Contents

	Page
INTRODUCTION ……...	1
REVIEW OF LITERATURE …….	4
1-Genotypes by environments interaction ……..	4
2-Gene action, heterosis and heritability ……	10
3-Genetic divergence among cotton genotypes …….	28
MATERIALS AND METHODS ……	35
I-Genetic materials ……	35
II-Mating design ……	36
III-Experiments design ……..	37
IV-Definition of studies traits ……	38
A-Vegetative and earliness traits ……	38
1- Plant height ……	38
2- Position of first fruiting node …….	38
3- Days to first flowers ..……	38
4- Number of fruiting branches / plant ……...	38
5- Number of vegetative branches / plant ……..	38
B- Yield and yield components traits ……	38
1- Seed cotton yield per plant …….	38
2-Number of bolls per plant …….	38
3- Boll weight in grams ……..	39

4- Lint yield per plant ……. 39

5- Lint percentage ……... 39

6- Seed index …….. 39

C- Fiber traits …… 39

1-Fiber strength …….. 39

2- Fiber fineness ……. 39

3- 2.5% span length …… 39

4- Uniformity ratio ……. 40

5- Fiber elongation ……. 40

V: Statistical analysis ……. 40

1-Analysis of variance …….. 40

2- Estimation of heterosis …….. 44

VI- Genetic components …… 45

VII- Estimation of general and specific combining ability effects…….. 46

a- General combining ability for lines and testers…….. 46

b. Specific combining ability effects …….. 46

VIII-Proportional contribution of lines, testers and their interaction in top crosses …… 47

VIIII- Estimation of heritability …… 48

RESULTS AND DISCUSSION …….. 50

1- Genetic variability and genotypic by location interaction 50

a- Proportional contribution……..…….. 59

b- Mean performance of parental genotypes under different locations……. 61

c- Performance of hybrids under the two locations …… 66

2-Heterosis, combining ability analysis, genetic components and heritability ……. 69

a) Heterosis ……. 69

b) Combining ability …….. 87

C-Genetic components and heritability ……. 108

3-Multivariate analysis and genetic divergence ……. 112

a- Multivariate analysis …….. 112

b-Hierarchical clustering analysis …….. 119

b- (1)- Diversity among parental genotypes …… 119

b- (2)-Divergence between parental genotypes and their F_1 progenies ……. 124

SUMMARY…… 128

CONCLUSION ……. 134

REFERENCES…….. 136

ARABIC SUMMARY ……..

List of Tables

No	Title	Page
1	The origin and pedigree of the parents.	36
2	Analysis of variance and expected mean squares.	41
3	Line X tester analysis of variance and the expected mean squares for one location.	42
4	Line x tester analysis of variance and the expected mean squares over the two locations (combined).	43
5	Mean squares of vegetative traits for each location and combined data.	52
6	Mean squares of yield and yield components' traits for each location and combined data.	53
7	Mean squares of fiber traits for each location and combined data.	55
8	Proportion contributions of lines, testers and their interaction for vegetative traits in the two locations and their combined data.	59
9	Proportion contributions of lines, testers and their interaction for yield and yield components' traits in the two locations and their combined data.	59
10	Proportion contributions of lines, testers and their interaction for fiber traits in the two locations and their combined data.	60
11	The mean performance of six parental lines and four testers for vegetative traits in each location and combined data.	62
12	The mean performance of six parental lines and four testers for yield and yield components' traits in each location and combined	63

	data.	
13	The mean performance of six parental lines and four testers for fiber traits each location and combined data.	64
14	The mean performance of F1 hybrids for vegetative in each location and combined data.	66
15	The mean performance of F1 hybrids for yield and yield components' traits in each location and combined data.	67
16	The mean performance of F1 hybrids for fiber property traits in each location and combined data.	68
17	Heterosis relative to the mid-parents for vegetative traits in the two locations and their combined data.	72
18	Heterosis relative to the better parent for vegetative traits in the two locations and their combined data.	73
19	Heterosis relative to the commercial variety for vegetative traits in the two locations and their combined data.	74
20	Heterosis relative to the mid-parents for yield and yield components in the two locations and their combined data.	76
21	Heterosis relative to the better parent for yield and yield components in the two locations and their combined data.	78
22	Heterosis relative to the commercial variety for yield and yield component in the two locations and their combined data.	80
23	Heterosis relative to the mid-parents for fiber traits in the two	84

	locations and their combined data.	
24	Heterosis relative to the better parent for fiber traits in the two locations and their combined data.	85
25	Heterosis relative to the commercial variety for fiber traits in the two locations and their combined data.	86
26	Specific combining ability relative to the general combining ability for vegetative traits in the two locations and their combined data.	88
27	Specific combining ability relative to the general combining ability for yield and yield components' traits in the two locations and their combined data.	88
28	Specific combining ability relative to the general combining ability for fiber traits in the two locations and their combined data.	88
29	General combining ability effects of the parental genotypes (lines and testers) for vegetative traits in the two locations and their combined data.	91
30	General combining ability effects of the parental genotypes (lines and testers) for yield and yield component traits in the two locations and their combined data.	93
31	General combining ability (GCA) effects of the parental genotypes (lines and testers) for fiber properties in the two locations and their combined data.	96

32	Correlation coefficients between GCA effects among the ten influential cotton genotypes.	98
33	Estimates of specific combining ability (SCA) effects for vegetative traits in the two locations and their combined data.	100
34	Estimates of specific combining ability (SCA) effects for yield and yield components in the two locations and their combined data.	103
35	Estimates of specific combining ability effects for fiber traits in the two locations and their combined data.	106
36	The partitioning of the genetic variance of vegetative traits in the two locations and their combined data.	110
37	The partitioning of the genetic variance of yield and yield component in the two locations and their combined data.	110
38	The partitioning of the genetic variance of fiber traits in the two locations and their combined data.	111
39	Principal component factor analysis of traits associated with 39 cotton genotypes.	114
40	Euclidean dissimilarity coefficients among ten parental cotton genotypes.	120
41	Inter and intra cluster distances.	122
42	Distribution of cotton parental genotypes into clusters.	123
43	Inter and intra cluster distance among eight clusters.	127

List of Figures

No	Title	Page
1	Loading plot of sixteen characters contributed in yield, fiber and earliness characters.	116
2	Representation of 34 Cotton genotypes of the first two PC axes of principal component analysis.	118
3	Dendrogram presentation of the Cotton parental genotypes based on Eeuclidean dissimilarity coefficients.	121
4	Results of hierarchical cluster analysis based on dissimilarity coefficient among 34 cotton genotypes.	125

Summary

SUMMARY

The present study was done in two locations, the first location at Sakha Agriculture Research Station, and the second location at Experimental Farm, Faculty of Agriculture, Mansoura University during 2010 and 2011 growing seasons.

The research was conducted to study (i) genetic variabilities and genotypic by location interaction (ii) determination of superior parents and combinations through combining ability analysis, (iii) to study types of gene which control of some quantitative traits and heritability in broad and narrow senses. Also, the study employed to determine the genetic divergence among parents and F_1 progenies as well as to investigate the importance of the evaluated traits.

The experimental materials comprised of ten cotton genotypes viz, Giza 70, Menofi, Giza 86, Giza 89, Ashmouni and Dandara as lines with two foreign genotypes i.e BBB and Suvin as well as to Egyptian varieties Giza 92 and Giza 88 as testers and 24 crosses generated by crossing six lines with four testers in line × tester design. The parents and their F_1 hybrids were evaluated in a separate randomized block design with three replications at two diverse locations. The growth and earliness traits, i.e. plant height, position of first fruiting node, days to first flower, number of vegetative branches / plant, number of fruiting branches / plant were studied. While, yield and yield. components traits, i.e. seed cotton yield / plant, lint yield / plant, boll weight, lint

percentage and seed index as well as fiber quality traits, i.e. fiber fineness, fiber strength, fiber length and uniformity ratio were also estimated.

The obtained results could be summarized as follows:

- Analysis of variance revealed highly significant difference among genotypes for all studied traits over two locations and their combined. This mostly due to the genetic factors rather than environmental ones as indicated by the high genetic variances.
- The variation due to parents Vs crosses were found to be significant for most studied traits at two locations and their combined indicated that the average heterosis was more pronounced for these traits.
- The interaction between lines and testers showed significant mean squares for most traits at both locations and their combined, thereby indicating that the experimental materials possessed considerable variability.
- Location mean squares were found to be highly significant for all traits except for fiber quality traits, indicating that these traits were more unstable at two locations comparable with fiber quality traits.
- Fiber quality traits were less affected by locations and it were more stable under different locations. While yield and growth traits, the genotypes behaved somewhat differently from location to another.
- The maximum contribution to the total variance of most traits was made by line × tester interaction. The contribution of testers were higher than lines for most traits over two locations and their combined, this indicates

unequal magnitude of the role of either lines or tester in the expression of specific combining ability and heterosis.

- The performance of parents distinctly varied from location to another. The means showed that there were no specific superior or inferior parents for growth and yield traits. The Indian genotype Suvin exhibited earliers in maturity with high yield potentials in both locations.
- The Egyptian genotypes Giza 86 and Ashmouni surpassed all parental genotypes for lint percentage, seed cotton yield / plant and lint yield.
- The parental genotypes Giza 70, Giza 88 and Giza 92 showed the best values for all fiber quality traits.
- The cross combinations Giza 86 × Giza 92 and Giza 89 × Suvin showed the best mean values for earliness traits, while, the cross combination Giza 86 × Suvin exhibited highest values for most yield traits in both locations and their combined.
- The hybrids involving Giza 92 as a common parent gave desirable values for micronair reading (fineness) with best values for other fiber traits. The combinations involving Giza 88 as a common parent showed high values for fiber length and strength with high uniformity.
- Some crosses were found to be superior to their respective better parent for most growth and earliness traits at one location only.
- The cross combinations exhibited high per-se performance for yield traits involved one of the parent as good general combiner for these traits.

- Useful heterosis for seed cotton yield / plant ranged from 24.90% to 84.69%. The combinations Giza 86 × BBB, Giza 86 × Suvin and Dandara × Suvin showed the best useful heterosis for most yield traits.
- No cross combination was finer than better parent at two locations and their combined except Giza 88 × Dandara. And there is no any cross combination showed desirable heterosis for all fiber traits.
- The ratio of GCA variance to SCA variance revealed predominance of non-additive gene action for all studied traits.
- The studies on general combining ability of parents revealed that the line Dandara was the good combiner for earliness traits. However Giza 86, Dandara and Suvin were the good combiners with respect to yield and its contributed traits. The Egyptian genotypes Giza 92, Giza 88 and Giza 70 were the best combiners for fiber quality traits over two locations and their combined.
- These parents can be utilized in breeding improvement programs for developing high yielding hybrids coupled with good fiber quality traits.
- The cross combinations Giza 70 × BBB, Suvin × Dandara, Giza 86 × BBB and Giza 86 × Suvin exhibited highest magnitude of positive significant SCA effect for most yield traits, this combinations exhibited highest magnitude of significant heterosis over better parent and commercial parent. No cross combinations were superior in all fiber traits. The combinations of Giza 70 × Giza 88 and Menofi × G. 88 showed best SCA effect for most fiber traits.

- The results revealed that the magnitude of non-additive genetic variance was larger than additive genetic variance for all studied traits so we use Programs in successive sessions of hybridization and recurrent selection to improve the studied traits.
- Heritability in narrow sense values were found to be much lower than those of broad sense at two locations and combined data for all studied traits. This due to the large portion of non-additive genetic variance.
- Principal component analysis indicated that the first five components were significant and accounted for about 76.5% of the total variance of all traits. While the first three principal components accounted for about 62.2% showing the highest eigen values.
- Lint yield / plant, seed cotton yield, lint percentage, boll weight followed by micronaire reading were a primary source of variation with the largest coefficients in the first PC axis. While, earliness traits followed by fiber elongation showed a large coefficients with the second PC axis. However, fiber length and strength exhibited a largest coefficients with the third PC axis.
- The genetic divergence among ten parents based on Euclidean distances revealed five major clusters, the foreign genotypes, Suvin and BBB formed two clusters and having divergent distance from the Egyptian genotypes.
- The dissimilarity coefficients among the genotypes in different clusters were significant, the highest distance between Giza 88 and Ashmouni was

44.10, and the lowest distance between Dandara and Giza 89 was 5.33 which grouped at the same cluster.

- Based on relative dissimilarity, the 34 genotypes, 10 parents and 24 F_1 hybrids, were grouped into eight major clusters. The distribution pattern of the F_1 heterozygous was more or less influenced by their parents as expected on the basic of close affinity between the parents and their F_1 progenies.

conclusion

CONCLUSION

1- it could be concluded that the performance of parents and F_1 hybrids varied from location to another for yield and earliness traits and somewhat stable for fiber character. The cross combinations Dandara × Suvin and Giza 86 × Suvin gave the highest values for most yield traits. However, the combinations which involved Giza 92 showed desirable values for most fiber traits.

2- The magnitude of SCA variance was greater than GCA for majority of the traits indicating that additive × non-additive and non-additive type of interactions were significantly higher among hybrids which could be exploited by heterosis breeding.

3- The parents Giza 86, Dandara and Suvin showed significant positive values for GCA effects for most yield traits. However, Giza 92 and Giza 70 followed by Giza 88 gave the best values for fiber traits.

4- The cross combinations Giza 86 × Suvin, Dandara × Suvin and Giza 86 × BBB exhibited highest magnitude of positive heterosis over better parent and also exhibited the highest magnitude of positive SCA effects for most yield characters.

5- However, most studied traits were governed by non-additive, dominance or epistatic genetic variance. Thus, recurrent selection approach would be appropriate for improvement of such traits.

6- In the same time, multivariate methods such as principal components analysis is useful for identifying most important traits effecting for genetic variation of population. However, cluster analysis could be efficiently for description the characteristics of group of genotypes in different clusters.

The cotton breeder desire to increase genetic diversity among cotton cultivars. In the same time maintaining the complex of desired agronomic and quality traits present in existing economic cultivar.