5. SUMMARY

The aim of this investigation was to determine heterosis and types of gene action and their interaction with seasons (environments) for some growth and yield traits i.e. days to heading, plant height, number of spikelets/spike, spike length, number of spikes/plant, seed index, number of grains/spike, straw yield per plant, biological yield and harvest index.

To achieve this target F_1 and F_2 of half diallel cross between seven wheat genotypes namely, Gemmeiza 3 (P_1), Line 5 (P_2), Line 8 (P_3), Gemmeiza 9 (P_4), Line (P_5), Sakha 93 (P_6) and Giza 168 (P_7) representing wide range of variability in most of the studied traits were utilized.

In 2001/2002 seasons, crossing was made with all possible combinations among these seven parents and evaluated in successive season 2002/2003 in a randomized complete block design with three replications. In 2003/2004 season, two experiments were conducted, the first involved the parental varieties and/or lines and their 21 possible F_1 crosses and the second included parents and F_2 crosses.

Data were recorded on 20 and 60 individual guarded plants, chosen at random from each plot for F_1 and F_2, respectively. Analysis of variance was performed for the studied traits in each season and then a combined analysis was carried out whenever homogeneity of error variance was realized. Heterosis mean squares and effects for both generations were calculated.

The data were genetically analysis by the procedures by **Griffing (1956) and Hayman (1954a)**.

The obtained results can be summarized as follows: analysis of variance, mean and heterosis:

A- F_1-generation:

1. Season mean squares were significant for all the studied traits, except for; number of spikelets/spike.
2. Significant genotype mean squares were detected for all the studied traits in the separate season as well as their combined analysis, except for; number of spikelets/spike in the first season. Significant denotypes x season interaction mean squares were obtained for all the studied traits, except for; flowering date, number of spikelets/spike, spike length and seed index.
3. Mean squares due to parents were significant for all the studied traits, except for; number of spikelets/spike at both seasons and spike length at the first season while, parents and seasons were detected for all the studied trait, except for; flowering date, plant height, number of spikelets/spike, spike length, number of spikes/plant and seed index.
4. P_1 (Gemmeiza 3) recorded the best values for; seed index, straw yield, biological and grain yield/plant also it ranked the third for plant height, grain yield/plant..
5. The two crosses P_5xP_6 (Line 59 x Sakha 93) and P_1xP_6 (Gemmeiza 3 x Sakha 93) had the highest grain yield/plant in the combined analysis.

6. Mean squares for parent vs. crosses were significant for all the studied traits, except some cases. Significant interaction between parents vs. crosses and season was detected for all traits, except for; number of spikelets/spike, spike length, straw and biological yields.

7. For heading date; five, seven and five crosses expressed significant negative heterotic effects relatives to mid-parent values at first, second seasons as well as their combined analysis, respectively. Meanwhile, the cross P_2xP_6 (Line 5 x Sakha 93) gave significant negative heterotic effects relative to either better parent and mid-parent in both seasons as well as their combined analysis.

8. The cross P_1xP_7 (Gemmeiza 3 x Giza 168) for number of kernels/spike, the crosses P_1xP_4 (Gemmeiza 3 x Gemmeiza 9), P_1xP_6 (Gemmeiza 3 x Sakha 93), P_2xP_4 (Line 5 x Gemmeiza 9), P_4xP_6 (Gemmeiza 9 x Sakha 93) and P_4xP_7 (Gemmeiza 9 x Giza 168) for seed index, cross P_2xP_4 (Line 5 x Gemmeiza 9) for straw and biological yields and three crosses, i.e., P_6xP_7 (Sakha 93 x Giza 168), P_1xP_6 (Gemmeiza 3 x Sakha 93) and P_2xP_6 (Line 5 x Sakha 93) for grain yield/plant, exhibited significant positive heterotic effects relative to the better parent.

9. Concerning grain yield/plant; six, nine and eight crosses exceeded significantly the mid-parent values at the first, second seasons and their combined data, respectively, while, two, five and four from the previous crosses exhibited significant positive heterotic effects relative to better parent.

F_2-generation:

1. Mean squares for; genotypes, parents, F_2 crosses and parents vs crosses, were highly significant for all the studies traits except, parent vs crosses for plant height, spike length and grain yield/plant.
2. The cross P_2xP_6 gave the most desirable remain heterotic effects for; grain, straw, biological yields, number of grains/spike, spike length and number of spikes/plant.

Combining Ability:

F_1-generation:

1. General and specific combing ability mean squares were significant for all studied traits except SCA for, number of spikelets/spike in both seasons and spike length in the first season and GCA for number of spikletes/spike in the first season. GCA/SCA exceeding the unity were detected for most traits.
2. The mean squares of the interaction between seasons and both types of combining ability were significant for; number of grains/spike, harvest index, straw, grain and biological yields/plant.
3. The parental lines P_6 (Sakha 93) and P_2 (line 5) for flowering date, P_6 (Sakha 93), P_3 (Line 8) and P_5 (Line 59) for plant height expressed significant negative g_1 effects. However, P_6 for number spikes/plant, P_1 (Gemmeiza 3) for seed index, P_4 (Gemmeiza 9) and P_1 (Gemmeiza 3) for biological yield/plant, P_3 (Line 8) and P_6 (Sakha 93) for straw yield, P_5

(Line 59) and P_6 (Sakha 93) for grain yield/plant showed significant positive $\hat{g}_1$ effects.

4. The parental combinations: P_2xP_5 (Line 5 x Line 59), P_2xP_6 (Line 5 x Sakha 93), P_3xP_4 (Line 8 x Gemmeiza 9) and P_5xP_7 (Line 59 x Giza 168) for flowering date, cross P_2xP_6 (Line 5 x Sakha 93) for number of spikes/plant, P_1xP_3 (Gemmeiza 3 x Line 8), P_1xP_6 (Gemmeiza 3 x Sakha 93), P_1xP_7 (Gemmeiza 3 x Giza 168), P_2xP_5 (Line 5 x Line 59), P_3xP_4 (Line 8 x Gemmeiza 9), P_4xP_6 (Gemmeiza 9 x Sakha 93) and P_2xP_5 (Line 5 x Line 59) for number of grains/spike; P_1xP_6 (Gemmeiza 3 x Sakha 93), P_1xP_4 (Gemmeiza 3 x Gemmeiza 9), P_5xP_7 (Line 59 x Giza 168) and P_2xP_5 (Line 5 x Line 59) for straw yield, and P_1xP_6 (Gemmeiza 3 x Sakha 93) and P_5xP_6 (Line 59 x Sakha 93) for biological and grain yields/plant expressed significant desirable S_{ij} effects.

5. Significant correlation coefficient values between the parental performance and its g_1 effects were obtained for; flowering date, plant height, seed index straw yield/plant and biological yield/plant in both seasons as well as their combined analysis, spike length and number of grains/spike in the first season as well as the combined analysis, number of spikes/plant and harvest index in the first and second seasons, respectively.

F_2-generation:

1. GCA and SCA mean squares were highly significant for all studied traits. GCA/SCA ratios were higher in magnitude in the F_2 than F_1 generation for most traits.

2. P_6 (Sakha 93) and P_1 (Gemmeiza 3) expressed significant desirable (g^i) effects for flowering date. While, P_5 (Line 59) and P_4 (Gemmeiza 9) expressed significant desirable (g^i) effects for grain yield/plant.
3. P_1xP_4 (Gemmeiza 3 x Gemmeiza 9) for flowering date and P_2xP_6 (Line 5 x Sakha 93) and P_6xP_7 (Sakha 93 x Giza 168) for grain yield/plant expressed significant desirable (S^ij) effects.

Genetic components:

F_1-generation:

1. Significant values for the dominance (H_1) and additive (D) components were obtained for all studied traits, except for; number of spikelets/spike at the second season, which insignificant (D) component was obtained. Significant h^2 values were detected for all studied traits, except for; harvest index in both seasons, flowering date in the first season, number of spikelets/spike and spike length in the second one.
2. Studies on degree of dominance revealed the existence of over dominance for all traits, except for plant height in the second season. The negative and positive alleles were unequally distributed in the parents for most studied traits. High to moderate heritability values were detected for most traits.

F_2-generation:

1. Significant additive (D) and dominance components (H_1) were obtained for all the studied traits.
2. The average degree of dominance showed the presence of partial dominance for all studied traits, except for; number of spikelets/spike and number of spikes/plant. Positive and negative alleles were unequally distributed in the parents for all studied traits.
3. Significant h^2 values for all traits, except for; plant height, spike length, grain yield/plant and harvest index.
4. Moderate to low heritability estimates in narrow sense were detected in all the studied traits.