Contents

V. SUMMARY

This study was carried out at Sids and Gemmeiza Experimental Stations, Agricultural Research Center (ARC), Egypt. During the four-successive seasons from 2001 to 2004.

The main objectives of the present study were to investigate:

1-The effectiveness of S_1 recurrent selection procedure for improving oil yield and oil percentage, yield and its components and other agronomic characters in two maize populations, *i.e.*, local and Pop-59E.

2-The genotypic, phenotypic variance components and other statistical and genetical parameters in S_1 progenies derived from the two cycles (C_0 and C_1) of the two populations for different studied traits.

3-The indirect selection for oil and grain yield of the two populations in the two cycles (C_0 and C_1).

4-The correlation coefficients between oil yield and some agronomic traits in the two cycles (C_0 and C_1) of the two populations *i.e.*, local and Pop-59E.

5-Path coefficient (indirect selection) between oil content and some agronomic traits in the two cycles (C_0 and C_1) for the two populations.

In 2001 summer season, S_1 recurrent selection procedure was applied in (local and pop-59E) at Sids Agricultural Research Station, where 150 S_0 plants from each population were selfed to produce S_1 progenies.

In 2002 summer season, two yield trials were conducted (one for each population). Simple Lattice Design in (12 x 12 for first population (local population) and 10 x 10 for second population (pop.59 E)) with three replications was followed at Gemmeiza and Sids Research Stations.

Based on the data of oil yield and grain yield, the highest 10% of S_1 progenies (14 S_1 progenies of the first Population (local Population) and 10 % S_1 progenies of the second Population (pop.59 E) were defined and their seeds were prepared from the remnant seeds for making all recombinations or inter-crossing in the following season.

In 2003 summer season, the inter-crossing among the selected 10% of S_1 progenies from each population were planted in non-replicated plots at Sids Agric. Res. Station. Pollinated ears from each population were harvested, dried and shelled together to from the first cycle seeds.

In 2004 summer season, for each population the original cycle (C_0) and the improved cycle (C_1) were evaluated in a Randomized Complete Block Design experiments with four replications at Gemmeiza and Sids Research Stations.

Data were recorded on Oil yield (Kg/ha.); oil percentage; grain yield / plant; ear length; ear diameter; number of rows/ear; number of kernels/row; 100- kernel weight; plant height; ear height and silking date

The obtained results could be summarized as follows:

1-S_1progenies performances:

There were highly significant differences among the S_1 progenies in yielding ability and most studied traits in the two populations.

Oil yield (kg /ha.):

1- For the first population (Local population), means of oil yield (kg/ha.) of S_1 progenies ranged from 68.4 to 449.8 kg/ha. at Gemmeiza ; from 61.9 to 471.3 kg/ha. at Sids and from 79.2 to 460.6 kg/ha. in combined data. Means of oil yield (kg/ha.) of the highest 10 % (14 S_1 progenies) ranged from 278.8 to 449.8 Kg / ha at Gemmeiza, from 285.5 to 471.3 kg/ha. at Sids and from 304.3 to 460.6 kg/ha. in combined data with

the means of 346.5 ± 13.3; 373.2 ± 15.2 and 360.0 ± 11.2 kg/ha. at Gemmeiza, Sids and combined data, respectively. These means were higher and highly significant than the means of all 144 S_1 progenies which were 206.3 ± 5.9; 205.7 ± 6.3 and 206.0 ± 5.7 kg/ha. at Gemmeiza, Sids and in combined data, respectively.

2- For the Second population (Pop-59 E population), means of oil yield (kg/ha.) of the S_1 progenies ranged from 45.5 to 461.0 kg/ha. at Gemmeiza, from 62.2 to 393.9 kg/ha. at Sids and from 85.3 to 399.0 kg/ha. in combined data . Means of oil yield (kg/ha.) of the highest 10 % (10 S_1 progenies) ranged from 213.8 to 461.0 kg/ha. at Gemmeiza, from 225.8 to 393.9 kg/ha. at Sids and from 256.5 to 399.0 kg/ha. in combined data with the means of 298.2 ± 25.0; 393.5 ± 17.1 and 295.8 ± 14.5 kg/ha. at Gemmeiza, Sids and combined data, respectively. These means were higher and highly significant than the means of all 100 S_1 progenies which were 183.9 ± 7.4; 189.6 ± 5.7 and 186.8 ± 5.8 kg/ha. at Gemmeiza, Sids and combined data, respectively.

3- For the first population (Local Pop.), means of oil percentage of the S_1 progenies ranged from 3.1 to 10.3% . Means of oil percentage of the highest 10% (14 S_1 progenies) ranged from 5.5 to 10.3% with the mean of 7.7 ± 0.4. This mean was higher and highly significant than the mean of all 144 S_1 progenies, which was 5.8 ± 0.1.

4- For the second population (Pop-59 E), means of oil percentage of S_1 progenies ranged from 5.0 to 11.2% . Means of oil percentage of the highest 10% (10 S_1 progenies) ranged from 6.0 to 11.2% with the mean of 7.7 ± 0.5. This mean was higher and highly significant than the mean of all 100 S_1 progenies, which was 7.1 ± 0.3 .

5- Estimates of genotypic ($\delta^2 g$) and phenotypic ($\delta^2 ph$) variance components exhibited significant differences among S_1 lines for the studied traits and these wide differences may allow improving these populations using S_1 recurrent selection.

6 - Heritability estimates for pop-A were high for oil yield where their values were 92.8 %; 90.4 % and 87.6 % at Gemmeiza, Sids and combined data, respectively. Meanwhile, for pop-B the values were also high for oil yield as they were 92.0 %; 85.4 % and 76.2 % at Gemmeiza, Sids and combined data, respectively.

7- The expected gain from selection for oil yield were 55.8, 57.7 and 49.8 % for pop-A and 65.0, 44.9 and 39.9 % for pop-B at Gemmeiza, Sids and in combined data, respectively.

Grain yield /plant:

1-Means of 144 S_1 progenies of the local population for grain yield/plant varied from 38.1 to 150.3 gm. at Gemmeiza; from 30.5 to 167.4 gm. at Sids and from 44.3 to 155.1 gm. in combined data. Range of grain yield/plant of the highest 14 S_1 progenies varied from 74.7 to 150.3 gm. at Gemmeiza; from 81.4 to 167.4 gm. at Sids and from 89.9 to 155.1 gm. in combined data with overall means of 111.6 ± 6.0; 119.2 ± 6.3 and 115.4 ± 5.5 gm. at Gemmeiza; Sids and combined data, respectively. These means were higher and significant than the overall means of all 144 S_1 progenies, which were 85.8 ±, 1.9; 85.2 ± 1.8 and 85.5 ± 1.6 gm. at Gemmeiza; Sids and their combined data, respectively. Meanwhile, in pop-59 E grain yield/plant of S_1 progenies ranged from 19.5 to 153.0 gm. at Gemmeiza; from 20.2 to 149.2 gm. at Sids and from 24.2 to 151.1 gm. in combined data. Means of grain yield/plant of the highest 10 S_1 progenies ranged from 57.9 to 153.0 gm. at Gemmeiza; from 47.9 to 149.2 gm. at Sids and from 69.6 to

151.1 in combined data with overall means of 95.0 ± 8.3; 95.7 ± 9.0 and 95.3 ± 7.6 gm. at Gemmeiza; Sids and combined data, respectively. These means were higher and significant than the means of all 100 S_1 progenies which were 62.4 ± 2.4; 64.8 ± 2.0 and 63.6 ± 2.0 gm. at Gemmeiza; Sids and their combined data, respectively.

2-For most remaining traits (Oil yield (Kg/ha.); oil percentage; grain yield / plant; ear length; ear diameter;; number of kernels/row; 100- kernel weight and silking date), significant differences were obtained between the overall means of the highest 10 % S_1 progenies and the respective overall means of all S_1 progenies.

3-Estimates of genotypic ($\delta^2 g$) and phenotypic ($\delta^2 ph$) variances components exhibited significant differences among S_1 lines for the studied traits and these wide differences may allow to improving of these populations using S_1 recurrent selection.

4- Heritability estimates for local population were high for grain yield/plant (88.4; 81.2 and 72.0 %) at Gemmeiza, Sids and combined data respectively. In pop-59E, heritability estimates were high for grain yield/plant (92.1; 87.1 and 78.6 %) at Gemmeiza, Sids and their combined data respectively.

5-The expected gain from selection for grain yield in local population were 40.9; 35.6 and 27.1 % and in pop-59E, were 62.8; 47.4 and 41.4 % for grain yield at Gemmeiza, Sids and their combined data, respectively.

2-First cycle population performances:

oil yield (kg/ha.)

Significant differences were detected between the improved and original cycles of the two populations under the two locations and combined.

1-At Gemmeiza, the average of oil yield (kg/ha.) and oil percentage in the first cycle of pop-A were 432.1(kg/ha.) and 6.7 % compared to 334.5 (kg/ha.) and 5.6 % in the original population (pop. A-C_0), respectively. The values of coefficient of variation of the two cycles (C_0 and C_1) were 14.3 and 5.5 % for oil yield and 5.8 and 6.5% for oil percentage, respectively. The increasing rates were 29.2 and 20.1 % for oil yield (kg/ha.) and oil percentage, respectively. The average of oil yield (kg/ha.) and oil percentage of the first cycle of pop-B were 386.5 (kg/ha.) and 7.7 % compared to 352.2 (kg/ha.) and 7.2 % of the original population (pop. B-C_0),respectively. The values of coefficient of variation of the two cycles (C_0 and C_1) were 9.5 and 8.6 % for oil yield and 5.4 and 1.6 % for oil percentage, respectively. The increasing rates were 9.6 and 7.1 % for oil yield (kg/ha.) and oil percentage, respectively.

2-At Sids, the average of oil yield (kg/ha.) and oil percentage in the first cycle of pop-A were 469.8 (kg/ha.) and 7.2 % compared to 332.7 (kg/ha.) and 5.5 % in the original population (pop. A-C_0), respectively . The values of coefficient of variation of the two cycles (C_0 and C_1) were 11.1 and 10.6 % for oil yield and 5.9 and 4.4 % for oil percentage, respectively. The increasing rates were 41.2 and 29.7 % for oil yield (kg/ha.) and oil percentage, respectively. The average of oil yield (kg/ha.) and oil percentage of the first cycle of pop-B were 415.2 (kg/ha.) and 7.6 % compared to 340.9 (kg/ha.) and 7.1 % of the original population (pop.B-C_0), respectively. Coefficient of variation values of the two cycles (C_0 and C_1) were 9.8 and 7.0 % for oil yield and 2.7 and 3.5 % for oil percentage, respectively. The increasing rates were 21.8 and 6.5 % for oil yield (kg/ha.) and oil percentage, respectively.

3-In the combined, mean of oil yield (kg/ha.) and oil percentage in the first cycle of pop-A were 450.9 (kg/ha.) and 7.0 % compared to 333.6

(kg/ha.) and 5.6 % in the original population (pop. A-C_0), respectively. The values of coefficient of variation of the two cycles (C_0 and C_1) were 15.3 and 10.5 % for oil yield and 11.7 and 4.1% for oil percentage, respectively. The increasing rates were 35.2 and 24.9 % for oil yield (kg/ha.) and oil percentage, respectively. The average of oil yield (kg/ha.) and oil percentage of the first cycle of pop-B were 400.8 (kg/ha.) and 7.6 % compared to 346.7 (kg/ha.) and 7.2 % of the original population (pop.B-C_0), respectively. The values of coefficient of variation of the two cycles (C_0 and C_1) were 15.9 and 14.3 % for oil yield and 6.3 and 2.9 % for oil percentage, respectively. The increasing rates were 15.6 and 6.8 % for oil yield (kg/ha.) and oil percentage, respectively.

4-The expected and actual gains from selection for oil yield (kg/ha.) in pop-A were (49.8 and 35.2 %) and these were higher than values of pop-B, which were (39.9 and 15.6%), respectively. The expected and actual gain from selection for oil percentage in pop-A were (36.2 and 29.7 %) and these were higher than values of pop-B, which were (23.9 and 6.5 %), respectively.

Grain yield /plant:

1-Significant differences were detected between the two cycles in each population for grain yield at the two locations. No significant differences were detected for most of the studied traits under the two locations except for ear length and days to 50% silking at Sids.

2-At Gemmeiza, the average of grain yield/plant of the first cycle in pop.A was 155.2 gm. compared to 144.3 gm. in the original population (pop.A-C_0). The values of coefficient of variation (C.v.%) of the two cycles (C_0 and C_1) were 15.4 and 8.7 %., respectively. The increasing rates were 7.6%. The average of grain yield/plant of the first cycle in

pop.B was 121.1 gm. compared to 117.5 gm. in the original population (pop.B-C_0). The values of coefficient of variation (C.v.%) of the two cycles (C_0 and C_1) were 9.2 and 7.9 %, respectively .The increasing rates were 3.1%.

3-At Sids, the average of grain yield/plant of the first cycle in pop. A were 157.0 gm. compared to 144.4 gm. in the original population (pop.A-C_0). The values of coefficient of variation (C.v.%) of the two cycles (C_0 and C_1) were 5.3 and 4.9 %, respectively .The increasing rates were 8.7 %. The average of grain yield/plant of the first cycle in pop. B was 132.0 gm. compared to 115.2 gm. in the original population (pop. B-C_0). The values of coefficient of variation (C.v.%) of the two cycles (C_0 and C_1) were 9.8 and 8.3 %, respectively. The increasing rates were 14.6 %.

4- Combined mean grain yield/plant of the first cycle in pop. A were 156.1 gm. compared to 144.3 gm. of the original population (pop. A-C_0). The values of coefficient of variation (C.v.%) of the two cycles (C_0 and C_1) were 16.0 and 12.7 %, respectively. The increasing rates were 8.1%. The average of grain yield/plant of the first cycle of pop.B was 126.5 gm. compared to 116.3 gm. of the original population (pop.B-C_0). The values of coefficient of variation (C.v.%) of the two cycles (C_0 and C_1) were 17.0 and 13.1 %, respectively. The increasing rates were 8.8 %.

5-The expected gain from selection for grain yield/plant were 27.1 and 41.1 % in pop-A and pop-B, respectively .The actual gain from selection for grain yield/plant were 8.1 and 8.8 % in pop-A and pop-B, respectively. The actual gain from selection for ear length, ear diameter, number of rows/ear, number of kernel/row, 100-kernel weight, plant height, ear height and silking date were - 0.7, 0.6, 1.6, - 2.7, 0.3, - 0.7,

5.2 and - 2.6 % in pop- A, respectively. The actual gain % from selection were - 2.3, 3.2, - 1.5, - 4.4, 1.9, - 0.9, - 1.1 and - 2.6 % for the same traits of pop- B, respectively.

3-Phenotypic correlation coefficients:

For population-A, in C_0, there were positive and highly significant correlations between oil yield and oil percentage, grain yield, ear diameter, plant height and ear height; oil percentage and plant height and ear height; grain yield and ear length, number of rows/ear, number of kernels/row, plant and ear height. Meanwhile, in C_1, positively significant correlation values were detected between oil yield and each of oil percentage, grain yield and number of rows/ear; oil percentage and oil yield, plant and ear height; grain yield and oil yield, ear length, number of rows/ear, number of kernel/row and plant height. On the other hand, for population-B, in C_0, significantly positive correlation coefficients were obtained between oil yield and oil percentage, grain yield, ear diameter, number of rows/ear; oil percentage and oil yield, ear length, ear diameter, number of rows/ear, kernel/row, 100-kernel weight and silking date; grain yield and oil percentage, ear diameter and number of rows/ear. Meanwhile, in C_1, positively significant correlation values were detected between oil yield and each of oil percentage, grain yield, ear length, ear diameter, 100-kernel weight and plant height; oil percentage and oil yield; grain yield and oil yield, ear length, ear diameter and 100-kernel weight. In the two cycles, silking date exhibited negatively significant correlation coefficients with oil yield; grain yield and oil percentage. It is expected and logic, where early mature genotypes mostly gave low oil yield and grain yield. In general, the characters considered for improving oil yield were oil percentage and grain yield where they expressed strong and positive correlation. Also, this suggested that oil yield could be improved through these characters using suitable selection indices.

4- Relative efficiency of indirect selection:

It is clear from the data in the two cycles, grain yield/plant in pop-A and oil %, grain yield/plant and ear diameter in pop-B had the greatest contribution of indirect selection for oil yield. Low or negative values in this respect were detected for silking date in the two populations. Low and/or negative estimates of the indirect selection and contrary results in the two cycles of both populations might be attributed to the weak genotypic and phenotypic association in each case.

5- Path coefficients:

In the two cycles, of both populations, oil %, grain yield and plant height,as well as, number of rows/ear in the two cycles of pop-B exhibited desirable indirect path for selection to oil yield. Low and/or negative values were obtained for silking date in this respect for the two populations.