SUMMARY

The main objectives of the present work were to evaluate inbred lines of maize through Line x tester analysis.

The experimental work of this study was carried out at the Experiment Research Station of Moshtohor, Benha University, Qalyubiya Governorate, Egypt during the two successive seasons 2006 and 2007.

A total of twenty (*Zea mays* L.) yellow inbred lines were used to establish the experiment materials for several characters among inbred lines under study. These lines were selected on bases of yielding ability and other desirable plant aspects. The plant materials were selected with a wide range of diversity for several traits. Three testers of yellow maize were used in this investigation to make all possible line x tester crosses. The three testers used in this study were chosen to represent wide difference in relation to the tested lines. i.e. (Gem. Pop.) representing broad genetic base, single cross (Elhosary 101) representing approximately narrow genetic base and the inbred line 100 representing narrow genetic base. Three check varieties were used in this investigation their names are single cross Giza 155, S. C. Pioneer 3080 and three way cross Giza 352.

In the first summer season 2006 seeds of the twenty inbred lines and three testers were split sown on 25th May, 30th May and 8th June to avoid differences in flowering time and to secure enough hybrid seed. All possible top crosses combinations were made between the twenty inbred lines and three testers by hand method giving a total of 60 top crosses.

Each top cross was constituted by collecting pollen from 40-50 protected tassels, representing the tester, then top crossing into protected silks of 15 plants, representing the inbred lines by hand pollinating.

In the second summer, season 2007 two adjacent experiments were conducted on two sowing dates. i.e. 15th June and 4th July. In each experiment the 60 top crosses as well as the three check hybrids (S.C. G.155,S.C Pioneer 3080 and T.W.C. G.352) were grown in a randomized complete block design with three replications.

Recorded data were days to 50% tasseling (tasseling date), days to 50% silking (silking date), maturity date, plant height (cm), ear height (cm), leaf area of upper ear (cm^2), ear husk, ear length (cm), ear diameter (cm), number of rows/ear, number of kernel/row, weight of 100-kernel (g), ear weight/ plant, grain yield per plant (g) adjusted at 15.5 % moisture content and shelling percentage was computed as 100 x (grain weight /ear weight). Line x tester analysis was used according to kempthorne (1957).

The results of the present study could be summarized as follows:

A) Analysis of variance

Sowing dates mean squares were significant for all traits except number of rows/ ear, number of kernels/ row and shelling percentage.

Crosses mean squares were significant for all the studied traits at both sowing dates as well as the combined analysis except ear diameter at early sowing date.Significant crosses x sowing date mean squares were obtained for all traits except ear height, ear husk, and ear diameter.

Lines mean squares were significant for all traits at early and late sowing dates as well as the combined over them.Significant lines x sowing date mean squares were detected for all traits except tasseling date, ear height, ear husk, ear diameter and shelling%.

Significant mean squares due to testers were obtained for all traits in both sowing dates as well as the combined analysis except maturity date at both sowing dates as well as the combined analysis; tasseling date, silking date, leaf area of upper

ear, ear diameter, number of kernels/ row at early sowing, and ear length at early sowing date and the combined analysis. In addition, lines mean squares were much higher than those of testers for most studied traits. Such results revealed that lines contributed much more to the total variation as compared to testers. Therefore, the total GCA variance was due to inbred lines(GCA variance) for most traits.

The interaction between tester x sowing date mean squares were significant for silking date, leaf area of upper ear, ear length, ear diameter, no. of kernels/ row, ear weight/ plant, 100-kernel weight and grain yield/ plant.

Significant line x tester mean squares were detected for all traits except ear diameter at both sowing dates as well as the combined analysis; ear husk, number of rows/ ear and number of kernels/ row at late sowing date and shelling percentage at early sowing date. Significant interaction between line x tester x sowing date mean squares were obtained for tasseling and silking dates, plant height, leaf area of upper ear, no. of rows/ ear, 100-kernel weight, shelling percentage, ear weight/ plant and grain yield/ plant.

B) Mean performance:

The top cross T_1xL_1 at early sowing date had earlier than the best check variety S.C. Pioneer 3080. While, the top crosses T_3xL_{14}, T_1xL_1 and T_3xL_{16} gave the lowest mean values compared with other genotypes at late sowing date. The top crosses T_1xL_1, T_1xL_{13} and T_3xL_{14} gave the lowest mean values for tasseling date at the combined data.

For silking date, the top crosses T_1xL_1, T_1xL_{13}, T_2xL_{12} and T_3xL_{10} gave the lowest mean values for this trait at the combined data.

Regarding maturity date, the top crosses T_1xL_1, T_1xL_6, T_2xL_7, T_2xL_9, T_2xL_{10}, T_2xL_{18}, T_3xL_6, T_3xL_{10} and L_3xL_{12} expressed the lowest significant values of maturity date and it were the earliest among the studied top crosses at the combined

analysis. For number of rows/ ear, the top crosses T_2xL_5 at early sowing date; T_2xL_4, T_3xL_5 and T_3xL_6 at late sowing date; T_1xL_{13}, T_2xL_5 and T_3xL_5 at the combined analysis exhibited significant higher than the best check hybrid. For number of kernels/row, with the exception of crosses T_1xL_3, $T_2xL_{11,}$ $T_2xL_{20,}$ $T_3xL_{6,}$ T_3xL_9 and T_3xL_{12} at late sowing dates, none of top crosses surpassed the best check hybrids in early, late sowing dates as well as the combined analysis. For 100-kernel weight, the top crosses $T_1xL_{1,}$ T_1xL_3, T_1xL_{12}, T_3xL_3 and T_3xL_{10} at early sowing date, $T_1xL_{12,}$ T_2xL_3, $T_2xL_{15,}$ T_3xL_3, T_3xL_{13} and T_3xL_{19} at late sowing date and $T_1xL_{1,}T_1xL_7$, T_1xL_{12}, T_2xL_3, $T_2xL_{15,}$ T_3xL_3 and T_3xL_{19} at the combined analysis exhibited significantly higher than the best check hybrid S.C. G 155. For shelling percentage, none of the studied top crosses significantly exceeded that of the best of check hybrid. For grain yield/ plant, the highest mean values were recorded by S.C. Pioneer 3080 at early sowing date but without significant superiority over those of hybrids T_1xL_{13}, T_1xL_{17}, T_2xL_5, T_2xL_{10}, T_2xL_{12} and T_2xL_{14}. While, twenty six and three top crosses exhibited significantly higher than the best check hybrid S.C. Pioneer 3080 at late sowing date and the combined analysis, respectively. However, the best top crosses were T_1xL_{13}, T_1xL_{17} and T_2xL_{12} at the combined data.

C) Combining ability:

Results indicated that σ^2 SCA was more important than σ^2 GCA for all studied traits in both sowing dates as well as the combined analysis except tasseling date and number of rows/ ear in the combined analysis and ear diameter at early sowing date and ear husk at late sowing date σ^2 GCA= σ^2 SCA revealing that additive and non additive gene effects was similar for controling this trait .

The magnitude of the interaction between specific combining ability and sowing dates was much higher than that of interaction between general combining and sowing dates for all traits except ear height, ear husk and number of rows/ ear.

C) 1. General Combining ability effect

Testers:

The tester T_1 (L 100) exhibited significant desirable ($\hat{g}_i$) effects for plant and ear heights and 100-Kernel weight at early and late sowing dates as well as the combined data; ear diameter, ear weight/plant and grain yield/plant at late sowing date and the combined data, and ear length at late sowing date.

The parental tester S.C. (Elhosary 101) expressed significant positive ($\hat{g}_i$) effects for leaf area of upper ear and shelling percentage at late sowing date and the combined data and ear husk at early sowing date and the combined data; ear weight, grain yield/ plant and 100-Kernel weight at early sowing date, Also, it gave significant positive (undesirable) ($\hat{g}_i$) effects at late sowing date and the combined data for tasseling date and late sowing date for silking date. However, it gave insignificant ($\hat{g}_i$) effects for other cases.

Parental tester (Gem. pop.) expressed significant desirable ($\hat{g}_i$) effects for number of rows/ ear in both sowing dates and the combined data; and leaf area of upper ear at late sowing date; tasseling date and silking date at late sowing date and the combined data. Also, it gave significant undesirable or insignificant ($\hat{g}_i$) effects for other cases.

Inbred lines:

The parental inbred lines L_1 and L_{13} exhibited the highest ($\hat{g}_i$) effects for tasseling and silking dates in both sowing dates as well as the combined data. Moreover, both inbred lines L_1 and L_{13} were the best combiners for both traits together. For maturity date, the parental inbred lines L_6 and L_{10} seemed to be the best combiners for earliness in both sowing dates as well as the combined analysis. For number of rows/ ear the lines L_5, L_6 and L_{13} were the best combiners inbred lines in both sowing dates as well as the combined data.

For no. of Kernels/ row, the best general combiners which had significant and positive ($\hat{g}_i$) effects were the parental inbred

lines L_{11} and L_{12} in both sowing dates and the combined over them. The most desirable ($\hat{g}_i$) effects for 100-kernel weight this trait were detected for the parental inbred lines L_3 followed by L_{19} in both sowing dates and the combined data. The most desirable combiners for ear and grain yields/ plant were the inbred lines L_5 and L_{13} in both sowing dates and the combined analysis.

C) 2. Specific combining ability effects:

For tasseling date the most desirable SCA effects were obtained for the top crosses T_1xL_1,T_2xL_{15} and T_2xL_{19} at early sowing date; T_1xL_7, T_1xL_{19}, T_2xL_3, T_2xL_{12}, T_3xL_2, T_3xL_{10}, T_3xL_{14} and T_3xL_{16} at late sowing date , and T_1xL_1, T_2xL_3, T_2xL_{19}, T_3xL_{10} and T_3xL_{14} at The combined analysis. Regarding to silking date, the most desirable SCA effects for this trait were obtained for the top crosses T_1xL_1 at early sowing date; T_2xL_3 and T_2xL_{12} at late sowing date and the combined analysis. For maturity date, the top crosses T_1xL_1 at early,late sowing date and the combined analysis; T_3xL_{15} at early sowing date and the top cross T_3xL_{17} at late sowing date and the combined analysis had the most desirable $\hat{S}_{ij}$ effects for this trait. For number of rows/ ear, the top crosses T_1xL_{13}, T_1xL_{14}, T_2xL_6 and T_3xL_{10} at early sowing date; T_1xL_{13}, $T_2x\ L_4$ and T_3xL_6 at late sowing date and T_1xL_{13}, T_2xL_4, T_2xL_6, T_3xL_3 and T_3xL_{10} at the combined analysis had the most desirable $\hat{S}_{ij}$ effects for this trait. Regarding number of kernels/ row, the top crosses T_1xL_{16} and T_3xL_{16} at early sowing; T_1xL_{18}, T_2xL_{15} and T_2xL_{20} at late sowing date; and T_1xL_{16}, T_2xL_{15} and T_2xL_{20} at the combined analysis exhibited significantly positive $\hat{S}_{ij}$ effects for this trait.The most desirable $\hat{S}_{ij}$ effects for 100-kernel weight were obtaind for the top crosses T_1xL_1, T_1xL_{12} and T_1xL_{12} at early, late sowing dates as well as the combined data, respectively. Concerning ear weight, the most desirable $\hat{S}_{ij}$ effects were recorded for the top crosses T_1xL_{17} and T_2xL_5 at early sowing date; T_1xL_{18}, T_2xL_{12} and T_3xL_9 at late sowing date; T_1xL_{13} and T_2xL_{12} at the combined analysis. For grain yield/ plant, the best $\hat{S}_{ij}$ effects were obtained

from top crosses T_1xL_{17}, T_2xL_5, T_2xL_{12} and T_3xL_{15} at early sowing date;T_1xL_{18},T_2xL_{12} and T_3xL_6 at late sowing date; T_2xL_{12} and T_1xL_{17} at the combined analysis.

D) Useful heterosis:

Regarding useful heterotic effects relative to S.C G 155, zero, fifty eight and nineteen top crosses exhibited significant and positive values for grain yield/ plant at early, late sowing dates as well as the combined analysis, respectively. The eight top crosses at early sowing dates did not differ significant compared S.C. G 155. However, the best heterotic effects were obtained for the top crosses T_1xL_7, T_1xL_{13}, T_1xL_{17}, T_2xL_4, T_2xL_5, T_2xL_{10} and T_2xL_{12} in the combined data.The useful heterotic effects relative to S.C. G 155 ranged from -39.37 to 4.38, -11.29 to 106.82, and -17.49 to 30.03% at early, late sowing date and the combined analysis, respectively.

Regarding useful heterotic effects relative to S.C. Pioneer 3080 Zero, twenty six and three top crosses exhibited significant and positive values for grain yield/ plant at early, late sowing date as well as the combined analysis, respectively. However, the best useful heterotic effects were obtained for the top crosses T_1xL_{13}, T_1xL_{17} and T_2xL_{12} in the combined data. The heterotic effects relative to S.C. Pioneer 3080 ranged from -41.09 to 1.42, -39.22 to 41.69% and -28.62 to 12.49% at early, late sowing date as well as the combined analysis.