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Evaluation of some Genotypes under Water Stress for some Yield and Fiber Quality Properties in Cotton (*Gossypium barbadense* L.)

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ABSTRACT

The objective of this study was to evaluate some genotypes under well irrigated compared with water stress conditions. The important results were as follows. Analysis of variance due to line x tester and combining ability for yield and fiber quality were highly significant for most traits in both normal and water stress conditions. The variance due to general combining ability (GCA) was lower than specific combining ability (SCA) for all studied characters which, means that all traits controlled by non-additive gene action. Contribution due to line parents were greater than contribution due to testers in under stress condition. Higher values were recorded in the parental genotypes Giza 67 for seed cotton yield/plant followed by Giza 86 and Giza 94, while highest seed cotton yield/plant and lint yield were recorded by the cross combination Giza 86 x Dandra followed by Minufy x Australy, Giza 96 x Dandra and Giza 67 x PimaS6 Under normal irrigation condition. On the other hand, seed cotton and lint yield/plant were consistently affected by water deficit. Fiber quality properties were decreased in inferior direction except micronaire value, since fiber was relatively fine but it was weak and shorter under water deficit condition. Positive correlations between yield and each of its components were observed in most cases, while correlations among yield traits were higher in normal irrigation as compared with water stress. Boll weight was positive correlated with most yield components at genotypic and phenotypic levels in both normal irrigation and water stress conditions. Positive correlation in general were found between most fiber quality traits (fiber strength (F.S), fiber length (F.L.) and fiber fineness (F.F.)) ,while it was positive between them with micronaire reading.

Keywords: Cotton, Line x Tester Design, Proportional contribution, Genotypic correlation, Phenotypic correlation.

INTRODUCTION

Water stress is the most important factor limiting crop productivity that adversely affects fruit production, square and boll shedding, lint yield and fiber properties quality in cotton (Karademir *et al.*, 2012). As the global climate change continues, water shortage and drought have become an increasingly serious constraint limiting crop production worldwide. The demand for drought tolerant genotypes will be exacerbated as water resources and the fumes to access them become more limited, Longnberger *et al.* (2006).

For successful breeding of cotton cultivars tolerant to drought through conventional approach, basic information about the breeding material must be available to the breeders. Firstly, there must be significant variability in genotypic response to water stress and secondly, this variation must be genetically controlled. Few studies revealed that water stress tolerant in *Gossypium hirsutum* L. is under genetic control Iqbal *et al.* (2011).

Cotton breeders have managed to evolve early and high yielding with better fiber quality genotypes through different genetic manipulation and breeding practices. For this purpose creation of new variability along with its genetic understanding, is of crucial importance in breeding programs. Thus, introducing new germplasm of cotton may be useful source for increasing the gene pool of cotton and will serve as a short term program to meet immediate national need (Khedr 2002). Therefore, the present study was conduct to evaluate thirteen parental cotton genotypes and their F1 hybrids under both normal and stress conditions to select the best parental cross combinations for tolerant water deficit stress.

MATERIALS AND METHODS

The present experiment was conducted at Sakha Agric. Res. Stat. Kafr EL-Sheikh, Agric. Res. Center Egypt, during 2014 and 2015 growing seasons. The thirteen parents were crossed, in such away Line x Tester (9x4) mating design by using four parents as a Tester parents i.e. Dandra, Pima S_6, Australy and 10229 and nine cotton genotypes as a Line parents i.e. Giza 45, Minufy, Giza 67, Giza 68, Giza 86, Giza 77, Giza 94, Giza 96 and Giza 69, in 2014 crop season to produce 36 F1 hybrid seeds, and the original parents were also selfed.

In 2015 season the 36 F1 hybrids and their parents were grown in a randomized complete block design with three replicates under two irrigated conditions. The first one is the normal irrigated 7 irrigations during the growing season and the second is the stress condition (3 irrigations) during the same growing season. Each experimental plot consisted of one row, measuring five meters in length and 0.70 m in width, with plants spaced 30 cm within row. Two plants were left per hill at thinning time. Recommended cultural practices were followed for all the entries. Ten guarded plants of each replicate were gained and used to determine yield components i.e. boll weight in grams (B.W), seed cotton yield per plant in grams (S.C.Y), lint yield per plant in grams (L.Y), lint percentage (L.P %), seed index in gm (S.I.), lint index in gm (L.I.), and fiber characters fiber fineness (F.F.) as micronaire reading , fiber strength (F.S) as Pressley index, uniformity ratio (U. R.) and fiber length (F.L.) as 2.5% span length.

statistical analysis:-

Adopted line x tester analysis was deviated to partitioning the genetic variance of the F1 top crosses due to lines, testers and their interaction, as described by Singh and Chaudhary (1977).

Finally, Correlations of both types (genotypic and phenotypic) were calculated using analysis of variance and covariance procedures proposed by Falconer and Mackey (1996), as follows:

$$\textbf{Genotypic correlation } (r_g) = \frac{\sigma g i j}{\sqrt{\sigma^2 gi \,.\, \sigma^2 \, gj}}$$

Where: σg_{ij}**= Genotypic covariance between i and j.**
$\sigma^2 g_i$ **= Genetic variance of the character i.**
$\sigma^2 g_j$ **= Genotypic variance of the characters j.**

$$\textbf{Phenotypic correlation } (r_{ph}) = \frac{\sigma \mathrm{pij}}{\sqrt{\sigma^2 \mathrm{pi} \,.\, \sigma^2 \mathrm{pj}}}$$

Where,:
σp_{ij}**= Phenotypic covariance between i and j .**

$\sigma^2 p_i$ = Phenotypic variance of the character i.
$\sigma^2 p_j$ = Phenotypic variance of the characters j.

All computation were performed using SPSS and Minitap computer procedures.

RESULTS AND DISCUSSION

Genetic variability is the basic requirement for any breeding and improvement program. Genetic advance from traditional breeding techniques may be limited due to insufficient genetic variation or undesirable linkage blocks. Plant breeders try to increase the frequency of desirable recombination but continual use of available genetic resource has been narrowed the genetic variation of cotton. Cotton breeders aimed to produce cultivars for dry land production systems that have high yield potential and enhanced water use efficiency, in addition tolerant for water deficit.

Analysis of variance presented in Tables (1,2) revealed significant mean square differences among genotypes, parents and crosses for all yield component and fiber quality characters under water stress and recommended irrigation. Indicating the presence of considerable amount of genetic variability such genetic variation could be attributed to the varied of genetic background. The variance due to line, tester were also significant for most characters under two conditions, and majority than the variance due to interaction, indicating that the experimental materials possessed considerable variability, and the two type of combining ability were involved in the genetic expression of these characters.

Table 1. Analysis of variance for line x tester and combining ability for yield and yield components traits under normal and water stress conditions.

		Analysis of variance											
		Mean squares											
S.O.V	**df**	**SCY/P (gram)**		**L.P %**		**B.W. (gram)**		**L.Y. (gram)**		**S.I. (gram)**		**L.I. (gram)**	
		N	**S**	**N**	**S**	**N**	**S**	**N**	**S**	**N**	**S**	**N**	**S**
Replication	2	44.32	57.59	3.73*	0.02	0.14	0.07	17.72	7.65	0.27	0.001	0.68*	0.01
Genotypes	48	501.10**	468.26**	4.46**	14.29**	0.17**	0.18**	74.89**	66.66**	1.38**	1.40**	0.94**	1.30**
Parents	12	454.04**	634.19**	4.78**	7.84**	0.25**	0.18**	65.61**	97.84**	0.68**	1.73**	0.86**	0.57**
Crosses	35	437.40**	373.02**	4.44**	15.12**	0.15**	0.19**	65.94**	54.75**	1.65**	1.32**	0.99**	1.47**
Parents x crosses	1	3295.18**	1810.65**	1.42	62.83**	0.04	0.08	499.41**	109.30**	0.17	0.20	0.01	3.97*
Lines	8	430.01**	238.31**	5.97**	37.19**	0.15*	0.26**	80.18**	51.65**	1.66**	2.08**	1.58**	2.79**
Testers	3	358.44**	758.75**	2.81**	15.96**	0.23**	0.30**	64.05**	87.89**	4.63**	2.54**	0.77**	2.82**
Lines x Testers	24	449.74**	369.70**	4.13**	7.66**	0.14**	0.15**	61.42**	51.64**	1.28**	0.91**	0.83**	0.87**
Error	96	67.46	34.32	0.97	1.23	0.05	0.05	10.19	4.99	0.23	0.27	0.18	0.17
σ^2 GCA		-0.22	0.06	0.01	0.13	0.0002	0.001	0.081	0.06	0.01	0.01	0.003	0.01
σ^2 SCA		128.23	111.56	1.04	2.18	0.03	0.03	17.24	15.48	0.35	0.20	0.21	0.23
σ^2 GCA/ σ^2 SCA		-0.002	0.001	0.01	0.06	0.01	0.03	0.005	0.004	0.03	0.05	0.01	0.04
CV%		9.62	8.94	2.64	3.02	6.70	6.98	10.04	9.29	4.34	5.54	6.39	7.45

Table 2. Analysis of variance for line x tester and combining ability for fiber quality properties under normal and water stress conditions.

		Analysis of variance							
		Mean squares							
S.O.V	**df**	**F.F.**		**F.S.**		**F.L.**		**U.R.**	
		N	**S**	**N**	**S**	**N**	**S**	**N**	**S**
Replication	2	0.05	0.12**	0.12	0.16	0.17	1.03	0.65	0.26
Genotypes	48	0.13**	0.10**	0.23**	0.26**	1.76**	2.71**	2.03**	2.23**
Parents	12	0.14**	0.10**	0.24**	0.45**	2.43**	1.57**	1.85**	1.08**
Crosses	35	0.12**	0.10**	0.24**	0.18**	1.57**	3.09**	2.07**	2.67**
Parents x crosses	1	0.19**	0.01	0.05	0.54**	0.11	3.23**	2.93**	0.78
Lines	8	0.24**	0.16**	0.42**	0.29**	0.81*	3.59**	1.61**	2.83**
Testers	3	0.02	0.11**	0.47**	0.16	1.12*	2.73**	0.78	9.47**
Lines x Testers	24	0.09**	0.08**	0.15**	0.15**	1.88**	2.97**	2.39**	1.77**
Error	96	0.02	0.02	0.06	0.06	0.34	0.50	0.28	0.43
σ^2 GCA		0.001	0.0004	0.002	0.001	-0.01	0.002	-0.01	0.02
σ^2 SCA		0.03	0.02	0.03	0.03	0.50	0.81	0.69	0.43
σ^2 GCA/ σ^2 SCA		0.03	0.02	0.07	0.03	-0.02	0.002	-0.01	0.05
CV%		3.63	3.65	2.33	2.51	1.73	2.20	0.62	0.78

The proportional contributions of lines (females) and testers (males) and their interactions to the total variance for different characters are presented in table (3). The data revealed that the maximum contribution of the total variance for most studied characters in both normal and stress conditions were made by lines x testers (male x female interaction). On the same time, the contribution due to line parents were greater than contribution due to testers in the stress condition.

Yield is the end product of cotton crop and high yielding capacity is the aim goal of the cotton breeder. The quantity and quality of the fiber yield produced from cotton plants are directly related to water availability during the different phonological phases of development.

Cotton yield is dependent upon the production and retention of bolls and both can decreased by water deficit stress. Under water stress, decrease in seed cotton yield is primary due to the reduction in number of bolls and boll weight Mert, (2005) and Basel and Unay (2006).

Data illustrated in Table (4) revealed that decreasing water irrigation lead to significantly decreased in seed cotton yield/plant, boll weight, lint yield, seed index and lint index, except for lint percentage. The results showed significant differences among cotton genotypes for yield and its components under normal irrigation and water stress conditions. Under normal condition the cotton parental genotypes Giza 67 showed the highest value for seed cotton yield/plant followed by Giza 86 and Giza 94, and the highest seed cotton yield/plant and lint yield were recorded by the cross combination Giza 86 x Dandra followed by Minufy x Australy, Giza 96 x Dandra and Giza 67 x PimaS6 under normal condition.

Table 3. Proportional contribution of lines, testers and their interactions for studied characters.

	Yield and yield components traits											
	SCY/P (gram)		**L.P %**		**B.W. (gram)**		**L.Y. (gram)**		**S.I. (gram)**		**L.I. (gram)**	
Source	**N**	**S**	**N**	**S**	**N**	**S**	**N**	**S**	**N**	**S**	**N**	**S**
Lines	22.47	14.60	30.71	56.23	23.08	32.21	27.79	21.56	22.96	36.10	36.41	43.27
Testers	7.02	17.44	5.43	9.05	13.33	13.67	8.33	13.76	24.02	16.53	6.67	16.41
Lines x Testers	70.51	67.96	63.85	34.72	63.59	54.12	63.88	64.68	53.02	47.38	56.92	40.32

	Fiber quality properties							
	F.F.		F.S.		F.L.		U.R.	
Source	N	S	N	S	N	S	N	S
Lines	45.04	35.86	40.44	35.85	11.84	26.53	17.75	24.21
Testers	1.43	8.77	17.17	7.26	6.14	7.57	3.22	30.38
Lines x Testers	53.53	55.37	42.40	56.89	82.01	65.89	79.03	45.41

On the other side, seed cotton and lint yields/plant were consistently affected by water deficit. The results from Table (4) revealed that water deficit had negative effect on seed cotton and lint yields/plant. Seed cotton yield decreased for about 15 to 45% due to water stress on the average. Among parental genotypes, highest seed cotton yield was obtained in Giza 86 followed by Giza 67 and PimaS6 under water stress condition. Giza 67 and Giza 86 also had the highest seed cotton yield under well water condition. These genotypes also maintained higher lint yield under stress condition. Amongst cotton parental genotypes the Egyptian extra-long staple variety Minufy and Giza 96, Giza 45 as well as long staple genotype Giza 69 showed high value of seed cotton yield under well irrigation but it recorded high reduction under stress condition. The cross combinations Giza 86 x Dandra recorded the highest values of seed cotton and lint yield under both conditions followed by Giza 69 x PimaS6 , Giza 77 x PimaS6 and Giza 68 x 10229. The highest depression on yield was recorded in combinations Minufy x Australy, Giza 96 x 10229, Giza 67 x Australy and Giza 67 x 10229. The reduce in cotton yield under water deficit condition is may be due to reduce in boll production primarily because of fewer flowers and increased of boll abortions.

Similar results were obtained by Basel and Unay (2006) and Abdel-Kader *et al,* (2015). Alishah and Ahmadikhah (2009) revealed that water stress at different growing stage reduced seed cotton yield with the greatest effect at the flowering and fruiting stages.

Significant differences among genotypes were obtained for lint percentage, seed index and lint index over both conditions. Among the parental genotypes lint percentage significantly increased response to water deficit. On the same time, seed index was generally decreased in response to water stress. The increased of lint percentage under water deficit condition is generally due to increase in motes, and less seed maturity such increased in lint percentage in face to decrease in seed index values. This trend was changed among crosses since lint percentage was increase and decrease under stress condition. The long staple Giza 94 recorded highest lint percentage value followed by Giza 86 and Giza 68 under stress, also recorded high value under well irrigation. Among crosses, the combination Giza 68 x PimaS6 followed by Giza 86 x Dandra and Giza 68 x Australy recorded high percentage values under well irrigation, while under stress condition, the cross combination Giza 86 x Australy followed by Giza 96 x Dandra and Giza 77 x 10229 showed high lint percentage values. Karademir and Gencer (2007) and Sahito *et al,* (2015) also reported that water deficit had remarkable decreasing effect on lint percentage.

Significant differences were obtained among cotton genotypes, parents and crosses for seed index over two conditions. Seed index was generally decreased in response to water deficit this may be due to higher ratio of immature seeds and high ratio of motes under water deficit. Similar trend was detected for lint index, since; this character was largely influenced by seed index.

Cotton is very susceptible plant to the quantity of irrigation water and therefore, water management is very complicated so that the result obtained in each case and for each genotypes are very useable. In deficit condition the yield loss could be large, so that the plants would be stunted and try to finish their growth through dropping of flowers and reducing yield. However in well irrigation, plant vegetative growth is induced. Flower production and yield are strongly reduced and plant finished its life period as soon as possible Alishah and Ahmadikhah (2009). Therefore, the involvement of these varieties or/and combinations showing least fluctuations in yield by regulating vegetative and generative phase in stressful and non-stressful conditions are of high important in production programs.

Table 4. Mean performance of cotton genotypes for yield and yield components traits under normal and water stress conditions.

genotypes	SCY/P (gram)		L.P%		B.W. (gram)		L.Y. (gram)		S.I. (gram)		L.I. (gram)	
	N	S	N	S	N	S	N	S	N	S	N	S
L1- Giza 45	77.59	62.19	34.43	34.62	3.23	2.87	26.67	21.53	10.37	9.87	5.45	5.23
L2- Min ufy	84.51	69.86	35.55	37.18	3.33	2.97	30.09	25.98	11.63	10.63	6.42	6.29
L3- Giza 67	98.1	44.88	37.51	38.27	3.23	3	36.83	17.17	11.5	8.93	6.9	5.53
L4- Giza 68	82.46	59.26	37	39.35	3.13	2.87	30.59	23.33	10.97	8.43	6.44	5.47
L5- Giza 86	76.61	61.13	36.33	39.8	3.27	2.97	27.89	24.33	11.07	7.9	6.31	5.22
L6- Giza 77	74.12	56.3	39.29	38.44	3.5	3.2	29.15	21.7	12.1	9.43	7.84	5.9
L7- Giza 94	84.1	73.57	37.63	40.56	4.2	3.3	31.66	29.84	10.67	9.9	6.43	6.75
L8- Giza 96	89.67	83.25	38.39	38.35	3.6	3.2	34.35	31.77	10.67	9.17	6.65	5.73
L9- Giza 69	75.27	59.44	37.69	38.35	3.8	2.4	28.4	22.78	11.3	9.1	6.84	5.67
T1- Dandra	66.19	54.6	36.88	37.44	3.3	2.7	24.39	20.44	10.97	9.57	6.41	5.72
T2- Pima S6	80.66	67.39	36.01	36.28	3.53	3.1	29.04	24.45	11.1	10.1	6.25	5.75
T3- Australy	70.62	61.49	37.62	36.21	3.63	3.03	26.58	22.26	10.7	9.37	6.46	5.31
T4- 10229	47.1	22.84	37.57	36.97	3.43	3.23	17.66	8.45	11.47	10.33	6.9	6.06
Giza 45 x Dandra	89.86	70.9	35.87	31.89	3.37	2.77	32.23	22.61	10.5	9.57	5.87	4.48
Giza 45 x Pima S6	89.42	74.27	36.61	34.18	3.2	2.87	32.78	25.36	10.1	8.43	5.85	4.38
Giza 45 x Australy	77.7	72.13	36.36	34.56	3.2	2.97	28.24	24.89	9.97	8.77	5.69	4.63
Giza 45 x 10229	74.01	55.44	37.47	36.77	3.73	3.4	27.73	20.38	12.3	9.8	7.38	5.7
Minufy x Dandra	88.07	67.91	36.39	33.56	3.03	2.43	32.02	22.79	11.83	11.1	6.77	5.61
Minufy x Pima S6	89.64	74.37	38.1	33.69	3.17	2.8	34.07	25.02	10.53	9.83	6.53	5
Minufy x Australy	115.67	59.47	37.15	33.56	3.3	2.8	43.03	19.92	10.93	10.23	6.46	5.17
Minufy x 10229	93.9	73.32	36	34.33	3.33	3.1	33.76	25.18	11.7	9.03	6.59	4.71
Giza 67 x Dandra	74.99	66.5	38.04	35.41	3.17	2.9	28.54	23.56	11.37	9.83	6.98	5.39
Giza 67 x Pima S6	110.95	71.88	35.65	35.89	3.07	2.77	39.57	25.81	10.5	8.97	5.82	5.02
Giza 67 x Australy	82.86	67.44	38.03	36.4	3.7	2.6	31.54	24.5	11.03	9.73	6.77	5.58
Giza 67 x 10229	88.42	50.64	36.7	34.41	3.83	3.37	32.4	17.42	11.3	9.47	6.56	4.97
Giza 68 x Dandra	93.88	69.68	36.55	37.54	3.4	3.17	34.32	26.16	12.1	9.37	6.97	5.63
Giza 68 x Pima S6	78.43	55.46	40.05	34.03	3.77	2.8	31.42	18.87	9.87	8.9	6.6	4.6
Giza 68 x Australy	88.04	56.03	38.81	38.53	3.47	3.33	34.2	21.57	12.57	10.1	7.98	6.34
Giza 68 x 10229	89.63	77.52	37.08	36.79	3.37	3.13	33.21	28.47	11.1	9.1	6.54	5.3
Giza 86 x Dandra	122.38	105.52	39.99	38.29	3.63	3.23	48.79	40.39	11.23	9.37	7.5	5.81
Giza 86 x Pima S6	84.26	57.57	38.24	35.84	3.53	3.2	32.23	20.59	10.5	8.9	6.5	4.97
Giza 86 x Australy	95.32	70.24	37.45	41.32	3.6	3.13	35.69	29.01	11.5	11.1	6.88	7.82
Giza 86 x 10229	83.36	67.19	38.29	38.3	3.73	3.47	31.93	25.76	11.83	9.7	7.34	6.03
Giza 77 x Dandra	85.81	75.89	38.51	37.52	3.4	3.1	33.08	28.49	10.97	8.9	6.87	5.36
Giza 77 x Pima S6	92.99	84.57	36.09	35.25	3.33	2.9	33.59	29.8	10.7	8.57	6.04	4.67
Giza 77 x Australy	88.41	68.34	37.84	33.79	3.73	3.4	33.48	23.11	12.5	9.43	7.61	4.81
Giza 77 x 10229	67.88	50.59	35.81	39.44	3.47	2.93	24.3	19.97	11.57	8.97	6.45	5.84
Giza 94 x Dandra	84.9	74.18	38.44	38.48	3.23	3.13	32.62	28.56	11.87	10.43	7.41	6.52
Giza 94 x Pima S6	78.65	65.39	39	38.5	3.8	3.47	30.69	25.17	10.3	9.03	6.58	5.66
Giza 94 x Australy	87.99	63.62	37.26	38.99	3.73	3.33	32.81	24.86	11.37	8.97	6.76	5.75
Giza 94 x 10229	87.11	74.75	36.24	37.59	3.13	2.93	31.51	28.08	11.3	10.03	6.42	6.04
Giza 96 x Dandra	113.82	73.82	36.6	39.85	3.43	2.97	41.63	29.44	10.63	9.1	6.15	6.04
Giza 96 x Pima S6	78.53	54.65	38.26	37.48	3.43	2.7	30.06	20.51	10.57	9.3	6.55	5.57
Giza 96 x Australy	88.12	55.95	36.6	37.37	3.5	3.2	32.23	20.91	10.3	8.97	5.95	5.34
Giza 96 x 10229	89.14	52.97	37.68	38.24	3.4	3	33.62	20.28	10.1	8.77	6.11	5.44
Giza 69 x Dandra	71.56	64.29	35.58	34.89	3.27	2.87	25.48	22.4	9.83	9.17	5.44	4.92
Giza 69 x Pima S6	95.15	86.56	37.48	32.43	3.43	3.03	35.68	28.09	10.77	8.77	6.47	4.21
Giza 69 x Australy	79.52	66.58	34.92	37.13	3.63	3.13	27.78	24.72	11.3	8.63	6.06	5.1
Giza 69 x 10229	74.3	60.04	37.36	36.39	3.33	3.07	27.82	21.86	10.57	8.5	6.32	4.87
LSD 0.05	13.28	9.47	1.59	1.80	0.37	0.34	5.16	3.61	0.78	0.84	0.68	0.66
LSD 0.01	17.64	12.58	2.11	2.38	0.50	0.45	6.85	4.80	1.03	1.12	0.90	0.88

Fiber length was decreased for all parental and cross combinations under water deficit condition Table (5). The highest depression among parents was recorded for Giza 96 followed by Minufy and Giza 45, while Giza 86, Giza 94 and PimaS6 showed the lowest depression. However, the cross combination Giza 94 x Dandra followed by Minufy x Dandra, Giza 86 x Dandra and Giza 96 x Dandra showed the best fiber length value over well irrigation. Most of these combination recorded high depression in stress condition. On the other side, the cross combinations Giza 68 x PimaS6 followed by Giza 67 x Dandra and Minufy x Dandra showed inferior fiber length values.

Fiber length is a desirable character for textile industry and spinning technology. Growth and development of cotton fiber are consisted of two phases, period of fiber elongation concluded development of fiber length and diameter and period of fiber thickening. Water deficit showed influence on cell elongation in the first period and would be result in an increased of short fiber.

Table 5. Mean performance of cotton genotypes for fiber quality properties under normal and water stress conditions.

genotypes	F.F.		F.S.		F.L.		U.R.	
	N	S	N	S	N	S	N	S
L1- Giza 45	3.7	3.37	10.9	10.57	34.6	32.7	85.67	84.4
L2- Minufy	4.23	3.93	10.2	9.67	34.37	32.2	85.3	83.77
L3- Giza 67	4.13	3.93	10.37	9.77	33.17	32.5	84.6	83.77
L4- Giza 68	4.07	3.57	10.8	9.8	33.77	31.63	84.5	83.2
L5- Giza 86	4.47	3.73	10.5	9.2	32.87	32	84.27	83.7
L6- Giza 77	4.5	4.03	9.9	9.2	33	32	83.7	82.77
L7- Giza 94	4.27	3.8	10.2	9.47	34.37	33.4	85.17	84
L8- Giza 96	4.17	3.9	10.4	9.7	35.7	32.8	86.7	84.47
L9- Giza 69	4.4	4	10.2	9.37	33.47	32.4	84.7	82.67
T1- Dandra	4.1	3.8	10.3	9.97	32.27	30.33	83.87	83.03
T2- Pima S6	4.37	3.73	10.2	9.3	33.9	32.2	84.53	83
T3- Australy	4.3	3.87	10.6	9.37	34.1	32.2	84.87	83
T4- 10229	4.07	3.8	10.67	9.97	33.17	31.7	84.57	83.8
Giza 45 x Dandra	3.67	3.4	10.8	10.07	32.97	30.87	85.07	83.53
Giza 45 x Pima S6	3.67	3.53	10.97	10.2	33.93	32.57	85.43	84.77
Giza 45 x Australy	4.1	3.87	10.5	10.07	32.3	31.23	84.5	84.2
Giza 45 x 10229	3.9	3.47	10.9	9.9	34.5	31.77	86.2	84.57
Minufy x Dandra	3.87	3.63	10.7	10.2	34.8	29.97	85.5	81.8
Minufy x Pima S6	4.37	3.8	10.5	9.4	33.57	32.47	85.27	83.87
Minufy x Australy	4.2	3.97	10.4	9.67	34.1	31.77	84	81.37
Minufy x 10229	4.07	3.83	10.47	9.77	33.1	31	85.3	84.1
Giza 67 x Dandra	4.4	3.5	10.77	9.57	33.17	29.57	84.37	81.87
Giza 67 x Pima S6	4	3.87	10.5	9.9	33.77	31.17	84.57	84.13
Giza 67 x Australy	4.1	3.67	10.37	10	34.2	32.67	85.2	83.6
Giza 67 x 10229	4.2	3.93	10.27	9.5	33.37	30.43	84.77	83.27
Giza 68 x Dandra	4.33	4.23	10	9.8	34.77	30.67	86.8	82
Giza 68 x Pima S6	4.27	3.9	10.1	9.63	32.2	29.3	84	82.17
Giza 68 x Australy	4.4	4.07	9.8	9.5	34.3	32.4	85.67	83.1
Giza 68 x 10229	4	3.6	10.53	9.97	34.2	32.9	84.9	83.93
Giza 86 x Dandra	4.37	3.8	10.67	9.2	33.27	32.57	84.13	83.73
Giza 86 x Pima S6	4.33	3.97	10.53	9.5	34	31.77	85.37	84
Giza 86 x Australy	4.2	3.9	10.17	9.77	34.57	32.1	85.43	83.87
Giza 86 x 10229	4.33	3.93	10.3	9.5	33.27	31.7	83.7	82.57
Giza 77 x Dandra	4.03	3.73	10.9	9.8	34.17	33.77	84.2	82.8
Giza 77 x Pima S6	4.37	4.1	9.9	9.63	33.5	31.37	85.67	83.8
Giza 77 x Australy	4.1	3.9	10.3	10	33.6	32.8	84.2	83
Giza 77 x 10229	4.23	3.9	10.03	9.67	33.23	32.47	84.9	84.27
Giza 94 x Dandra	4.37	3.9	10.57	9.5	35.7	31.2	86.4	82
Giza 94 x Pima S6	4.07	3.97	10.33	9.97	34.33	32.7	84.4	83.33
Giza 94 x Australy	3.87	3.57	10.67	10.17	34.27	32.77	85.57	82.6
Giza 94 x 10229	4.1	3.87	10.47	9.67	33.13	32.13	86.7	83.67
Giza 96 x Dandra	4.3	3.97	10.47	9.47	33.07	32.3	84.2	81.27
Giza 96 x Pima S6	4.23	4	10.27	9.77	34.2	31.57	85.97	83.57
Giza 96 x Australy	4.07	3.83	10.4	10	34.2	33	85.6	84.37
Giza 96 x 10229	4.17	3.83	10.37	9.6	33.7	31.97	85.2	84.17
Giza 69 x Dandra	3.83	3.73	10.87	10	34.77	33.4	86.6	83.87
Giza 69 x Pima S6	4.23	4.03	10.23	9.87	33.7	31.77	84.7	83.2
Giza 69 x Australy	4	3.83	10.53	9.83	33.2	31.8	84.13	83.33
Giza 69 x 10229	4	3.73	10.4	9.97	34.03	31.77	85.8	84.57
LSD 0.05	0.24	0.23	0.39	0.40	0.94	1.14	0.85	1.06
LSD 0.01	0.32	0.30	0.52	0.53	1.25	1.51	1.13	1.40

Mert (2005) reported that water stress affects in lint quality especially during the fiber elongation period, which result in decreasing in fiber length. Fiber fineness as micronaire reading significantly differences among genotypes under both conditions. Water deficit had a significant influence on fiber fineness. Micronaire reading recorded decreasing values under stress as compared with well irrigated. Similar results were obtained by Karademir *et al,* (2011).

For fiber strength significant differences were observed among genotypes under both conditions. Fiber strength of all genotypes was generally decreased in response to water deficit stress. Such decreased was clearly pronounced among parents. The parental genotype Giza 45 was the smallest affected for fiber strength as result of water deficit followed by Minufy, Dandra and Giza 67. On the other side, the cross combinations which contain Giza 45, Minufy and Giza 69 showed high fiber strength values under both conditions and recorded smallest depression on fiber strength under stress condition. Similar results were obtained by Karademir *et al,* (2011).

It is interest to note that, under water deficit condition fiber quality properties were decreased in inferior direction except micronaire value, since fiber was relatively fine but it was weak and shorter, these due to immature fiber under stress condition. Generally growth and development of cotton fiber are consisted of two phases, period of fiber elongation, concluded development in fiber length and diameter and period of fiber thickening which causes deposition of cellulose. Water deficit causes reduce of fiber elongation which causes decrease of fiber length and increased of short fiber as well as decreased in fiber uniformity. In the same time deposition of secondary wall was reduced as result to stress, which causes reduced in metabolic components. This led to decreased in fiber strength and a high number of short fiber causes a high number of nodes Seagull *et al,* (2000).

Genotypic and phenotypic correlation

To identify the most desirable lines and testers genotypes, genotypic and phenotypic correlations between yield and fiber quality properties studied in Table (6). Under non-stress data revealed that seed cotton yield was positively and significantly correlated with lint yield at genotypic and phenotypic level.

Boll weight was positive correlated with lint percentage, lint index, lint yield, fiber length and micronaire reading at genotypic and phenotypic levels in both normal and water stress conditions and positively correlated with seed cotton yield at phenotypic correlation under non stress similar results were obtained by Murtaza *et al.* (2004) and Iqbal *et al.* (2006).

Yield components were positively correlated among them in most cases under non-stress, but were low positively correlated under water stress compared with non-stress. Positive correlated were observed between fiber quality traits in most cases fiber strength (F.S), uniformity ratio (U. R.) and fiber length (F.L.) fiber fineness (F.F.) except micronaire reading was positive with them generally at phenotypic and genotypic levels in both normal and stress.

Table 6. Phenotypic and genotypic correlation among yield and fiber quality traits under non-stress and water stress conditions.

		Phenotypic correlation									
		SCY	**L.P**	**B.W**	**L.Y**	**S.I**	**L.I**	**U.R**	**F.L**	**F.S**	**F.F**
SCY	N		0.044	-0.100	0.977*	-0.017	0.020	-0.039	0.102	-0.046	0.068
	S		-0.108	-0.001	0.947*	-0.055	-0.096	-0.006	0.158	-0.101	-0.001
L.P	N	0.044		0.394*	0.253	0.115	0.692*	-0.213	0.011	-0.208	0.462*
	S	-0.111		0.299	0.214	-0.008	0.780*	0.010	0.363*	-0.365*	0.215
B.W	N	-0.113	0.575		-0.012	0.115	0.313*	-0.158	0.051	-0.319	0.209
	S	-0.022	0.370*		0.102	-0.025	0.234	0.134	0.282	-0.150	0.167
L.Y	N	0.980*	0.241	0.006		0.009	0.166	-0.083	0.101	-0.082	0.162
	S	0.947*	0.211	0.104		-0.043	0.163	-0.013	0.264	-0.220	0.063
S.I	N	-0.009	0.118	0.078	0.015		0.795*	-0.002	0.115	-0.273	0.275
	S	-0.080	-0.011	-0.063	-0.068		0.614*	-0.284	-0.128	0.002	-0.030
L.I	N	0.027	0.680*	0.387*	0.161	0.807*		-0.130	0.093	-0.317*	0.478*
	S	-0.112	0.796*	0.274	0.153	0.591*		-0.150	0.211	-0.281	0.164
U.R	N	-0.056	-0.262	-0.155	-0.106	0.009	-0.148		0.663*	0.081	-0.240
	S	-0.027	0.010	0.192	-0.037	-0.391*	-0.204		0.380*	0.261	-0.245
F.L	N	0.109	0.009	0.134	0.109	0.172	0.135	0.743*		0.136	-0.162
	S	0.163	0.444*	0.400*	0.294	-0.184	0.255	0.406*		0.024	-0.042
F.S	N	-0.052	-0.296	-0.483*	-0.102	-0.327*	-0.411*	0.152	0.232		-0.645*
	S	-0.132	-0.431*	-0.162	-0.273	0.004	-0.338*	0.266	-0.018		-0.476*
F.F	N	0.097	0.563*	0.261	0.205	0.322*	0.571*	-0.271	-0.183	-0.766*	
	S	0.009	0.255	0.196	0.086	-0.042	0.194	-0.330*	-0.069	-0.513*	
Genotypic correlation											

***significant at 0.05 level of probability**

Most of yield and its components traits positive correlated with fiber length at phenotypic correlation except the correlation between fiber length with seed index and with micronaire under non-stress except the correlation between seed index and seed cotton yield under water stress, while positive correlations were found between fiber strength (F.S), uniformity ratio (U. R.) with mostly yield and its components this was evident in the existence of negative significant correlations between fiber strength with lint index under normal and between fiber strength with lint percentage under water stress condition. At genotypic correlation positive significant were observed between fiber length with (lint percentage and boll weight) under water stress, while under non-stress positive significant were found between micronaire with (lint index, seed index and lint percentage).

CONCLUSION

The experiment shows the possibility of using good genotypes as parents and make cross combination among them to produce proper genotypes to reduce the water stress effect to a minimum when water scarcity becomes wide spread.

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تقييم بعض التراكيب الوراثية لتحمل الإجهاد المائى لبعض صفات المحصول ومكوناته وصفات جودة الألياف فى أقطان الباربادينس

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أجريت هذه الدراسة بإستخدام أربعة أباء من القطن مختلفة فى صفاتها ككشافات (دندرة ، بيماس٦ ، إسترالى ، ١٠٢٢٩) مع تسع سلالات فى تجربة السلالة x الكشاف وكانت السلالات المستخدمة كالتالى (جيزة ٤٥ ، منوفى ، جيزة ٦٧ ، جيزة ٦٨ ، جيزة ٨٦ ، جيزة ٧٧ ، جيزة ٩٤ ، جيزة ٩٦ ، جيزة ٦٩) وبذلك أمكننا الحصول على ٤٩ تركيب وراثى (٣٦ تركيب وراثى ناتج من التزاوج بين السلالات فى الكشافات بالإضافة إلى ١٣ من الأباء الممثلة فى الأصناف المستخدمة ككشافات وسلالات). وتم تقييم التراكيب التراكيب الوراثية (١٣ أباء و ٣٦ تركيب هجين) فى تجربة قطاعات كاملة العشوائية فى ثلاث مكررات تحت ظروف الرى الموصى به وظروف الإجهاد المائى.وأظهرت النتائج الأتى:- أظهر تحليل التباين وجود إختلافات عالية المعنوية بين التراكيب الوراثية لكل الصفات المدروسة.أظهر تقدير نسبة المساهمة إلى أن مساهمة تفاعل السلالة x الكشاف من التباين الكلى كان عاليا لمعظم الصفات المدروسة ، كما وأن قيم نسبة مساهمة السلالات كانت أعلى من مساهمة الكشافات لمعظم الصفات المدروسة تحت ظروف الإجهاد المائى.أعطت التراكيب الوراثية الأبوية جيزة ٦٧ ، جيزة ٨٦ وجيزة ٩٤ أعلى القيم لصفة محصول القطن الزهربينما أعطت الهجين جيزة ٨٦ x دندرة ، منوفى x إسترالى ، جيزة ٩٦ x دندرة وجيزة ٦٧ x بيماس٦ أعلى القيم لصفتى محصول القطن الزهر ومحصول القطن الشعر تحت ظروف الرى العادى.أدى حدوث نقص المياه إلى تدهور صفات المحصول عموما نتيجة نقص عدد اللوز العاقد على النبات وظهر ذلك جليا فى الهجن منوفى x إسترالى ، جيزة ٩٦ x ١٠٢٢٩ ، جيزة ٦٧ x إسترالى وجيزة ٦٧ x ١٠٢٢٩.أعطى كلا من التركيبين الوراثيين جيزة ٦٧ وجيزة ٩٤ عموما قيم متوسطات عالية لصفة محصول القطن الزهر تحت كلا من الظروف الطبيعية وظروف الإجهاد المائى.كما أظهرت التراكيب الوراثية الهجين جيزة ٨٦ x دندرة ، جيزة ٦٩ x بيماس٦ ، جيزة ٧٧ x بيماس٦ وجيزة ٦٨ x ١٠٢٢٩ قيم عالية لصفتى محصول القطن الشعر ومحصول القطن الزهر تحت كلا من الظروف الطبيعية وظروف نقص المياه.لوحظ تأثر صفات جودة الألياف لكل التراكيب الوراثية الأبوية والهجن تحت ظروف الإجهاد المائى بالمقارنة بالظروف الطبيعية.بالنسبة لصفة طول التيلة سجلت التراكيب الوراثية الأبوية جيزة ٩٦ ، منوفى وجيزة ٤٥ أعلى إنخفاض فى صفة طول التيلة تحت ظروف الإجهاد المائى بينما سجلت التراكيب الوراثية للأصناف جيزة ٨٦ ، جيزة ٩٤ وجيزة ٧٧ أقل قيم للإنخفاض فى الطول.أظهرت الهجين جيزة ٦٨ x بيماس٦ ، جيزة ٦٧ x دندرة ومنوفى x دندرة قيم متدنية لصفة طول التيلة تحت ظروف الإجهاد المائى.معامل الإرتباط الوراثى عموما كان أعلى من معامل الإرتباط المظهرى ، كما لوحظ وجود إرتباطات معنوية وموجبة بين كل من محصول القطن الزهر ومحصول القطن الشعر وبين معدل الحليج ومعامل الشعر وبين معامل البذرة ومعامل الشعروبين الإنتظام والطول لكل من الإرتباط الوراثى والمظهرى تحت كلا من ظروف الرى العادى وظروف الإجهاد المائى ، كما لوحظ أيضا وجود إرتباط وراثى معنوى بين الطول مع كلا من معدل الحليج ووزن اللوز تحت الظروف الإجهاد المائى.الخلاصة:- توضح التجربة أهمية البدء فى برامج تربية للوصول إلى أفضل تراكيب وراثية تعطى أعلى محصول وأعلى صفات جودة ألياف تحت ظروف الإجهاد المائى خاصة وذلك من خلال برنامج تربية متكامل.