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ESTIMATION OF GENETIC VARIABILITY IN SOME COTTON CROSSES (*Gossypium barbadense* L.) UNDER WATER STRESS.

Abd El-Aty, M. S.[1] ; H. M. E. Hamoud[2] ; A. M. Omar[1] and H. Sh. Turkey[2]
1-Agronomy Dept., Fac., of Agric., Kafrelsheikh University.
2- Breeding Dept., Cotton Res., Institute, Agric., Res., Center, Egypt.

ABSTRACT

Water deficit is considered one of the most important factors affecting on cotton yield. The purpose of this study was to assess genotypic variation for water deficit stress in a set of cotton germplasm using geometric mean yield (*GMY*) and drought suscepatability index (*DSI*) as a selection criteria and to determine genotype x environment interaction influences on cotton yield. Seven lines and five testers were crossed at Sakha in 2010 growing season. The parents and their 35 crosses were evaluated in two locations Sakha and Elnobaria in growing season 2011 under well waterd (W1) and water limited (W2) regimes in each location. Water stress detrmined by the drought intensity index which was similar in the two locations (0.34 in Elnobaria and 0.32 in sakha).Genotypic variation was detected in the both locations and substintial variation in *GMY* ranged from 92.3 to 156.2 g and 54.5 to 135.1 g for Sakha and Elnobaria, respectively. Significant negative correlation of *DSI* with seed cotton yield, lint cotton yield, boll weight, seed index and harvest index in the two locations. AMMI analysis showed that interaction principle component (IPCI) effects, and (IPC2) have justified 61.87 and 21.05% of the total variations related to genotypes interactions in the environments, respectively. Among all the environments, Elnobaria under well waterd (NW1) has been categorized as highly interactive environments, because it exhibited high positive interaction (IPC1 score) effect.

INTRODUCTION

A highly competition between cotton and cereal crops inside Delta region, affected on the dedicated area for cotton crop year by year and subsequently push cotton area to get out step by step outside Delta region to new reclemation areas which, suffering from water shortage. Breeding for yield under stress condition is even more complex due to defficulties to define and apply a precise set of environmental conditions relevant to range of naturally occuring stress scenaries (Levi *et al.*, 2009) . The coparative performance of genotypes under drought stress condition is a common study point in idenfication of drought toterance and selection of genotypes for dry environments. However, High yield potential in the absence of drought (Cattivelli *et al.*, 2008) rather than or as well as, the possession of adaptation specifically favoring performance under drought stres (Fischer and Mourer, 1978, Malik and Wright, 1998). Amongst the abiotic stresses reducing crop productivity, shortag of irrigation water is a primary limiting factor in many regions of the world (Turner, 1997 and Sinculair, 2005). There has been controversy of environment for selection and breeding for yield traits. One approach is to screen germplasm by coducting traits in dry locations to select productive genotypes. however, these high yielding genotypes under water stress could likely to be low yielding under well-watered environment (Roosielle and Hamblin, 1981). Other approach suggests testing of germplasm under stress and non-srress conditions and ranking genotypes for drought tolerance succeptibility on reduction of the yield (Blum, 1988).

However, values are confounded with differential yield potential of genotypes, other yield based estimates of drought tolerance are based on geometric mean yield (*GMY*) (Fernandez, 1993). And drought susceptibility index (*DSI*) (Fischer and Maurer, 1978). *GMY* is often used by breeders interested in relevant performance since drought stress may vary in severity regarded to field environment over the locations where *DSI* is a measure of the reduction in the yield of a genotype under water stress conditions with respect to the mean reduction of all the genotypes under consideration . Genotypic differences in *GMY* and *DSI* have been demonstrated in different crop species (Ramirez – Vallego and Kelly, 1998 ; Frahin *et al.*, 2004).

The genetic variation for yield indices including *DSI* and *GMY* and their relationship with productivity and physiological attributes in cotton are not well documented. Therefore, the objective of the present study was i) to asses genotypic variation for drought tolerance in a set of germoplasm comprising commercial vareties as well as newly developed elite cotton lines using *GMY* and *DSI* as selection criteria and to determine association of these measures with some productivity and physiological attributes ii) to determine the basis of adaptive response for yield in range of enviroments using the AMMI statistical model, Therfore present investigation provides insight into the selection strategies required for identifying superior genotypes for target growing environments. The crosses Suvin x Giza 86, Karshenky x (Giza 75 x sea), Karshenky x(Giza 84 x Giza70 x Giza 51B) X Pima 62), Pima S6 x (Giza 77 x Pima 56), Karshenky x (10229 x Giza 86), Suvin x (10229 x Giza 86) and TNB x (10229 x Giza 86) grouped in quadrant-3 in both locations, which were identified as the most water stress tolerant using both indices as selection criteria.

MATERIALS AND METHODS

The plant materials used in the present study were obtained by line x tester crossing. According to this method, five foreign cotton cultivars (Karshenky, Suiven, Pima S6, TNB and Australian 12) were used as the testers with seven Egyptian cotton genotypes, (Giza 86, Giza 92, Giza 75 x Sea, G89 x G86, G 77 x Pima S6, 10229 x Giza 86 and (G84 x G70 x G51B) X Pima 62) as the lines and all these genotypes belong to (*Gossypium barbadense* L.) at Sakha Agriculture Research Station during 2010 growing season.

47 genotypes (twelve parents and their F_1 crosses) were evaluated in two locations Sakha and Elnobaria in 2011 growing season. Two irrigation regimes have been used in each location which, furrow irrigation system was used in Sakha with two regimes, well-watered (W1) (eight times) and water limited (W2) (four times). Meanwhile, in Elnobaria, drip irrigation system was

used, well-watered (W1) (two times every week) and water limited (W2) (one time every week).

Quadruplicated randomized complete block design with one row each of F_1's and their parents which having ten plants with 70 cm apart, 40 cm between hills and 4 m long. Three replications were used for productivity estimates and the 4th for physiological attributes. recommended package of production was followed to raise the crop.

Measurment of productivity traits, Seed cotton yield (SCY) g/plant average six plants gurded for each replication. Lint yield (LY) g/plant, number of bolls (BN) was calculated by dividing seed cotton yield per plant by boll weight, Boll weight calculated as, average of 10 bolls/plant. Seed index (SI), calculated as weight of 100 seed in gram. Plant height (*PH*) was recorded in centimetres from the first cotyledonary node to the apical bud after 120 days. Harvest index (HI), was recorded from above ground parts of five plants per plot were harvested at 50% boll opening and sun-dried in a glasshouse to constant weight before weighing for biological yield (BY) and average per plant for statistical analysis. (HI) Calcalated as the ratio (SCY) to the total above ground (BY) (Ullah *et al.*, 2006 a).

Drought intensity index (D) for each location was calclated as $D = 1-(Xd/Xp)$, where xd and xp are mean (SCY) of all genotypes in W2 and W1 regimes respectively.

Geometric mean yield of each genotype was caluclated as $GMY = (Yp*Yd)^{1/2}$.

The formula proposed by (Fisher and Maurer,1978) was used to calculate drought susceptability index (*DSI*) for each genotype $DSI = (1- (Yd/Yp) / D)$. Where yd and yp are mean yield of a given genotypes in W2 and W1 regime respectively and (D) Drought intensity index.

K^+ and Na^+ had estimated in the 4th leaf after 120 days by using Sherwood 410 flame photometer.

$K^+ = \{(meg/l)/1000\}\ x(50/1000)\ x(33/.2)\ x100$, and $Na^+ = \{(meg/l)/1000\}\ x(50/1000)\ x(23/.2)\ x100$ which K^+ % or Na^+ % = meg/l x.975 (Chapman, and pratt. 1961).

To analyze the G x E interaction, The additive mean and multiplicative interaction (AMMI) model was used. The AMMI stastical model is a combination of customary analysis of variance (ANOVA) and interaction priniciple component analysis (IPCA). The equation of this model is: The AMMI model equation by Gauch (1992) is:

$$Y\,ger - \alpha\,g - \beta\,e + \mu = \Sigma\,n\,\lambda\,n\,\gamma\,gn\,\text{ỏ}\,en + \rho\,ge + \varepsilon\,ger$$

Where Y ger is the plot of genotype g in the environment e and replicate r; μ is the grand mean; αg is the deviation of the genotype g from the grand mean; β e is the deviation of the environment e from the grand mean; λ n is the singular value of PCA axis n; γ gn is the genotype eigenvector for axis n; ỏ en is the environment eigenvector; ρ ge is the residual of the genotype x environment interaction and ε ger is the error term.

RESULTS AND DISCUSSION

Comparatively larger magnitude for drought intensity index (D) in two locations, Sakha (0.32) and Elnobaria (0.34) which refer to the magnitude of water stress that varied between them, Table 1. Positive association between Yp and Yd supported the hypothesis that genotypic advantages selected under near-optimum growing condition may be obtained under less favorable growing environments (Quisenberry *et al,*1980) However, the correlation was comparatively stronger in Elnobaria (r:0.62) under high stress than in Sakha (r:0.47). Genotypic variation for *DSI* and *GMY* was tangible in both locations Table 1.In Sakha *DSI* ranged from 0.27 to 1.49 which twenty five genotypes showed water stress tolerance (*DSI* less than one) in comparison with twenty five genotypes in Elnobaria were ranged from 0.23 to 1.74. Meanwhile, twenty two genotypes in Sakha showed less tolerance (*DSI* value greats than one) in comparison with twenty two genotypes in Elnobaria. Significant negative association of *DSI* with seed cotton yield, lint cotton yield, boll weight, seed index and harvest index In the two locations and for number of fruiting branches and plant height in Elnobaria suggested *DSI* as a useful prediction of drought tolerance in cotton Table 2. Moreover, non significant correlation of *DSI* with ginning outturn and certain physiological attributes including Na^+ and k^+ Table 2 further elucidated which it does not use in identification of water stress tolerant genotypes. Substantial variation in *GMY* ranged from 92.3 to 156.2 gm and from 54.5 to 135.1 gm was found among the genotypes in Sakha and Elnobaria respectively. The crosses L1xT2, L3xT2, L5xT1, L6xT2, L7xT1, L7xT2 and L7xT3 produced comparatively higher *GMY* in both locations Table1. Significant positive correlation of *GMY* was found with seed cotton yield, lint cotton yield and harvest index in both locations under (W2) and boll weight, number of fruiting branches/plant and plant height were also significantly associated with *GMY* in Elnobaria under W2 condition, however the level of these association was not significant in Sakha. Significant negative correlation of *GMY* was found with K^+ in Sakha and non significant correlation in ELnobaria Table 2.

Significant correlation between *GMY* and Yp (r=0.85) in sakha; (r=0.86) in Elnobaria) provides additional support for using *GMY* as stress tolerance predictor.

DSI and *GMY* estimates in Sakha and Elnobaria were utilized to generate the bi-plot Figure 1. The genotypes and the crosses were grouped into four quadrants when the bi-plot was truncated at moderate *DSI* and *GMY* in both locations. Quadrant-1 contained cultivars with high *DSI* and high *GMY*. The genotypes with high *DSI* and low *GMY* were grouped in quadrant-2.The genotypes characterized with low *DSI* and high *GMY* were cluster in quadrant-3 whereas quadrant-4 included cultivars with low *DSI* and low *GMY*.

Table 1: Drought susceptibility index (*DSI*) and geometric mean yield (*GMY*) of twelve parents and 35 crosses in Sakha and Elnobaria locations.

Genotypes	Abrev.	Sakha				Elnobaria			
		SCY W1.	SCY W2	DSI	GMY	SCY W1.	SCY W2	DSI	GMY
Giza 86	L1	124.7	93.0	0.80	107.5	86.7	58.2	0.97	71.0
Giza 92	L2	131.2	92.1	0.93	109.8	73.5	57.3	0.63	64.8
G75*Sea	L3	129.2	89.5	0.96	107.3	99.6	53.7	1.37	73.1
(Giza.84 x Giza.70 x Giza. 51B) X Pima 62)	L4	150.7	103.0	1.00	124.5	82.7	46.5	1.30	62.0
G89*G86	L5	133.8	95.8	0.89	113.2	118.1	63.8	1.37	86.8
G77*Ps6	L6	123.7	95.9	0.70	108.9	87.9	38.7	1.67	58.2
10229*G86	L7	183.3	109.8	1.26	141.9	122.3	60.5	1.50	86.0
Karshenky	T1	164.2	117.7	0.88	138.9	110.3	70.7	1.06	88.3
Suvin	T2	117.6	89.7	0.74	102.7	134.4	62.5	1.58	91.4
Pima S6	T3	124.0	102.5	0.54	112.7	84.8	35.2	1.74	54.5
Brown	T4	127.2	78.4	1.19	99.7	94.3	45.5	1.54	65.4
Australian 12	T5	134.8	90.3	1.04	110.3	74.9	48.0	1.07	60.0
L1xT1	1	151.2	114.1	0.76	131.2	128.1	65.1	1.46	91.3
L1xT2	2	136.6	106.0	0.71	120.3	109.6	93.8	0.43	101.3
L1xT3	3	124.1	95.9	0.72	108.9	106.2	82.3	0.67	93.5
L1xT4	4	164.4	89.7	1.43	121.4	97.4	77.1	0.58	86.3
L1xT5	5	124.6	108.9	0.40	116.5	90.1	50.5	1.30	67.4
L2xT1	6	143.8	93.7	1.09	116.1	93.2	71.5	0.69	81.6
L2xT2	7	115.1	91.9	0.62	102.8	126.1	77.0	1.16	98.4
L2xT3	8	127.8	89.1	0.95	106.7	109.9	82.6	0.74	95.2
L2xT4	9	129.8	90.6	0.94	108.4	91.0	65.5	0.83	77.1
L2xT5	10	115.1	77.9	1.02	94.6	99.5	66.6	0.98	81.3
L3xT1	11	154.3	122.8	0.64	137.6	105.4	84.4	0.59	94.3
L3xT2	12	121.2	82.4	1.00	99.9	109.2	100.7	0.23	104.7
L3xT3	13	175.9	96.8	1.41	130.4	112.6	85.5	0.70	97.9
L3xT4	14	140.3	92.6	1.05	113.7	121.9	72.9	1.20	94.2
L3xT5	15	131.4	72.7	1.40	97.7	116.9	74.0	1.09	93.0
L4xT1	16	152.4	111.0	0.85	130.0	110.0	74.2	0.93	90.0
L4xT2	17	130.2	89.8	0.97	108.1	112.4	73.4	1.02	90.7
L4xT3	18	145.7	91.5	1.17	115.3	102.8	65.7	1.02	81.8
L4xT4	19	151.9	91.9	1.24	118.1	94.2	78.4	0.49	85.8
L4xT5	20	85.2	78.5	1.06	96.4	104.7	69.8	0.99	85.5
L5xT1	21	170.2	113.7	1.03	139.0	143.3	114.4	0.60	128.0
L5xT2	22	178.4	102.3	1.34	135.1	109.8	73.3	0.99	89.7
L5xT3	23	185.4	99.2	1.46	135.6	104.0	53.4	1.39	74.0
L5xT4	24	133.1	93.9	0.90	111.1	91.6	72.4	0.61	81.1
L5xT5	25	154.4	81.1	1.49	111.8	99.2	72.1	0.82	84.5
L6xT1	26	173.7	112.6	1.08	139.5	128.0	73.1	1.28	96.7
L6xT2	27	145.1	81.3	1.37	108.5	112.3	90.4	0.56	100.6
L6xt3	28	169.3	124.0	0.84	144.8	100.8	89.7	0.33	95.1
L6xT4	29	168.6	90.6	1.45	123.6	108.8	73.7	0.95	89.5
L6xT5	30	126.0	67.7	1.45	92.3	86.2	44.2	1.45	61.6
L7xT1	31	182.2	134.0	0.83	156.2	149.2	122.5	0.53	135.1
L7xT2	32	151.3	104.8	0.96	125.8	161.0	107.2	0.99	131.4
L7xT3	33	118.4	108.1	0.27	113.1	150.9	86.8	1.26	114.4
L7xT4	34	147.0	106.4	0.86	124.9	128.5	86.9	0.96	105.7
L7xT5	35	119.5	92.5	0.71	105.1	112.2	70.7	1.10	89.0
LSD 0.05		20.50	13.53			12.83	11.60		
Grand mean		142.3	96.97			108.42	71.96		

Table 2:Correlation coefficient between drought susceptibility index, geometric mean with productivity traits of 12 parents and 35 crosses under water stress at Sakha and Elnobaria locations.

Traits	DSI		GMY	
	Sakha	Elnobaria	Sakha	Elnobaria
Seed cotton yield	-0.54**	-0.71**	0.87**	0.94**
Lint cotton yield	-0.52**	-0.65**	0.86**	0.93**
Ginning outturn	0.01ns	0.10ns	0.10ns	0.09ns
Boll weight	-0.19*	-0.35**	0.15ns	0.42**
Number of fruiting branches	-0.05ns	-0.25**	0.13ns	0.19*
Plant height	-0.03ns	-0.25**	0.14ns	0.20*
Seed index	-0.16*	-0.24**	-0.03ns	-0.08ns
k+	0.02ns	0.15ns	-0.21**	0.15ns
Na+	0.08ns	-0.02ns	-0.03ns	-0.02ns
Harvest index	-0.18*	-0.37**	0.30**	0.49**

*, significant at 0.05%, **, highly significant at 0.01% probability and ns, means non significant.

Drought susceptibility index (*DSI*) = (1- Yd/Yp)/(1-Xd/Xp). Geometric mean yield (*GMY*)= =$(Yd*Yp)^{1/2}$.

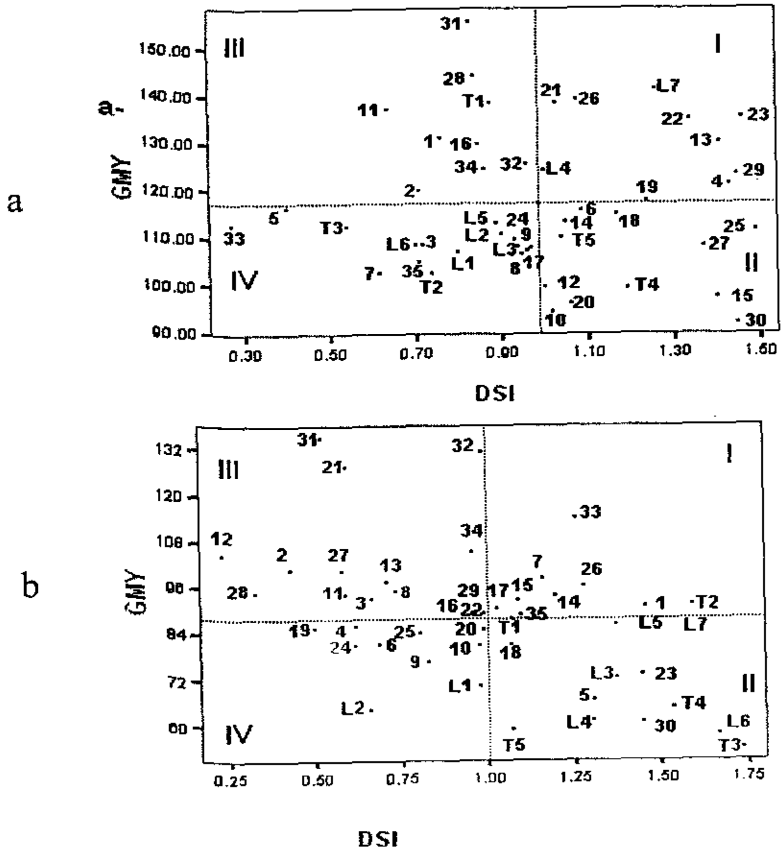

Fig 1: Biplot between drought susceptibility index (*DSI*) and geometric mean yield (*GMY*) for 12 parents and 35 crosses for Sakha (a) and Elnobaria (b) .

Nine genotypes in Sakha and fifteen genotypes in Elnobaria were placed in quadrant-3. The crosses Suvin x Giza 86, Karshenky x (Giza 75 x sea), Karshenky x(Giza 84 x Giza 70 x Giza 51B) X Pima 62), Pima S6 x (Giza 77 x Pima 56), Karshenky x (10229 x Giza 86), Suvin x (10229 x Giza 86) and TNB x (10229 x Giza 86) grouped in quadrant-3 in both locations, which were identified as the most water stress tolerant using both indices as selection criteria. The results indicated that estimation of *DSI* and *GMY* supported the hypothesis that selection for combination of *DSI* and *GMY* indices might be more useful in improving drought tolerance in cotton instead of using a single yield basis criterion, (Ullah *et al.*, 2006 b).

Stability analysis for seed cotton yield.

The combined ANOVA showed significant genotype, environment and genotype by environmental differences in the data, accounting for 19.31%, 65.09% and 15.09% of the total variation respectively Table3. The results from AMMI analysis showed that IPC1 and IPC2 were meaningful in probability level of 0.01%. Models of IPC1 and IPC2 have justified 61,87 and 21.05% of the total variations related to genotypes interactions in the environments, respectively. Hamoud (2008) which reported that E, G and GxE explained 80.28%, 7.5% and 12% for seed cotton yield, respectively and also, Hamoud *et al.* (2012) found that AMMI1 and AMMI2 for seed cotton yield was account 51.6% and 32.23%, respectively. The IPC1 and IPC2 were used in decision making about stability of genotypes and drawing of bi-plots. Figure 2 showed mean and interaction principle component (IPCI) effects, which lines and testers represents by higher case, crosses represented by lower case as numbers mainwhile, environments represents by NW1 (Elnobaria) well-watered drip irrigations, NW2 (Elnobaria, limited watered drip irrigation), SW1 (Sakha, well-watered) and SW2 (Sakha, limited watered).

Table 3: AMMI analysis of variance for cotton yield

SOURCE	D.F.	S.S.	M.S.	SS%
Genotypes	46	35690	775.569**	19.31
Environments	3	120262	40087.3**	65.09
Genotypes X Environments	138	28806.9	208.745**	15.59
AMMI COMPONENT 1 (IPC1)	48	17824.8	371.351**	61.87
AMMI COMPONENT 2 (IPC2)	46	6066.34	131.87**	21.05
AMMI COMPONENT 3 (IPC3)	44	4915.69	111.72	17.06
Total	187	184759		

**, Significant at 0.01 % probability.

Whatever, these spots are near zero or origin of coordinates, they have little interactions and if their yield is high, then they would be more stable and spots which are further from the origin of coordinates are unstable, accordingly, the testers, 1, 3 and 5 and the line 2 in addition the crosses 9, 3, 17, 2, 29, 13, 26, 1, 4 and 28 were near zero or origin of coordinates, so that, they placed on group of genotypes which have a good stability. The abscissa showed the main effects and the ordinate showed the frist multiplicative axis term (IPC1). The horizontal line showed the interaction score of zero and the vertical line indicated the grand mean yield. The crosses 27, 34, 21, 24, 19, 25, 11 and the lines 5 and 6 were further the origin of coordinates and they are unstable.

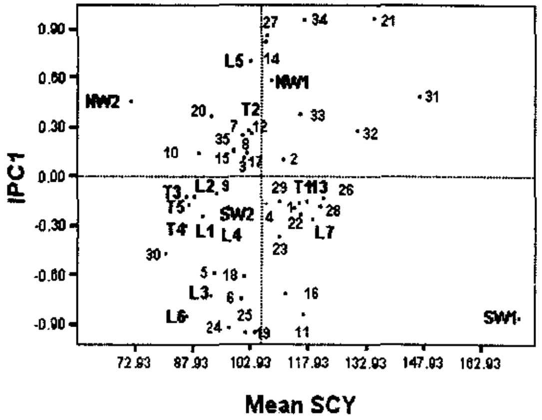

Figure 2. AMMI biplot showing the main and interaction (IPC1) effects of both genotypes and environments on seed cotton yield ,AMMI additive main effects and multiplicative interaction; PC principle components analysis axis.

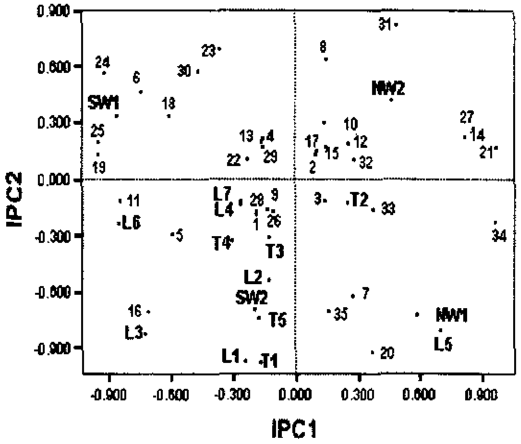

Figure 3. AMMI biplot analysis showing IPC1 and IPC2 scores for seed cotton yield of 12 parents and 35 crosses

For Figure 3, and related to model AMMI 12, in which environments and genotypes are displayed in bi plots. The crosses, 31, 8, 24, 25, 19, 20, 34, 27, 14 and 21 were more far away from the origin of coordinates and based on this model they are recognized as unstable genotypes, in addition the lines 3, 1, 6 and plus the testers, 1 and 5 also were far away from the origin. In contrast, the crosses 9, 28, 3, 2, 17, 29, 22 and the lines 7 and 4 plus the tester 2 were located near to origin points of coordinates and they have general compatibility relation to the most regions. Among all the environments, NW1 has been categorized as highly interactive environments, because it exhibited high positive interaction (IPC1 score) effect. Separation between NW1 and NW2 and each of SW1 and SW2 might have been due to substantial differences in total water supply received during the crop growth.

CONCLUSION

The analysis have shown the insight into the nature of G X E interaction in the cotton raised under water stress and emphasises importance of varietal development for this condition. Furthermore this study brings out that, drought tolerance in cotton is related to *DSI* and *GMY* for more efficient selection to acquire higher yield under drought condition. Bi-plots generates by AMMI model gives more variable and hidden useful information from the data, which give over an overall picture of genotypes behavior under moisture stress condition. The crosses 2, 28 ,26 ,13 and 29 came out as drought tolerant crosses and revealed stability tolerance across environments and could be exploited in breeding program aiming to improve drought tolerance.

REFERENCES

Blum, A. (1988). Plant breeding for stress environments. CRC press, Florida. Crop Sci.,21:43-47.

Cattivelli, L., F. Rizza, F.W. Badeck, E.mazzucotelli,A.M. Mastranglo, E. Francia, C. Mare,A. Tondelli and A.M Stanca, (2008). Drought tolerance improvement in crop plants:An intergrated view from breeding to genomics. Field crop Res., 105:1-4.

Champman, H. D and Pratt(1961). Methods of analysis of soil,plant and water . Univ. Calf.

Fernandez, G.C.J. (1993). Effective selection criteria for assessing plant stress tolerance. In:Adaption of food crops to temperature and water stress, C.G. Kuo (ed.). AVRDC, Shanhua, Taiwan, pp:257-270.

Fischer, R.A. and R. Maurer. (1978). Drought resistance in spring wheat cultivars. 1. Grain yield responses. Aust. J. Agic. Res., 29:897-912.

Frahin, M. A., J. C. Rosas, N. Mayek Perez, E. Lopez-salinas, J.A. Acosta-Callegos and J.D Kelly. (2004). Breeding beans for resistance to terminal droght in the lowland tropics. Euphytica, 136:223-232.

Gauch, H. G. (1992) . Statistical analysis of regional yield traits AMMI analysis of factorial designs . Elsevier, Amsterdam.

Hamoud, H. M. E (2008). Studies on Genotype x Environment Interaction using GGE-Biplot Analysis for seed Cotton Yield in Delta region (Egypt). Egypt. J. Agric. Res. Vol, 86. No, 6. P, 2351-2364.

Hamoud, H.M.E; Abd El-Bary A.M.R., Yehia, W.M.B and Soliman Y.A. (2012). Application of AMMI Model and GGE biplot analysis of multi-environments trials data in Egyptian cotton. 1st Alex. International Cotton Conf. from 17-18 April.

Levi, A. A. H. Palerson, V. Barak, D. Yakir, B. Wang, P. W. Chee and Y. Saranga, (2009). Field evaluation of cotton near-isogenic lines introgressed with QTLs for productivity and drought related traits. MOL. Bread., 23:179-195.

Malik, T. A. H. and D. Wright, (1998). Morphological traits and breeding for drought resistance in wheat . JAPS, 8: 93-99.

Quisenberry, J.E., B. Roark, D.W. Fryer and R.J Kohel. (1980). Effectiveness of selection in upland cotton in stress environments. Crop Sci., 20:450-453.

Rameriz- Vallego, P. and I.D. Kelly. (1998). Traits related to drought resistance in common bean. Euphytica, 99:127. 139.

Roosielle, A.A. and J. Hamblin, (1981). Theoretical aspects for yield in stress and non-stress environments. Crop Sci., 21: 943-946.

Sinculair, T.R. (2005) Theoretical analysis of soil and plant traits influencing daily plant water flux on drying soils .Agron.J,97: 1148-1152.

Turner,N,C, (1997). Further progress in crop water relations. Adv. Agron., 58:293-338.

Ullah, I. M. Rahman, M. Ashraf and Y. Zafar (2006 a). Genotypic variation for drought tolerance in cotton (Gossypium hirsutum L.): Leaf gas exchange and productivity. (NIBGE), P.O. Box 577, Pakistan.

Ullah, I. M, UR, Rahman and Y, Zafar(2006 b). Genotypic variation for drought tolerance in cotton (*Gossypium hirsutum L.*):seed cotton yield responses. Pak. J. Bot., 38(5):1679-1687.

تقدير التباين الوراثى فى بعض هجن القطن (*Gossypium barbadense.* L.) تحت الاجهاد المائى.

محمد سعد عبد العاطى[1]، هشام مسعد حمود[2]، عبد الحميد محمد محمد عمر[1] و حازم شحاته تركى[2]

١ - قسم المحاصيل كليه الزراعة ، جامعة كفر الشيخ.
٢ - قسم تربية القطن ، معهد بحوث القطن، مركز البحوث الزراعية، مصر

نقص الماء من اهم العناصر التى تؤثر على محصول القطن والغرض من هذة الدراسة هو دراسة التباين الوراثى لمجموعة من التراكيب الوراثية تحت ظروف الإجهاد المائى فى القطن بإستخدام كلا من *GMY* وكذلك *DSI* حيث يستخدما كمعيار للإنتخاب وكذلك لدراسة التفاعل بين البيئة والوراثة تحت ظروف الاجهاد المائى.

وقد تم استخدام سبع سلالات و خمس تراكيب وراثية كشافة وتم اجراء التهجين موسم ٢٠١٠ وتم تقييم الاباء و ٣٥ هجين فى موسم ٢٠١١ فى منطقتين هما سخا والنوبارية مع استخدام نظامين مختلفين من الرى فى كل منطقة كالاتى:

١- رى سطحى: ثمان واربع ريات للرى العادى والاجهاد في سخا على التوالى.

٢- رى بالتنقيط : ريتين وريه واحده فى كل اسبوع للرى العادى والاجهاد فى النوباريه على التوالى.

وقد كانت شدة الجفاف تقريبا متساوية في كلا المنطقتين حيث بلغت ٠.٣٤ فى النوبارية و ٠.٣٢فى سخا. وقد تراوحت قيم *GMY* بين ٩٢.٣ جرام/نبات الى ١٥٦.٢ جرام/نبات فى سخا ومن ٥٤.٥ جرام/نبات الى ١٣٥.١ جرام/نبات فى النوبارية. وقد لوحظ وجود ارتباط سالب ومعنوى بين كلا من *DSI* وصفة محصول القطن الزهر والشعر ووزن اللوزة ودليل البذرة ودليل الحصاد فى الموقعين مما يشير الى امكانية استخدام هذه الصفات كأدلة انتخاب. وقد اظهرت طريقة AMMI ان تباين كلا من IPC1 و IPC2 كان ٦١.٨٧% و٢١.٠٥% منسوبا الى قيمة تفاعل الجزء البيئى مع الوراثى. وقد كانت منطقة النوبارية تحت نظام الرى بالتنقيط الطبيعى (W1) اكثر تباينا مما يشير الى ان التراكيب الوراثية بها سلكت سلوكا متباينا حتى انها كانت ذات تاثير IPC1 عالى.

قام بتحكيم البحث

أ.د / محمود سليمان سلطان	**كلية الزراعة – جامعة المنصورة**
أ.د / يوسف صلى محمد	**كلية الزراعة – جامعة كفر الشيخ**