leaf area and harvest index, it considered as an excellent combiner for two yield components i.e., kernels/spike and 1000-kernel weight under both normal and water stress conditions.

High no. of spikes/plant, stretched grain filling period and high harvest index considered as direct selection criteria for high yield under both normal and water stress conditions.

pedigree method still the perfect method for wheat breading, especially the results of the present study pointed that, additive and additive x additive gene effects predominant in the inheritance of most studied traits and hence the suitability of this method of breeding in segregating generations.