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## V. SUMMARY AND CONCLUSION

The present work was carried out at Nubaria research station, Maize Research Department, Field Crop Research Institute (FCRI), Agriculture Research Center (ARC), Egypt, during the period from 2010 to 2012.

The present investigation consisted of four experiments; the first and second ones were conducted to determine general and specific combining abilities effects through Line x Tester and diallel mating designs respectively. The third experiment was conducted to determine some agronomic traits to the maize inbred lines under investigation. The fourth experiment was conducted to apply ISSR-analysis for detecting of genetic polymorphism among 12 maize inbred lines.

### • Line x tester experiments

The following results were detected from these experiments:

- No homogeneity of errors was found between the two locations.
- Highly significant differences were found among crosses, lines, and line-tester interaction for grain yield within Nubaria and Gemmiza locations.
- Highly significant differences were obtained for number of days to mid-silking and ear height to all the sources of variation at Nubaria and Gemmiza locations except the line-tester interaction for number of days to mid-silking and ear height at Gemmiza location.
- No significant differences were observed for plant height at Nubaria location to lines, testers, and line-tester interaction.
- No significant differences were obtained to line x tester interaction at Gemmiza location for number of days to mid-silking and ear height.
- Significant differences were found among crosses for plant height at Nubaria location.
- Significant differences were found to testers and line-tester interaction for plant height at Gemmiza location
- For grain yield at Nubaria location, the Gz656 inbred line had the highest value of GCA effect (1.67), while Nb582 inbred line had the lowest value (-1.13).
- For grain yield at Gemmiza location the Nb509 inbred line had the highest value of GCA effect (0.99), while Nb612 inbred line had the lowest value (-0.85).
- For number of days to mid-silking at Nubaria location, the Gz656 and Gz657 inbred line had the highest values of GCA effect (3.07 and 3.19 respectively), while Nb582 and Nb612 inbred lines had the lowest values (-3.93 and -3.81 respectively),.
- The Gz656 inbred line had the highest value of GCA effect for number of days to mid-silking at Gemmiza location (2.06), while Nb612 inbred line had the lowest value (-2.06).
- The Gm1002 inbred line had the highest value of GCA effect for plant height at Nubaria location (9.03), while Nb582 inbred line had the lowest value (-8.19).
- The Gz657 inbred line had the highest value of GCA effect for plant height at Gemmiza location (12.59), while Nb579 inbred line had the lowest value (-17.96),.

- For ear height at Nubaria location, the Gz655, Gz656 and Gz657 inbred lines had the highest values of GCA effect (10.6, 10.1 and 9.5 respectively), while Nb579 inbred line had the lowest value (-13.19),.
- For ear height at Gemmiza location, the Gz655, Gz656, Gz657, and Nb517 inbred lines had the highest values of GCA effect (7.81, 6.59, 9.15 and 8.15 respectively), while Nb579 inbred line had the lowest value (-11.63),.
- The Gz657 inbred line had the highest value of GCA effect for ear length at Nubaria location (2.53), while Nb612 inbred line had the lowest value (-2.8).
- The Gz657 inbred line had the highest value of GCA effect for ear length at Gemmiza location (2.40), while Nb612 inbred line had the lowest value (-2.55).
- For ear diameter at Nubaria location The Gm1004 inbred line had the highest value of GCA effect (0.36), while Gz658 inbred line had the lowest value (-0.20).
- For ear diameter at Gemmiza location, the Gm1004 inbred line had the highest value of GCA effect (0.32), while Gz658 inbred line had the lowest value (-0.25).
- The Gm1004 inbred line had the highest value of GCA effect, for number of rows per ear at Nubaria location (2.93), while Nb612 inbred line had the lowest value (-0.92).
- For number of rows per ear at Gemmiza location, the Gm1004 inbred line had the highest value of GCA effect (3.31), while Nb612 inbred line had the lowest value (-0.97), Gz656 and Nb517 inbred lines have the highest values of GCA effect (4.65 and 4.53 respectively), while at Nubaria location, Nb612 inbred line had the lowest value (-4.93), for number of grains per row.
- Gz656 and Gz657 inbred lines have the highest values of GCA effect for number of grains per row at Gemmiza location, (3.87 and 3.70 respectively), while Nb612 inbred line had the lowest value (-4.69).

- **HSGCA method from line-tester experiment at Nubaria location**

The 12 inbred lines were classified into the following three heterotic groups:

- Group 1 (Nb552): Gz655, Gz658, Gm1002, Gm1004, and Nb509.
- Group 2 (Gz639): Nb579, Nb603, and Nb612
- Group 3 (Gm1021): Nb517, and Nb582

- **HSGCA method from line-tester experiment at Gemmiza location**

The 12 inbred lines were classified into three heterotic groups:

- Group 1 (Nb552): Gz655, Gz657, Gz658, and Gm1004.
- Group 2 (Gz639): Gm1002, Nb582, and Nb603.
- Group 3 (Gm1021): Nb517, Nb579, and Nb612

## • Diallel mating design

- The results of diallel (1) at Nubaria location showed that all the studied traits showed highly significant differences among general and specific combining abilities. At Gemmiza location, both general and SCA effects were significant for all characters except plant and ear height.
- For diallel (2), all the studied traits showed highly significant differences among the tested lines, general and SCA effects at Nubaria and Gemmiza, except for plant height at Gemmiza.
- For grain yield at Nubaria location, results for diallel (1) showed that the highest values for GCA effects were found for Gm1002 inbred line (3.45).while the lowest values were found for Gz656 inbred line (-1.59), and results for diallel (2) appeared that the inbred line had the highest values for GCA effects were Nb509 (0.87). While the lowest values were found for Nb517 inbred line (-1.19).
- Results of diallel (1) for grain yield at Gemmiza location, showed that the inbred line had the highest values for GCA effects was Gm1002 (3.30), while the lowest values were found for Gz658 inbred line (-2.02), and results from diallel (2) showed that the GCA effect was the highest for Nb603 (0.73), while the lowest values were found for Nb509 inbred line (-0.28).
- Results from diallel (1) for number of days to mid-silking at Nubaria location, showed that the highest values for GCA effects were found for Gz657 inbred line (4.08).while the lowest values were found for Gm1002 inbred line (-8.08), while the results for diallel (2) appeared that the highest values for GCA effect was recorded for Nb579 (1.36), while the lowest value was found for Nb509 inbred line (-0.56).
- Results for diallel (1) for number of days to mid-silking at Gemmiza location, showed that the highest value for GCA effect was for Gz658 (3.64), while the lowest value was found for Gm1002 inbred line (-7.28). For diallel (2) the inbred line Nb517 had the highest value for GCA effect, (0.69), while the lowest values were found for Nb612 inbred line (-0.64).
- Results for diallel (1) for plant height at Nubaria location, showed that the highest values for GCA effects were found for Gm1002 inbred line (26.39).while the lowest values were found for Gz655 and Gz656 inbred lines (-11.94 and -12.78 respectively). For diallel (2) the highest values for GCA effects were obtained with Nb612 (17.50), while the lowest values were found for Nb603 inbred line (-10.83).
- Results for plant height of diallel (1) at Gemmiza location, showed that, the highest values for GCA effects were Gz656 and Gm1002 inbred lines (6.86 and 5.94 respectively), while the lowest values were found for Gz655 inbred line (-6.39). For diallel (2) the highest values for GCA effects, was recorded for Nb603 (36.72), while their respective lowest values was found for Nb517 inbred line (-22.03).
- Results for diallel (1) for ear height at Nubaria location, showed that the highest values for GCA effects were found for Gm1004 inbred line (8.75).while the lowest values were found for the G655 and Gz656 inbred lines (-4.17 and -5.83 respectively). Results for diallel (2) appeared that the highest value for GCA effect was Nb517 (5.83), while the lowest value was found for Nb579 inbred line (-5.42).
- Results for diallel (1) at Gemmiza location for ear height, showed that the highest value for GCA effects was Gm1002 (17.42), while the lowest values were found for Gz657 inbred line (-13.92).
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- **Heterotic groups based on agronomic heterosis from diallel results**

- The heterotic groups based upon the agronomic heterosis among the 12 inbred lines were as follows:
- Group 1: Gz655, Gz656, Gz657, and Gz658.
- Group 2: Gm1002, and Gm1004.
- Group 3: Nb509, Nb517, Nb579, Nb582, Nb603 and Nb612

- **Agronomic characters for inbred lines**

The following 18 morphological and physiological characters were measured for the 12 inbred lines were taken for the grouping into different heterotic groups:

- Data for leaf area index at flowering stage referred to that the inbred line Gz657 had the highest value (3.6), but the inbred line Nb517 had the lowest value for same agronomic character (2.10).
- Results for chlorophyll content at flowering stage showed that the inbred lines Nb509 had the highest values (614.9  $\mu\text{g mg}^{-1}$ ), while the inbred line Gz639 had the lowest value for the same agronomic character (463.3  $\mu\text{g mg}^{-1}$ ).
- Number of days to mid-pollen shedding ranged between 55.0 days to 69.6 days, the inbred line Gz656 had the highest value (69.6 days), and the inbred Nb552 line had the lowest value for the same agronomic character (55.0 days).
- Number of days to mid-silking showed that inbred line Gz656 was the latest with (71.6 days), while the inbred line Nb552 was the earliest.
- Measurements of plant height ranged between 102 cm for inbred Gm1004 to 137.3 cm for inbred Nb582.
- Measurements of ear height showed that the inbred line Nb582 had the highest value (80.6 cm), and the inbred line Nb579 had the lowest value for same agronomic character (50.3 cm).
- Data of dry weight at maturity stage showed that the inbred lines Gz639 and Gz657 have the highest values (311.8 and 307.6 gm plant<sup>-1</sup> respectively), while the inbred lines Gm1004, Nb603, Gm1002, and Nb517 have the lowest values for same agronomic character (167.3, 163.5, 140.1, and 128.0 gm plant<sup>-1</sup> respectively).
- Data of growth rate referred to that the inbred lines Gz639, Gz657, and Gz656 have the highest value (3.23, 3.20, and 3.16 gm day<sup>-1</sup> respectively), while the inbred lines Gm1002 and Nb517 have the lowest value for same agronomic character (1.46, and 1.33 m day<sup>-1</sup> respectively).
- Measurements of leaf angle at maturity stage appeared that the inbred line Gz655 had the highest value (39.8°), while the inbred lines Gm1004 and Nb603 have the lowest values for same agronomic character (15.100 and 12.4° respectively).
- Number of tassel branches per plant referred to that the inbred line Nb509 had the highest value (20.5 branches tassel<sup>-1</sup> plant<sup>-1</sup>), while the inbred lines Nb579 and Nb517 have the lowest value for same agronomic character (7.9 and 7.5 branches tassel<sup>-1</sup> plant<sup>-1</sup> respectively).
- Results for number of leaves per plant at flowering stage showed that the inbred line Gm1004 had the highest value (13.9 leaves plant<sup>-1</sup>), while the inbred line Nb517 had the lowest value for same agronomic character (10.5 leaves plant<sup>-1</sup>).
- Data of grain yield per plant appeared that the inbred lines Nb552 had the highest values (68.4 gm plant<sup>-1</sup> respectively), while the inbred lines Gm1002 had the lowest values for same agronomic character (20.9 gm plant<sup>-1</sup>).

- Number of ears per plant showed that the inbred line Gm1021 had the highest value (2.0 ear plant<sup>-1</sup>), while the inbred lines Nb509, Gm1002, Nb517, NB552, Gz639, Gz655, Gm1004 and Nb603 have the lowest values for same agronomic character (1.0 for all).
- Results for number of rows per ear ranged from 10.5 rows ear<sup>-1</sup> for the inbred line Nb612 to 19.7 rows ear<sup>-1</sup> for the inbred line Gm1004.
- Results for number of grains per ear row showed that the inbred lines Nb603 and Nb509 have the highest values (25.4 and 25.1 grains row<sup>-1</sup>), while the inbred line Gz658 had the lowest value for same agronomic character (10.4 grains row<sup>-1</sup>).
- Measurements of ear length appeared that the inbred line Gz639 had the highest value (15.2 cm), while the inbred line Gm1002 had the lowest value for same agronomic character (10.9 cm).
- Measurements of ear diameter showed that the inbred line Gm1004 had the highest value (4.1 cm), while the inbred line Gz656 had the lowest value for same agronomic character (2.7 cm).
- Data of weight of 100 grains showed that the inbred line Nb612 had the highest value (37.7 gm), while the inbred line Gm1004 had the lowest value for same agronomic character (17.6 gm).

- **Grouping inbred lines using agronomical characters.**

The previous 18 characters were used to group the 12 inbred lines to different heterotic groups, the cluster analysis released only two groups and they were:

Group 1: Gz656, Gz657, and Gz658.

Group 2: Nb579, Nb603, and Nb612.

But the remaining inbred lines, Gm1002, Gm1004, Nb509, Nb517, and Nb582 inbred lines were not grouped because their morphological characters were not sufficient for grouping them.

- **Molecular marker grouping**

Grouping 12 inbred lines using Inter-Simple Sequence Repeats (ISSR) markers, results showed that the 12 inbred lines are grouped into five groups as follows:

Group 1: Gz655, Gz656, Gz657, and Gz658, inbred lines.

Group 2: Gm1002 and Nb517 inbred lines.

Group 3: Gm1004, Nb603, and Nb612 inbred lines.

Group 4: Nb509, Nb579, and Nb582 inbred lines.