VI- SUMMARY

The aim of the present invistigation is to study the genetic behaviour of some economic characters, estimated per individual plants, in grain sorghum, namely : plant height, head length, head width head index, head weight and seed weight.

Nine crosses included the two local varieties : Giza 15 and Giza 114 and the three exotic varieties : NES 324, NES 645 and TAM 428 were performed and data were obtained on the parents, F_1, F_2, Bc_1 and Bc_2 generations. Besides - the relationship between number of these characters were determined. There experiment, were conducted at Shandaweel Experimental Station, Field Crops Research Institute, Agriculture Research Center. The experimental work lasted for the three seasons : 1979, 1980 and 1981. Results could be summerized as follows :

I- Plant height:

1- The F_2 data showed that plant height behaved as a quantitative character. Partial dominance for tallness was evident in the five crosses : NES 324 x G.114 ; NES 645 x G.15; NES 645 x G.114; TAM 428 x G.15 and G.15 x G.114. On the other hand, the three crosses : NES 324 x TAM 428; NES 645 x TAM 428 and TAM 428 x G.114 showed overdominance of the taller parent. Besides the cross NES 324 x NES 645 indicated complete dominance of tallness.

2- The estimated heterosis percentages calculated from mid-parents were positive and ranged from (+0.81 %) to (+52.97 %) Estimating heterosis by comparing with the better parent showed negative values in the five crosses: NES 324 x G.114; NES 645 x G.15; NES 645 x G.114 ; TAM 428 x G.15 and G.15 x G.114 and ranged from (-3.99 %) to (-11.70 %). Moreover, the four crosses : NES 324 x NES 645; NES 324 x TAM 428; NES 645 x TAM 428 and TAM 428 x G.114 showed positive heterosis ranging from (+0.07 %) to (+ 39.10 %). The negative values of heterosis may be due to difference between parents in genetic background and their response to environmental conditions.

3- Inbreeding depression percentage in most crosses gave high values ranging from (9.79 %) to (20.25 %). This may be due to homozygosity of most factors influencing plant height in grain sorghum.

4- Nature of gene action determined by comparing the arithmetic and geometric means showed that both additive and multiplicative gene action may be involved with the same amount in the four crosses : NES 324 x NES 645 ; NES 324 x G.114, NES 645 x G.114 and G.15 x G.114 . However, cross NES 645 x TAM 428 showed that genes controlling this character act multiplicatively, Meanwhile, in the four crosses: NES 324 x TAM 428 ; NES 645 x G.15; TAM 428 x G.15 and TAM 428 x G.114 nature of gene action was not possible

to determine due to insignificant differences between the F_2 means and arithmetic and geometric means. The estimates of gene action parameters for plant height using the population means showed that, in general, the dominance effect was relatively the most important parameter followed by the additive x additive interaction effect.

5- The differences between parents were governed by one to eight pair of genes confirming the continuous distribution.

6- The heritability values in broad sense ranged from 57.78 % to 98.03 % indicating that selection for this character would be effective. On the other hand, the narrow sense heritability, in most crosses, could not be determined due to presence of high variance in the F_1 plants, but in the three crosses : NES 324 x G.114; TAM 428 x G.15 and TAM 248 x G.114 there were values of $h^2\%$ which indicate that plant height is greatly influenced by environmental flactuations.

II- Head length per plant :

1- The data on head length showed to be quantitatively inherited. These data indicated that in most crosses studied there was overdominance for the taller head. Meanwhile, the cross NES 324 x NES 645 showed complete dominance of the taller head, Moreover in the cross NES 645 x G.114 partial dominance for the taller head was found.

6- Heritability (h^2 %) estimates in broad sense ranged from (54.18 %) to (95.53 %). These high values showed that selection for head length would be effective. On the other hand heritability estimates in narrow sense ranged from (12.59 %) to (62.00%) in the five crosses : TAM 428 x G.15 ; NES 324 x G.114; NES 645 x G.15 ; NES 645 x G.114 and NES 324 x NES 645. These low values may be due to the environmental effect. However, in the four crosses : G.15 x G.114 ; TAM 428 x G.114; NES 324 x TAM 428 and NES 645 x TAM 428, the narrow sense heritability could not be calculated because of the high environmental effects.

III- Head width per plant :

1- The data of head width showed that this character behaved as a quantitiative character. Overdominance of the wider head was noticed in most crosses studied, but the cross NES 645 x G.15 showed complete do inance of the wider head. Meanwhile, the cross NES 324 x NES 645 showed obsence of dominance.

2- All crosses gave positive heterosis values over mid-parents ranging from (+ 4.10%) to (+ 30 99%). These values indicate that the hybrids tend to carry wider head per plant. Estimating heterosis by comparing with the better parent showed also positive values ranging from (+3.01 %) to (+ 30.60 %) indicating that these crosses can give wider heads than the higher parents.

3- Inbreeding depression percentage gave high values ranging from (4.90 %) to (32.30 %) . This may be due to homozygosity of most factors influencing head width.

4- Analysis of data showed that both additive and multiplicative gene action may act with the same amount in most crosses. Meanwhile, the nature of gene action tends to be additive in the two crosses : NES 645 x G.15 and NES 324 x TAM 428. The estimates of gene action parameters for head width using the population mean showed that in most crosses the dominance and dominance x dominance effects were relatively the most important parameters.

5- Head width per plant seems to be governed by one to nine pair of genes in most crosses studied. On the other hand, the number of genes could not be calculated in the two crosses : NES 324 x TAM 428 and NES 324 x G.114. In addition, there was overdominance in the F_1 generation.

6- Heritability values in broad sense showed that most crosses had values above 65 % which indicated that selection for head width would be effective. However, in the two crosses : NES 324 x TAM 428 and NES 324 x G.114 broad sense heritability could not be calculated due to the high variance of F_1 (s). On the other hand, h^2 % values in narrow sense were as low as 50 % which may be due to the environmental effects.

IV- Head index per plant:

1- Head index was extracted from dividing head width by head lenght. The behaviour of this character showed overdominance, complete dominance and partial dominance of the larger head index in the three crosses : NES 324 x TAM 428 ; G.15 x G.114 and NES 645 x G.114 . On the other hand, the five crosses : NES 645 x TAM 428; NES 324 x G.114; NES 645 x G.15; TAM 428 x G.114 and TAM 428 x G.15 showed overdominance, complete dominance and partial dominance of the smaller head index. However the cross NES 324 x NES 645 showed absence of dominance.

2- Heterosis percentages over the mid-parents in all crosses gave positive values ranging from (+4.10%) to (+30.99%) Heterosis in relation to better parent showed that positive values ranged from (+ 3.01 %) to (+ 30.99%).

3- In most crosses studied inbreeding depression gave high values ranging from (4.90 %) to (32.30 %) .

4- Comparing of the arithmetic and the geometric means showed that genes controlling this character may act either additively or multiplicatively in all crosses except the cross NES 645 x G.15 which showed that genes controlling this character were additive. The estimates of gene action parameters for head index using the population means

showed that dominance and dominance x dominance effects were the most important parameters.

5- Estimates of number of genes showed one to two pair of genes affecting this character in all crosses.

6- Data of broad sense heritability (h^2 %) showed that most crosses had values above 60 % indicating that individual plant selection would be effective. Besides the two crosses : NES 324 x TAM 428 and NES 645 x G.114 had low values of h^2%. Estimates of heritability in narrow sense showed that most crosses had values above 50 % indicating that the selection for this character would be effective.

V Head weight per plant :

1- The F_2 data showed that head weight behaved as a quantitative character. Overdominance for heavy head weight was evident in most crosses. Besides, The cross NES 645 x G.15 showed partial dominance of the heavy head weight. However the two crosses TAM 428 x G.15 and G.15 x G.114 showed absence of dominance.

2- Estimates of heterosis compared with mid-parents were positive and ranged from (+12.95 %) to (+113.57 %) in all crosses except in the cross G.15 x G.114 which had negative heterosis (-0.19 %). This negative value may indicate that certain genes tend to give lighter head weight. Estimating heterosis by comparing with the better parent showed positive heterosis in most crosses ranging from (+15.68 %) to (+85.35 %) , but the three crosses : NES 645 x G. 15 ;

TAM 428 x G.15 and G.15 x G.114 gave negative values ranging from (-3.83 %) to (-19.67 %) . This may be due to difference between parents in genetic background and their response to environmental conditions.

3- Inbreeding depression percentage gave high values ranging from (9.07 %) to (64.47 %), suggesting homozygosity of most factors influencing head weight.

4- Comparing the arithmetic and geometric means showed that genes controlling this character may act either additively or multiplicatively in most crosses. On the other hand the cross TAM 428 x G.114 showed that nature of gene action tends to be multiplicative . However in the cross NES 324 x NES 645 nature of gene action could not be determined. The six parameters of gene effects estimated of the population means showed that dominance, dominance x dominance and additive x addituve effects contribute more to the performance of head weight in those populations than the additive x dominance and additive effect.

5- The difference between parents was governed by one to ten pair of genes.

6- Data of broad sense heritability showed that the three crosses : NES 645 x TAM 428 ; NES 645 x G.15 and NES 324 x NES 645 had values obove 50 % which indicate that selection for head weight would be effective. However in some crosses heritability could not be calculated due to the presence of heterosis in the F_1 (s) beside, the high

environmental effects. On the other hand, h^2 % values in narrow sense were as low as 50 % which may be due to dominance effect causing heterosis in the F_1 (s).

VI- Seed weight per plant :

1- The F_2 population showed that this character behaved as a quantitative character. overdominance of heavy seed weight was noticed in most crosses, while data of the two crosses : NES 645 x G. 114 and NES 645 x G.15 showed partial dominance of the heavy seed weight. However, data in the two crosses : TAM 428 x G.15 and G.15 x G.114 showed absence of dominance.

2- Estimates of heterosis compared with mid-parents for seed weight were positive and ranged from (+0.59 %) to (+113.76 %) which may explain the presence of overdominance of heavier seed weight and indicate the increase of seed weight per plant. Also heterosis compared to the better parent showed that most crosses had positive values ranging from (+15.83 %) to (+84.90 %) except in the three crosses : NES 645 x G.15; TAM 428 x G.15 and G.15 x G.114 which had negative values ranging from (-2.39 %) to (-18.46 %). This may be due to difference between parents in genetic background and their response to environmental conditions.

3- Inbreeding depression percentage in all crosses gave high values ranging from (10.57 %) to (64.50 %).

4- In most of the crosses studied, gene action may act either additively or multiplicatively, while, the cross TAM 428 x G.114 showed that gene action was nearly multiplicative. However the cross NES 324 x NES 645 showed that nature of gene action could not be determined . The estimates of gene action parameters for seed weight using the population means showed that the additive x dominance dominance x dominance and dominance gene effects were the most important parts in this character.

5- The number of genes controlling this character was found to be one to ten pair of genes.

6- The data showed that some crosses had heritability values in broad sense above 50 % which indicated that selection for this character would effective. However, in some cases h^2 % could not be calculated due to the high variance in the F_1 (s) causing heterasis. Heritability in narrow sense in the three crosses : NES 324 x TAM 428; NES 324 x G.114 and G.15 x G.114 was low. Besides, in some cases heritability estimates could not be calculated.

VII- Correlation between some characters

The corellation coefficient for seed weight per plant and each of plant height, head length, head width and head index showed insignificant positive values which ranged from $r = (+ 0.067)$ to $r = (+ 0.346)$.

The correlation between seed weight per plant and head weight had significant positive value (r = +0.659) which indicated high relationship between these two characters.