

# SUMMARY

## SUMMARY

This study was carried out at the Gemmeiza Agricultural Research Station, El- Gharbia Governorate, Egypt and the laboratories of Seed Technology Research Department, Field Crops Research Institute (FCRI), Agricultural Research Center (ARC), Giza, Egypt. during 2001 and 2002 summer seasons. The objective of this study is to identify inbred lines and varieties using the necessary information on field testing procedures, prevent genetic contamination as well as granting and securing plant breeders right (PBR).

For achieving the previous goals, eleven inbred lines (Gemmeiza 2,4,14,18,21,22,27,30 and Sids 7,34,63), six single crosses (10,11,12,113,14 and 15) and six three-way crosses (310,311,314,325,326,327) of maize were used during this study. Experimental plots were arranged in a randomized complete block design (CRBD) for each of inbred lines, single crosses and three-way crosses. The results could be summarized as follows:

### **I- Morphological characteristics:**

#### **A-Quantitative characteristics**

##### ***1- Tassel characteristics***

The inbred line Sids 34, was of the greatest number of primary late branches. Whereas, inbred line Gemmeiza 4 showed of the lowest number of primary late branches. Data indicated that the inbred line Gemmeiza 27 was of the greatest length of main axis above lowest; upper side and side branches whereas,

the inbred line Gemmeiza 14 had the lowest of length of main axis above lowest; upper side and side branches.

The single cross 13 had the greatest number of primary late branches, length of main axis above upper side and side branches and was of the lowest of length of main axis above lowest side branches.

Three-way cross 310 was of the greatest number of primary late branches. Meanwhile, three-way cross 314 was of the greatest of length of main axis above lowest side and side branches.

## *2- Plant characteristics*

Maize inbred line Gemmeiza 30, had the greatest plant length. Whereas, inbred line Gemmeiza 2 was of the lowest plant length and ratio height of insertion of upper ear to plant length.

Single cross 12 possessed the greatest ratio height of insertion of upper ear to plant length and the shortest plants.

Three-way cross 326 was of the greatest ratio height of insertion of upper ear to plant length and the shortest plants.

## *3- Leaf characteristics*

Leaf width of blade and leaf of upper ear were of limited differences among the studied maize genotypes. Therefore, this variable is not dependable in genotypes identification.

## *4- Ear characteristics*

Maize inbred line Sids 34, was of the greatest length of peduncle, length of ear without husk and diameter of ear.

Whereas, inbred line Gemmeiza 2 was of the lowest length of peduncle and lowest length of ear without husk.

Single cross 10 had the greatest length of ear without husk and the greatest diameter of ear and the shortest length of peduncle. Whereas, single cross 15 was of the greatest length of peduncle and diameter of ear with the lowest length of ear without husk.

Three-way cross 310 had the longest length of ear without husk and the lowest length of peduncle and diameter of the ear. Three-way cross 314 was of the greatest length of peduncle and diameter of ear with the lowest length of ear without husk.

## **B-Qualitative characteristics**

### ***1-Leaf characteristics***

Maize inbred lines Gemmeiza 4, 21, S. 7, single crosses 11, 12 and all the three-way crosses possessed strong anthocyanin coloration on the sheath of the first leaf at seedling stage. Inbred line Gemmeiza 2 was of a very small angle between blade and stem (above upper ear).

Anthocyanin coloration of sheath in the middle of plant showed differences among genotypes in single crosses 12, 13, 14 and three-way crosses 311 which were absent or weak. While such characteristic in Gemmeiza.27 was strong in coloration. Another genotypes range weak included Gemmeiza 2, 14, 18, 22, 30, Sids.34, 63, single crosses 10, 11, 15, three-way crosses 314, 325, 326 and three-way cross 327. Whereas, Gemmeiza 4, 27, Sids.7 and three-way crosses 310 have medium anthocyanin coloration of sheath.

## ***2- Stem characteristics***

Both of the inbred lines and single crosses were of absent degree of zig-zag except inbred line Gemmeiza 30 was strong. All of the three-way crosses have slight degree of zig-zag.

Anthocyanin coloration of brace roots, proved to have four recognized color categories that could be detected. The first category included the inbred lines Gemmeiza 2, 14, 18, 27, 30, Sids. 34 and Sids 63 which was of absent or very weak anthocyanin coloration of brace roots. The second category included single crosses 11, 12, 13 and three-way cross 325 which showed weak anthocyanin coloration of brace roots. The third category of Gemmeiza 4, 21, single cross 10, three-way cross 311 and three-way cross 314 they were medium in anthocyanin coloration of brace roots. And the fourth category included Gemmeiza 22, Sids. 7, single cross 14, single cross 15, three-way crosses 310, 326 and 327. They possessed strong anthocyanin coloration of brace roots.

## ***3- Tassel color characteristics***

Anthocyanin coloration at base of glum characteristic classified the studied genotype into five groups. The first group include Gemmeiza 22, 27, 30, single cross 13 and 14 which was of absent or very weak anthocyanin coloration at base of glum. Whereas, the second group include inbred lines Gemmeiza 2, 14, Sids 34, single cross 15 and three-way cross 310 of weak anthocyanin coloration at base of glum. The third groups include three-way crosses 311, 314, 326 and 327 which showed medium

anthocyanin coloration at base of glum. The fourth group included inbred lines Gemmeiza 4, 18, Sids 7, 63, single cross 10, 11, 12 and three-way cross 325. They were strong in anthocyanin coloration at base of glum. The last group include inbred line Gemmeiza 21 which was of very strong anthocyanin coloration at base of glum

Regarding anthocyanin coloration of glumes (excluding the base), inbred lines Gemmeiza 22 and 30 were of no or very weak anthocyanin coloration of glumes (excluding the base). Results classified maize genotypes into three classes. The first class include Gemmeiza 14, 22, Sids 34, single crosses 11, 15 and the three-way cross 310 were of weak anthocyanin coloration of glumes (excluding the base). Whereas the second class included (Gimmeiza 2, single crosses 10, 12, 13, 14, three-way crosses 311, 314, 326 and 327) which was of medium anthocyanin coloration of glumes (excluding the base). The third class included (Gemmeiza 4, 21, Sids 7, Sids 63 and three-way cross 325) which was of strong anthocyanin coloration of glumes (excluding the base).

Anthocyanin coloration of anthesis was influenced by genotypes. All inbred lines were of absent or very weak anthocyanin coloration of anthesis. Whereas, single crosses and three-way crosses were of weak anthocyanin coloration of anthesis, except the three-way cross 310 was strong in the anthocyanin coloration of anthesis.

Concerning the degree of density of spikelets, all genotypes were of medium density of spikelets except inbred line Gemmeiza 18, three-way cross 325 and three-way cross 326

which were of lax density of spikelets. Three-way crosses 311 and 327 were dense in density of spikelets.

The angle between main axis and lateral branches of all genotypes have medium angle between main axis and lateral branches, except nine genotypes that were of small angle between main axis and lateral branches Gemmeiza 14, 18, 21, 22, 27, Sids 7, 63, single cross 10. Whereas, three-way cross 310 was of large angles between main axis and lateral branches.

The attitude of lateral branches varied among the tested genotypes. All genotypes were recurved except in Gemmeiza 14 and single cross 11 which were of straight recurved attitude of lateral branches. Mean hile Gemmeiza 2, 4, 30 and single cross 10 were of slightly recurved attitude of lateral branches.

#### ***4- Flowering characteristic***

The obtained time of anthesis of 50% of the plants and time of silk emergency of 50% of the plant divide the studied genotypes into four groups. The first group included (Gemmeiza 2, 4, 18, 21, Sids 34, 63, single crosses 10, 11, 12, three-way crosses 310, 326 and three-way cross 327) was early in anthesis and silk emergency. Whereas, the second group included (Gemmeiza 14, Sids 7, single crosses 13, 14, 15, three-way cross 311, and three-way cross 314) was of medium earliness of anthesis 50 %of plant and time of silk emergency 50% of plant. The third groups included, Gemmeiza 22 which was medium to late. The fourth group included Gemmeiza 27, 30 and three-way cross 325 was of late anthesis for 50 %of plant and time of silk emergency of 50% of plants.

### ***5- Ear characteristics***

concerning degree of anthocyanin coloration of silks, results classified maize genotypes into two classes. The first class included (Gemmeiza 27, 30, Sids 7, single crosses 10, 14, 15 and all three-way crosses) was of absent anthocyanin coloration of silks. The second class included genotypes of which anthocyanin coloration of silks was present.

Regarding the intensity of anthocyanin coloration of silks, the obtained results classified maize genotypes into three classes. The first class included (Gemmeiza 4, 14, 27, 30, Sids 7, 34, single crosses 10, 14, 15 and all of the three-way crosses) was of very weak anthocyanin coloration of silks. Whereas, the second class included (Gemmeiza 2, 18, 21, Sids 63, single crosses 11, 12 and single cross 13) where their silks color were weak. The third class included Gemmeiza 22 which was of medium anthocyanin coloration of silks.

Ear shape of Gemmeiza 2 and the three-way cross 327 was of conical shape, while Gemmeiza 14, S.63, single crosses 13, 15 and three-way cross 325 were of con. cylindrical ear shape. Whereas, the other genotypes were of cylindrical ear shape.

Concerning type of kernel (middle third of ear), results indicated that all single crosses and inbred line Gemmeiza 4 have dent link. The three-way crosses appeared to be of dent shape except the three-way cross 327 and inbred lines Gemmeiza 22, 30, Sids 7,34 and Sids 63 were of flint link. However, Gemmeiza 2, 14, 18, 21 and Gemmeiza 27 were of flint type of kernel (middle third of ear).



Color of top of kernel and color of dorsal side of kernel could not be used as descriptor for maize genotypes under the circumstances of this study. Obtained results showed that all of the studied inbred lines had no differences in the anthocyanin coloration of glumes of cob. Whereas, all single crosses and three-way crosses were of present anthocyanin coloration of glumes of cob.

Degree of intensity of anthocyanin coloration of glumes of cob for single crosses 11, 12, 13 and 15 were weak. Whereas all of the genotypes under study were very weak in anthocyanin coloration of glumes of cob.

The number of rows per ear could be classified among maize genotypes into three classes. The first class included (Gemmeiza 27, and Sids 7) which were few in number of rows. Whereas, the second class included (Gemmeiza 4, 14, 18, 21, 30, single crosses 10, 11, 12, 14, 15, and three-way cross 310) which were of medium number of rows per ear. The third class included (Gemmeiza 2, 22, Sids 34, 63, single crosses 10, 13, 314, three-way crosses 311, 314, 325, 326 and three-way cross 327) that was of higher number of rows/ ear.

## ***II-Germination and Vigour tests***

The inbred lines Sids 63 gave of the highest germination percentage and cold test percentage. Whereas, inbred line Gemmeiza 22 had the lowest germination percentage and the highest accelerated ageing percentage. While, Gemmeiza 2 was of the lowest accelerated ageing percentage and cold test percentage

Single cross 15 was of the greatest germination percentage and cold test percentage. Whereas, single cross 11 was of the lowest accelerated ageing percent and cold test percentages.

The three-way cross 326 was of the greatest germination percentage, accelerated ageing and cold test percentages. Whereas, the three-way cross 310 had the lowest accelerated ageing percent and cold test percentage

### ***III- Chemical characteristics***

The inbred line Gemmeiza 22 was of the highest total carbohydrates percentage and the lowest crude protein and oil percentages. Whereas, inbred line Sids 63 had the highest crude protein and total carbohydrate and oil percentages.

The single cross 10 had the highest total carbohydrates and oil percentages and lowest crude protein percentage. Whereas, single cross 15 had the highest crude protein and oil percentages.

The three-way cross 314 had the highest oil percentage. Whereas, the three-way cross 327 was of the lowest total carbohydrates and the highest crude protein percentages.

***IV- Fingerprinting using the Randomly Amplified Polymorphic DNA (RAPD) analysis using five random 10-mer primers the identified number of bands by the assigned primers for each of the studied maize genotypes will be presented as follows:***

### *1- For the eleven maize inbred lines*

- **Primer B11** induced the maximum number of seven bands for inbred lines Gemmeiza 30 and Sids 34. Whereas, only single band was obtained for Sids 7. Meanwhile, inbred line Gemmeiza. 4,18,22 and Sids 63 showed 4 bands. Gemmeiza 14 was of 6 bands and Gemmeiza 2, 21, and Gemmeiza 27 were of 3 bands each.
- **Primer B12** showed the follows: seven bands for inbred lines Sids7, 34, 63; five bands for Gemmeiza 2; 4 bands for Gemmeiza 4,14; three bands for Gemmeiza 22,27,30; two bands for Gemmeiza 18 and single band for Gemmeiza 21.
- **Primer B14** induced the maximum number of 7 bands for inbred line Sids 63. whereas, single band was obtained for Gemmeiza 4,22,30 and Sids 34. Meanwhile, inbred lines Gemmeiza 18 and 21 showed 3 bands. Gemmeiza 27 showed 4 bands and Gemmeiza 2, 14, and Sids 7 were of 2 bands each.
- **Primer B17** induced the maximum number of 11 bands for inbred lines Gemmeiza 2 and Gemmeiza 14. Whereas, only single band was obtained for Gemmeiza 22. Meanwhile, inbred lines Gemmeiza 21 and Sids 34 showed 7 bands. Gemmeiza 4 and Sids 7 showed 3 bands and Sids 63, Gemmeiza 30, 27 and Gemmeiza 18 were of 10,6,5 and 4 bands, respectively.
- **Primer B18** induced the maximum number of 9 bands for inbred line Gemmeiza 14. Whereas, only a single band was obtained for Gemmeiza 4. Meanwhile, inbred

lines Gemmeiza 18,21 and 30 showed 5 bands. Gemmeiza 27 and Sids 63 was of 3 bands. Gemmeiza 2, 22, and Sids 7 were of 2 bands each and Sids 34 showed 6 bands.

- The RAPD data matrix was utilized to estimate the genetic similarity among the eleven inbred lines. Genetic similarity ranged from 0.02-70% across all lines. The mean value of genetic similarity was 35%. The similarities among the ten inbred lines ranged from 0.02% between inbred lines Sid.34 and Sid.63 to as high as 70% between inbreds Gemmeiza 4 and Gemmeiza 22.
- The dendrogram constructed from cluster analysis based on RAPD data is represented collectively distinguished two main clusters. The first cluster include inbred line Sids 63. The second cluster, include another inbreds, was belonging to the same cluster, while inbreds Gemmeiza 2 and Gemmeiza 4 were closely-related.

## *2- For the six maize single crosses*

- **Primer B11** clarified two bands for single cross 11 and 12; four bands for single crosses 10, 13 and 14 and three bands for single cross 15.
- **Primer B12** clarified seven bands for single cross 11, 12 and 15; five bands for single cross 13; four bands for S.C. 14 and three bands for S.C. 10.
- **Primer B14** identified 8, 6, 4 and 1 bands for the single cross 11, S.C. 12, S.C. 15 and S.C. 10 respectively. Meanwhile, S.C. 13 and S.C. 14 showed 3 bands.

- **Primer B17** clarified five bands for single cross 15; four bands for S.C. 12; two bands for S.C. 11 and 14; one band for S.C. 10 and S.C. 13 .
- **Primer B18** identified 6, 4, 3 and 2 for the S.C. 14, S.C. 11, S.C. 10 and S.C. 15. Meanwhile, S.C. 12 and S.C. 13 showed 5 bands

### *3- For the six maize three-way crosses*

- **Primer B11** clarified 7 bands for T.W.C.314 and T.W.C.325; 5 bands for T.W.C.310, T.W.C. 327; 2 bands for T.W.C.326; 1 band for T.W.C.311.
- **Primer B12** clarified 1 band for T.W.C. 311, T.W.C.314 and T.W.C.326; 2 bands for T.W.C.310 and three-way cross327; 4 bands for T.W.C.325.
- **Primer B14** clarified 2 bands for T.W.C. 310, T.W.C.325 and T.W.C.327; 1 band for T.W.C.314; 3 bands for T.W.C.311; 4 bands for T.W.C.326.
- **Primer B17** clarified 10 bands for T.W.C.310, T.W.C.326 and T.W.C.327; 11 bands for T.W.C.314; 9 bands for T.W.C.311; 5 bands for T.W.C.325.
- **Primer B18** identified 9, 8, 7 and 6 for the T.W.C.314, T.W.C.326, T.W.C.311 and T.W.C. 325. Meanwhile, both T.W.C.310 and T.W.C.326 showed 5 bands