VI. SUMMARY AND CONCLUSION

This investigation was carried out at Shandawill Agricultural Research Station (Sohag), during the 1976, 1977 and 1978 seasons, to study the two phases of combining ability, heterotic effects and some genetical studies. Four Egyptian sorghum varieties (Sorghum bicolor (L.) Moench) Giza 15, Giza 114, Giza 54 and local 29/62 were crossed with three male-sterile varieties: Martin A, combine Kafir 60 A and Male-sterile 605 and their fertile counter parts, i.e., Martin B, Combine Kafir 60 B and SA 605 to get twelve hybrid combinations.

The studied characters were: plant height, 50% flowering, grain yield per plant, 1000 kernel weight, number of seeds per head, ear length, ear width and head size. The last three characters were taken as criteria for fertility. Also association tests were performed for the characters: grain yield per plant, plant height, 50% flowering, number of seeds per head, head size and 1000 kernel weight.

The results obtained can be summarized as follows:-

1. The differences among parents and hybrids were highly significant for all traits except 50% flowering, ear length and ear width.

2. General combining ability (g.c.a) and specific combining ability (s.c.a) variances were not significant for all characters studied in both 1977 and 1978 seasons, but the effects of s.c.a were more than those of g.c.a for plant height, 50% flowering, plant grain yield, 1000 kernel weight and ear length. Meanwhile, the g.c.a effects were more than s.c.a. effects for number of seeds per head, ear width and head size in 1977. During the season 1978, the g.c.a effects were more than the s.c.a. effects for plant height, 50% flowering, 1000 kernel weight and ear length. The s.c.a. effects were superior in the other characters. Differences between both seasons are certainly due to seasonal effect.

3. The g.c.a. effects for female parents showed that, Martin A is the best combiner parent for plant height and earliness, while the other female parents were poor general combiners for all characters studied.

4. The g.c.a. effects for male parents showed that the male parent, Giza 15 was the best combiner for plant height, plant grain yield, 1000 kernel weight, number of seeds per head, ear length and head size. The male parent Giza 114 was a high general combiner for grain yield per plant, head size and shorter plant height. The male parent, Giza 54 showed to be a good combiner

for plant height, plant grain yield and 1000 kernel weight. The male parent local 29/62 was the best combiner for 1000 kernel weight, ear length, head size and shorter plant height.

5. The g.c.a. variances for all characters studied were due to the additive effect of genes.

6. It was noticed that the parents which were high combiners for grain yield per plant were also high combiners for the yield components.

7. The s.c.a. effects fof most of the traits, showed that s.c.a. effects were higher than the g.c.a. effects in all characters studied except 50% flowering and 1000 kernel weight which showed poor s.c.a. effects. All the hybrids showing highly s.c.a. effects, had poor g.c.a. in their parents, Lower values for s.c.a. effects were obtained in the characters, ear length, ear width and head size.

8. It was proposed that the s.c.a. effects in all characters studied were due to the non-additive gene action.

9. The comparisons between $\sigma^2 gca/\sigma^2 sca$ showed that the additive gene effects was more important than non-additive gene action in most cases.

10. Highly significant effects for heterosis existed in plant height in all crosses studied, moreover the remaining characters showed highly significant and significant effects for heterosis. Meanwhile head size and 50% flowering showed negative heterotic effects.

11. The estimated heterosis percentages measured from mid-parents were (+54.84%) for plant height, (-18.14%) for 50% flowering, (+71.36%) for grain yield per plant (+60.58%) for number of seeds per head (+23.18%) for 1000 kernel weight, (+31.16%) for ear length, (+43.98%) for ear width and (-16.08%) for head size in the crosses (MS 605 x G 54), (Martin A x G 15), (MS 605 x G 54), (Martin A x L 29/62), (CK60A x L 29/62), (MS 605 x L 29/62), (CK60A x L 29/62), and (CK60A x L 29/62), respectively.

12. Expression of heterosis when estimated from the better-parents were; (-15.59%) for plant height, (-10.23%) for 50% flowering, (-59.60%) for grain yield per plant, (-55.82%) for number of seeds per head, (-29.28%) for 1000 kernel weight, (+28.24%) for ear length, (-32.52%) for ear width and (-39.96%) for head size in the crosses (Martin A x G 54), (Martin A x G 114), (artin A x G 114), (Martin A x G 114), (Martin A x G 15),

(MS 605 x L 29/62), (CK60A x G 15) and (CK60A x L 29/62), respectively.

13. The inheritance of plant in all the crosses studied revealed that the F_1 plants showed partial dominance tallness as in the Egyptian taller plants. The estimates of genes governing plant height were (1-4) pairs and gene action was mostly additive except in the cross (MS 605 x G 15) where it was multiplicative. The heritability for this character was high ranging from 75.73% to 94.26%. These high values in the broad sense indicated the effectiveness of selection for this character. However, in the cross (Martin A x G 54), heritability was medium giving 59.89%.

14. Data analysed for grain yield per plant indicated that F_1 plants showed partial dominance of the highly productive Egyptian varieties. Number of genes governing grain yield per plant was estimated by one major pair of genes with both additive and multiplicative gene actions in most crosses. However, in the cross (Martin A x G 15) it was nearly multiplicative. Meanwhile, the crosses (Martin A x L 29/62), (CK60A x G 114) and (MS 605 x G 54) gene action seemed to be additive. The heritability values was high ranging from 71.98% to 97.21% indicating the effectiveness of selection for this trait. In the cross (Martin A x G 15)

heritability gave medium value 67.15% and in the cross (CK60A x G 15) it gave a rather lower value of heritability 52.50%.

15. The study of ear length indicated that the F_1 plants showed partial dominance of longer ears as in the Egyptian varieties, except in the crosses (Martin A x G 114), (Martin A x G 54), (Martin A x L 29/62), (CK60A x L 29/62) and (MS 605 x L 29/62), which showed partial dominance of the male-sterile short varieties, Martin A, CK60A and MS 605. Number of genes governing ear length was estimated as one major pair of genes with modifiers, except in the cross (Martin A x G 114) which showed four pairs of genes for ear length. The nature of gene action seemed to be both additive and multiplicative nearly equal to each other. Some of the hybrids showed high values of heritability ranging from 69.74% to 78.26%. However, the cross (CK60A x G 114) gave a medium value of 61.66% and the hybrids (Martin A x G 114), (Martin A x G 54), (MS 605 x G 114), (CK60 A x G 54) and (Martin A x G 15) showed rather low values of heritability ranging from 12.55% to 55.87%.

16. The F_1 data for ear width showed the partial dominance of the broad ear width possessed by the Egyptian cultivars. The number of genes controlling this

character ranged from (1-5) pairs. However, in the cross (CK60A x G 114) the number seemed to be from (8-14) pairs. Both gene actions additive and multiplicative seemed to act nearly with the same amounts. Only the two crosses (CK60A x L 29/62) and (MS 605 x G 114) exhibited high values of heritability ranging from 71.02% to 73.33% indicating the effectiveness of selection for this character. However, the two crosses (Martin A x L 29/62) and (MS 605 x G 54) showed medium values of heritability ranging from 61.70% to 63.58%. The remaining hybrids had low heritability values which ranged from 9.81% in (CK60A x G 114) to 56.50% in (CK60A x G 54).

17. The phenotypic correlation coefficient between grain yield per plant and number of seeds per head showed a highly significant positive correlation value in both seasons ranging from r = 0.959 to r = 0.962, indicating that the high productivity of grain yield per plant was due mainly to the increase in number of seeds per head.

18. The correlation coefficient between grain yield per plant and plant height had positive medium values which ranged from r = 0.267 to r = 0.295. The relationship between grain yield per plant and 1000 kernel weight showed positive low values ranging from r = 0.090 to r = 0.183. The correlation between grain yield per plant

and 50% flowering ranged from r = -0.390 to r = +0.121. The correlation coefficient between grain yield per plant and head size gave low values ranging from r = -0.111 to r = +0.069. These low values for correlation coefficients indicated that this correlation may not be effective and therefore it can be neglected. The phenotypic correlation coefficient between 50% flowering and number of seeds per head showed also negative low values which ranged from r = -0.032 to r = -0.304. The phenotypic correlation coefficients between head size and number of seeds per head were negative with low values ranging from r = -0.072 to r = -0.129. All the correlation coefficients were insignificant and unreliable except between grain yield/plant vs number of seeds per head which was highly significant.