LIST OF CONTENTS

CONTENTS

CONTENTS

5- SUMMARY

The present work was carried out at the Experimental Farm of Gemmeiza Agriculture Research Station, Egypt during 2005/06 and 2006/07 growing seasons. Ten local and introduced bread wheat genotypes i.e Gemmeiza 7, Giza 168, Sids 1, Gemmeiza 10 four local genotypes, Line 1, Line 2, Line 3, Line 4, Line 5 and Line 6 were used in a diallel cross excluding reciprocals to study;

(I) The effect of nitrogen fertilizer in wheat.

(2) The potentiality of heterosis expression for number of days to heading, number of days to maturity, kernel weight per main spike, plant height, spike length, number of spikes per plant, number of spikelets per spike, number of kernels per spike, 100-kernel weight and grain yield per plant.

(3) The magnitude of both general and specific combining ability and their interactions with the two nitrogen fertilizer levels.

(4) Gene action and the importance which should be given to this material in a breeding program by evaluating the ten wheat varieties according to their general combining ability effects.

In the first season of 2005/06 the ten parental wheat genotypes were self-pollinated to produce enough seeds from each parental genotype. In the same time all cross combination between them were made excluding reciprocals to produce 45 F_1 hybrids. In the second season 2006/07, 45 F_1 crosses together with their parental cultivars were evaluated under the two nitrogen fertilization levels i.e., 30 kg N./fed (low level) and 70 (normal level) Kg. N./fed. In two adjacent experiments, respectively. In each nitrogen level, randomized complete block design with three replicates was used.

The obtained results can be summarized as follow:-

A: Analysis of variance means and heterosis:

Nitrogen fertilizer levels mean squares were found to be highly significant for all traits studied under the two nitrogen fertilizer levels as well as the combined data. The effect of nitrogen fertilizer levels on the studied traits showed that all traits increased significantly with increasing nitrogen levels up to 70 kg N/fed.

Test of significance indicated that the mean squares of genotypes were highly significant for all studied traits at two nitrogen fertilizer levels as well as the combined except spike length in level 1, analysis and the genotypes by nitrogen fertilizer level interaction were also highly significant for all studied traits except kernel weight in the main spike, spike length and number of kernels per spike.

Mean squares due to parents were significant and highly significant for all traits at the two nitrogen fertilizer levels as well as the combined data except kernel weight in the main spike in level 1, while mean squares due to interaction between parents and nitrogen levels were obtained highly significant for all studied traits except number of days to maturity, kernel weight in the main spike, spike length, and number of kernels per spike and 100- kernel weight.

Mean square due to crosses were highly significant for all studied traits at two nitrogen fertilizer levels as well as the combined data except spike length in level 1, while mean squares due to interaction between crosses and nitrogen levels were obtained significant for all studied traits except number of days to

heading, kernel weight in the main spike, spike length, number of spikelets per spike and number of kernels per spike.

Parents vs crosses mean squares as an indication to average heterosis overall crosses were found to be significant and highly significant for all studied traits studied at the two nitrogen fertilizer levels and their combined data except number of days to maturity, kernel weight in the main spike, spike length and number of spikes per plant in level 1 and kernel weight in the main spike, spike length, number of spikelets per spike and grain yield per plant in level 2. The interaction of parents vs crosses with nitrogen fertilizer levels was found to be significant for all studied traits, except number of days to heading, number of days to maturity, kernel weight in the main spike, spike length, number of spikes per plant, number of kernels per spike and 100- kernel weight and.

The parental line (P_1) was the first for kernel weight per main spike, number of spikeletes/ spike, number of kernels / spike and the second for main spike length. The parental line (P_2) ranked the first porent for grain yield / plant and the second for number of spikeletes / spike and number of kernels / spike. The parental line (P_3) ranked the third for talled main spike length. The parental line (P_4) ranked the second for shortest plant (101.25cm) and the third for grain yield / plant. The parental line (P_5) was the first for the number of spikes / plant, the second for number of days to heading (81.6 days) and the third for shortest plant (102.80 cm). The parental variety (P_6) ranked the first for shortest plant (100.02cm), main spike length, the second for number of days to maturity (141.56 days) and the third for number of days to heading (81.63 days). The parental variety (P_7) ranked the first for number of days to heading (80.56 days),

number of days to maturity (140.4 days), the second for the grain yield / plant and the third for the 100- kernel weight. The parental variety (P_8) was the third for talled plant (114.29cm). The parental line (P_9) the first for the main spike length, 100- kernel weight, the second for number of spikes / plant and the third for number of spikeletes / spike and number of kernels / spike. The parental variety (P_{10}) ranked the first for talled plant (120.51cm), the second for the kernel weight per main spike, 100- kernel weight and the third for number of days to maturity (141.2 days).

The, three crosses (P_6 x P_7, P_6 xP_9 and P_5 x P_7) were the best for number of days to heading; the three crosses (P_6 x P_9, P_5 xP_{10} and P_6 xP_{10}) for number of days to maturity; four crosses (P_5xP_6 , P_3 xP_6, P_6 xP_9 and P_5 xP_7) for plant height; four crosses (P_1 xP_{10}, P_5 xP_9, P_2 xP_3 and P_9xP_{10})for kernel weight main spike; the crosses (P_1x P_4, P_2 x P_9, P_2 xP_4 and P_1xP_9) for spike length; four crosses(P_9xP_{10}, P_3 xP_5, P_2xP_3 and P_6 xP_7)for number of spikes per plant; four crosses(P_1xP_4, P_4xP_{10}, P_1xP_9 and P_4 xP_9)for number of spikelets per spike; four crosses(P_4xP_7, P_4xP_5, P_2xP_3 and P_1xP_4) for number of kernels per spike; five crosses(P_9xP_{10}, P_5 xP_8, P_4xP_6, P_6xP_8 and P_1 xP_5) for 100-kernel weight and four crosses(P_7xP_{10}, P_8xP_9, P_3xP_8 and P_7xP_9) for grain yield /plant and had the best values at different nitrogen fertilizer levels as well as the combined data.

The wheat cultivars; P_5, P_6 and P_7 and their crosses (P_6 × P_7), (P_5 × P_7) exhibited good level of earliness. Meanwhile, the wheat parents P_6 and P_5 as well as their F_1 (P_6 × P_9) and (P_5 × P_{10}) had earliness maturity date. With regard to plant height, the exotic parental wheat cultivars P_5 and P_6 and their F_1 crosses (P_5 ×

P_6) and (P_3 ×P_6) were the shortest ones. Otherwise, the wheat parental genotypes; P_1 and P_{10} as well as their F_1 crosses (P_1×P_{10}), (P_9× P_{10}) and (P_4× P_{10}) were the tallest ones and kernel weight main spike. These results hold true under the two nitrogen levels and the combined data. The parental wheat genotypes; P_1, P_4, P_7 and P_9 as well as their F1 crosses (P_1 ×P_4), (P_4×P_7), (P_4 ×P_{10}), (P_1× P_9) and (P_2 × P_3) were the promising ones for number of spikelets per spike and number of kernels per spike under the two nitrogen levels and their combined data. The wheat genotypes, P_1, P_2, P_4, P_5, P_7, P_8, P_9 and P_{10} as well as their F_1 crosses (P_1 × P_4) , (P_4 × P_6) , (P_2 × P_9), (P_8 × P_9) , (P_8× P_{10}) and (P_9 × P_{10}) were superior for main spike length, number of spike per plant, 100-kernel weight and grain yield per plant under different cases.

The results showed that sixteen, twenty and seventeen crosses expressed significant and highly significant negative heterotic effect relative to mid-parents values at 30, 70 kg N./fed. as well as their combined data for number of days to heading comparing the heterosis better parent one, five and three crosses at 30, 70kg N/fed. and their combined data. For number of days to maturity for five, three and two crosses xpressed significant highly significant negative heterotic effects relative to mid- parents values for 30,70 kg N./fed. as well as the combined data and one crosses expressed significant negative heterotic effect relative to better parent values at 30 kg N/fed.

As for plant height for the tallest plants (undesirable), eight, twenty two and fifteen crosses xpressed significant and highly significant positive heterotic

effects relative to mid- parents values for 30,70 kg N./fed. as well as their combined data. While, twenty one, thirty five and thirty from the previous crosses showed significant and highly significant positive heterotic effect relative to better parent at 30, 70 kg N./fed. levels as well as their combined data. On the other hand plant height for shortness twenty four, nine and fifteen crosses expressed significant and highly significant negative heterotic effects relative to mid- parents values for 30, 70 kg N./fed. as well as their combined data, while six, two and two from the previous crosses showed significant and highly significant negative heterotic effects relative to their better parent at 30, 70 kg nitrogen levels/fed. as well as their combined data.

For kernel weight in the main spike one, four and four crosses xpressed significant positive heterotic effects relative to mid- parents values for 30,70 kg N./ fed. as well as their combined data and two crosses expressed significant positive heterotic effect relative to their better parent values at 70 kg N/fed. As for spike length, two, eleven and seven crosses expressed significant and highly significant positive heterotic effects relative to mid- parents values for 30, 70 kg nitrogen levels/fed. as well as their combined data, while eight and one from the previous crosses showed significant and highly significant positive heterotic effect relative to their better parent at 70 kg N./fed as well as their combined data.

As for number of spikes per plant five, four and two crosses expressed significant and highly significant positive heterotic effects relative to mid-parent values for 30, 70 kg N./fed as well as their combined data. While two, one and three from the previous crosses showed significant and highly

significant positive heterotic effects relative to the better parent at 30, 70 kg/fed. nitrogen levels as well as their combined data.

As for number of spikelets per plant eighteen, seven and eleven crosses expressed significant and highly significant positive heterotic effects relative to mid- parents for 30, 70 kg/fed. nitrogen levels as well as their combined data while, five and one from the previous crosses showed significant and highly significant positive heterotic effects relative to better parent at 30 kg nitrogen per feddan.

As for number of kernels per spike twenty five, twenty two and twenty two crosses expressed significant and highly significant positive heterotic effects relative to mid- parents values for 30, 70 kg/fed. nitrogen levels as well as their combined data while fourteen, nine and twelve from the previous crosses showed significant and highly significant positive heterotic effects relative to better parent at 30, 70 kg/fed. nitrogen levels as well as their combined data.

For 100- kernels weight eleven, eighteen and ten crosses expressed significant and highly significant positive heterotic effects relative to mid- parents values for30, 70 kg/fed. nitrogen levels as well as the combined data. While three, three and two from the previous crosses showed significant and highly significant positive heterotic effects relative to the better parent at 30, 70 kg/fed. nitrogen levels as well as the combined data.

With regard grain yield /plant, fifteen, fourteen and seven crosses expressed significant and highly significant positive heterotic effect relative to mid-parents values for for30, 70 kg/fed. nitrogen levels as well as their combined

data while, ten and four from the previous crosses showed significant and highly significant positive heterotic effect relative to the better parent at 30 kg/fed nitrogen levels as well as the combined date.

B-Combining ability

The mean squares associated with general and specific combining ability were significant and highly significant for all studied traits studied at the two different nitrogen fertilizer levels and their combined data except kernels weight in the main spike in level 2.

The mean squares of interaction between nitrogen levels and both general and specific combining ability were significant and highly significant for all studied traits studied except kernels weight in the main spike and number of kernels per spike for general and specific combining ability. While, for spike length and number of spikelets per spike for general combining ability and 100-kernel weight for specific combining ability.

The mean squares of SCA x nitrogen levels/SCA were higher than GCA x nitrogen levels / GCA for all studied traits.

The parental line (P_1) has highly significant general combining ability values for spike length, number of spikelets per spike and number of kernels per spike at 30, 70 kg N./fed. as well as their combined data. ; the parental line (P_2) for number of spikelets per spike and number of kernels per spike at 30 , 70 kg N./fed. as well as the combined data; the parental line (P_3) for plant height number of spikes per plant at the two nitrogen levels and their combined data; the parental line (P_4) for number of spikelets per spike and number of kernels

per spike at the two nitrogen levels and their combined data; The parental line (P_5) for number of days to heading, number of days to maturity and plant height at the two nitrogen levels and the combined data. The parental variety (P_6) has highly significant general combining ability values for number of days to heading, days to maturity and plant height at the two nitrogen levels and the combined data; the parental variety (P_7) number of days to heading and number of days to maturity at the two nitrogen levels and their combined data. The parental variety (P_8) for 100-kernels weight at the 70 kg nitrogen level and the combined data while grain yield per plant at the 30 nitrogen levels and the combined data; The parental line (P_9) for kernel weight in the main spike, spike length, number of spikelets per spike and number of kernels per spike at the two nitrogen levels and their combined data while 100-kernel weight and grain yield per plant; the parental variety (P_{10}) days to maturity, kernel weight main spike, number of spikelets per spike, for number of kernels per spike, 100-kernel weight and grain yield per plant at the two nitrogen levels and their combined data while number of spikes per plant at the 30 kg nitrogen level and their combined data.

Eleven, ten and seven parental combinations exhibited significant and highly significant negative effects for number of days to heading at 30, 70kg N/fed. as well as their combined data; two, four and three parental combinations exhibited significant and highly significant negative effects for number of days to maturity at 30 and 70kg N/fed. as well as their combined data. For plant height thirteen, thirteen and eight crosses exhibited significant and highly significant negative SCA effects at 30, 70 kg N /fed. as well as their combined data. For grain weight in the main spike three, three and one parental combinations exhibited

significant positive effects for grain weight in the main spike at 30, 70kg N/fed. as well as their combined data. As for spike length seven and one crosses exhibited significant and highly significant positive SCA effects at 70 kg N/fed. as well as the combined analysis. As for number of spikes per plant seven, four and five crosses exhibited significant and highly significant positive SCA effects at 30, 70 kg N/fed. and their combined analysis. With regard to number of spikelets per spike six, six and five crosses exhibited significant and highly significant positive SCA effects at 30, 70 kg N/fed. as well as their combined analysis. For number of kernels per spike twelve, ten and eleven crosses exhibited significant and highly significant positive SCA effects at 30, 70 kg N/fed. and their combined analysis. For 100-kernel weight five, four and three crosses exhibited significant and highly significant positive SCA effects at 30, 70 kg N/fed. and their combined analysis. For grain yield per plant ten, six and eight crosses exhibited significant and highly significant positive SCA effects at 30, 70 kg N/fed. and their combined analysis.

From the preview results, it could be concluded that due to the importance of additive genetic variance in the inheritans of the traits under study, we can use these crosses as started materials in selection breeding programe to improve these traits. On the other hand, the frequency of dominance genes were higher than the corresponding recessive genes in most of studied lines, therefore, the produced hybrids from these parental lines, could be used for direct cultivation.