GENETICAL STUDIES FOR YIELD AND ITS COMPONENTS ON DROUGHT AND DROUGHT SUSCEPTIBILITY INDEX IN WHEAT

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Abstract

A diallel cross involving five bread wheat genotypes was evaluated to determine the genetic behaviour of yield and its components in wheat under irrigation and drought conditions in addition to drought susceptibility index. The resultant hybrids along with their parents were evaluated in two experiments. The first experiment (stress) was irrigated once, while the second experiment (normal) four times.

Genotypes mean squares were significant for all studied traits in both experiments as well as drought susceptibility index the parent P3 expressed the highest desirable values for number of kernels/ spike, and grain yield/ plant in drought condition and drought susceptibility index. The crosses P2 x P3 and P3 x P5 expressed the best mean values for most traits under stress conditions and drought susceptibility index, respectively.

Mean squares due to GCA and SCA were significant for all traits except GCA for the number of kernels/ spike in stress experiment and drought susceptibility index and SCA for grain yield in normal experiment and straw yield/ plant in drought index. High GCA/ SCA ratios which exceeded the unity were detected for most traits indicating the predominance of additive and additive x additive gene action in controlling the studied traits. Parents P3 and P4 could be considered as good combiners for the number of spikes/ plant, total plant weight, grain weight/ plant and straw yield/ plant under drought condition and drought susceptibility index. Parent P2 was the best combiner for most traits under normal irrigation condition. The best SCA values were detected by the cross P2 x P3 for no. of spikes/ plant, total plant weight, grain yield/ plant and straw yield/ plant under stress condition and drought susceptibility index. Cross P1 x P5 gave the best SCA effects for total plant weight and straw yield/ plant under normal irrigation experiment.

Key words: *Wheat, Combining ability, Drought susceptibility index,*

INTRODUCTION

The ultimate goal of wheat breeder is to develop new genotypes characterized by high yield potentiality and tolerance to stress conditions such as drought. To achieve this target some important genetic information are required about drought susceptibility indices for yield and yield components in wheat. Such genetic information direct the breeding program towards the use of selection program if the additive gene action was responsible is predominant or to exploit heterosis if non additive gene action was respis prevailed in controlling the traits of interest. Additive gene action was responsible for the inheritance of the number of spikes/ plant (Mahmoud, 1999; and Abdel- Wahed, 2001), 1000 kernel weight (Alkaddoussi *et al.* 1994; and Hassan, 2002), grain yield (Khalifa *et al.* 1998; Ghanem, 2001; Abdel Hameed, 2002; and Muhammad and Muhammad, 2003). On the other hand, non additive gene action played an important role in the inheritance of the number of spikes/ plant (Nassar, 1992 and Abdel Hameed, 2002), and grain yield (Hassan, 2002; and Ammar, 2003).

Regarding drought susceptibility index, Abul- Naas *et al.* (2000) reported that additive gene action was predominant in the inheritance of total plant weight and straw yield while, non additive gene action was important in controlling the number of spikes/ plant, 1000 kernel weight and grain yield.

The aim of the present work was to study general and specific combining ability for yield and yield components under normal and drought conditions as well as drought susceptibility index in wheat. It is hoped that this study may help wheat breeders in developing new genotypes with high yield potentiality and tolerance to drought stress.

MATERIALS AND METHODS

The present work was carried out at Giza Agricultural Research Center, during the two successive seasons 2002/ 2003 and 2003/ 2004. Five common wheat genotypes (*Triticum aestivum* L.), representing a wide range of diversity for several agronomic characters and drought tolerance were selected for this study. The pedigree and origin of these parental materials are presented in Table (1).

Table 1. The name, pedigree and origins of the parental common wheat cultivars and/ or lines.

No.	Name	Pedigree	Origin
P1	Sakha 94	Opta/ Rayon// Kauz	Egypt
P2	Gemmeiza 9	ALD"S"/ HUAC"S"// CMH74A. 630/ SX	Egypt
P3	Sahel 1	NS732/ Pima/ Vee"S"	Egypt
P4	Line #	Giza 158/5/ CFN/ CNO"S"// RON/3/BB/NOR67/4/t1/3/FN/TH//NAR 59*2	
P5	Zemamra- 1	ICW91-0157-3AP-OTS-4AP-OTS- 2AP-OL-OAP	ICARDA

In 2002/ 2003 winter growing season, grains of each of the parental genotypes were sown at various planting dates to overcome the differences in time ȷ and secure enough grains for evaluation. Parents were crossed in all possible combinations excluding reciprocals to obtain total of 10 F_1 crosses.

In 2003/ 2004 winter season, the five parents along with their single crosses (10 crosses) were sown in two adjacent experiments. The first experiment (stress experiment) was irrigated once (70 days after planting irrigation). The second experiment (non stress or normal experiment) was irrigated four times after planting irrigation. A border of fifteen meter was set between the two experiments. Each experiment was arranged in a randomized complete block design with three replications. Each plot consisted of one row of three meter long, with single plants spaced 20 cm within and 30 cm between rows. The proper culture practices were applied as recommended for wheat production in both experiments. The amounts of total rainfall during the second growing season were recorded in Table (2).

Table 2. Monthly average of total rainfall at Giza during 2003/ 2004 winter season.

Month	Nov. 2003	Dec. 2003	Jan. 2004	Feb. 2004	Mar. 2004	Apr. 2004	May 2004
Rainfall mm/ month	0.15	0.30	0.20	0.24	0.04	0.00	0.00

Observations and measurements were recorded in both experiments as mean values of eight individual guarded plants for the number of spikes/ plant, number of kernels/ spike, 100 kernel weight (g), total plant weight (g), grain yield/ plant (g) and straw yield/ plant (g).

A drought susceptibility index (S) was calculated according to Fischer and Maurer (1978) as follows:

$S= (1-Y_d/Y_p)/D$

Where:

S = An index of drought susceptibility.

Y_d= yield or yield component from drought stress experiment of a genotype.

Y_p= yield or yield component from normal irrigated experiment of a genotype.

D = drought intensity = 1-(mean Y_d of all genotypes/ mean Y_p of all genotypes).

Analysis of variance was performed for all studied traits in stress experiment and normal irrigation experiment as well as drought susceptibility index according to Steel and Torrie (1980). General and specific combining abilities were estimated according to Griffing (1956) as method 2 model 1.

RESULTS AND DISCUSSION

Analysis of variance and mean performance

Analysis of variance for all the studied traits in stress and non stress experiments as well as drought susceptibility index is presented in Table (3). Results indicated that mean squares due to genotypes were significant for all the traits indicating a wide range of diversity for the studied traits. Mean squares due to both parents and crosses were significant for most traits in both experiments and drought susceptibility index.

Mean performance for parents and their hybrids are presented in Table (4). Under stress condition, parent P3 expressed the highest mean value for the number of kernels/ spike and grain yield/ plant. Also, parent P4 had the best mean value for 100- kernel weight. While, parent P5 exhibited the most desirable values for the number of spikes/ plant, total plant weight, and straw yield/ plant. In normal irrigation experiment, the highest desirable mean values were recorded by parents P1 for 100- kernel weight; P2 for number of spikes/ plant, total plant weight, grain yield/ plant and straw yield/ plant; and P4 for number of kernels/ spike. For drought susceptibility index, the most desirable mean values were detected by parents P3 for number of kernels/ spike and grain yield/ plant; P4 for number of spikes/ plant, 100- kernel weight and total plant weight; and P5 for straw yield/ plant.

Regarding hybrid mean performance, it is clear that the highest desirable values in stress experiment were recorded by cross combination P2 x P3 for number of spikes/ plant, total plant weight, grain weight/ plant and straw yield/ plant; P1 x P4 for number of kernels/ spike and P1 x P5 for 100- kernel weight. Such results indicated that these cross combinations are promising and prospective in drought conditions. Under normal irrigation, the best hybrids were P1 x P2 for number of spikes/ plant, and straw yield/ plant; P1 x P3 for number of kernels/ spike; P1 x P5 for 100- kernel weight; P2 x P4 for grain yield/ plant and P2 x P5 for total plant weight. The most desirable hybrids for drought susceptibility index were detected by the crosses P1 x P4 for number of kernels/ spike; P2 x P3 for number of spikes/ plant and grain yield/ plant; P3 x P5 for 100- kernel weight, total plant weight and straw yield/ plant.

From these results, it could be concluded that the two cross combinations P2 x P3 and P3 x P5 seemed to be the best among the studied hybrids since they expressed the most desirable values for most traits under stress conditions and drought susceptibility index, respectively. In this connection, several investigators reported that there was a wide range of response to drought resistance in wheat genotypes. Among those are: Saadalla (1994), Esmail and El- Tabbakh (1995), Abul- Naas *et al.* (2000) and Ammar (2003).

Table 3. Observed mean squares from diallel cross analysis of drought, irrigated and drought susceptibility index for all studied traits.

Source of variation	d.f	Number of spikes/ plant			Number of kernels/ spike			100- kernel weight		
		Stress	Normal	S^I	Stress	Normal	S^I	Stress	Normal	S^I
Replication	2	0.66	4.40	0.11	166.55	74.29	0.001	0.15	0.03	0.001
Genotypes	14	8.54**	32.98**	0.43**	139.43*	140.25**	1.68**	0.27**	0.48**	1.05**
Parents (P)	4	2.31	72.73**	0.41**	158.73	75.69	2.01**	0.59**	0.27	2.01**
Crosses (C)	9	11.25**	17.99**	0.46**	146.22*	155.38**	1.51**	0.15	0.41**	0.43*
P x C	1	9.17*	8.17	0.25*	1.12	262.35*	1.93*	0.00	1.92**	2.96**
G. C. A	4	2.75**	28.89**	0.27**	26.76	39.93*	0.39	0.09**	0.14*	0.39**
S. C. A	10	2.89**	3.70*	0.09**	54.55*	49.47**	0.63**	0.09**	0.17**	0.34**
Error	28	2.01	4.22	0.05	60.01	46.48	0.48	0.08	0.12	0.19
GCA/ SCA		0.95	7.80	2.90	0.49	0.81	0.64	1.01	0.82	1.15

Table Extended To:

Total plant weight			Grain yield/ plant			Straw yield/ plant		
Stress	Normal	S^I	Stress	Normal	S^I	Stress	Normal	S^I
8.18	219.67	0.01	2.91	35.90	0.06	1.60	197.66	0.01
354.94**	2699.73**	0.18**	43.71**	120.74**	0.19**	167.22**	1894.97**	0.20**
310.25**	6740.9**	0.29**	18.66	318.02**	0.20**	136.65**	4476.10**	0.33**
418.14**	1200.95**	0.15**	50.44**	43.50	0.19**	191.26**	958.05**	0.17**
312.59*	24.05	0.01	83.29**	26.75	0.19*	73.09	2.66	0.01
190.45**	2535.1**	0.15**	18.43**	102.76**	0.13**	97.51**	1738.52**	0.17**
89.43**	245.94**	0.02**	13.02**	15.22	0.04**	39.03**	188.92**	0.03
41.75	130.75	0.01	8.12	23.98	0.03	23.62	156.55	0.04
2.13	10.31	6.11	1.42	6.75	3.02	2.50	9.20	6.34

* and ** significant at 0.05 and 0.01 levels of probability, respectively.

S^I = Drought susceptibility index

Table 4. Mean performance of drought, irrigated and drought susceptibility index of wheat genotypes for all studied traits.

Genotype	Number of spikes/ plant			Number of kernels/ spike			100- kernel weight		
	Stress	Normal	S^I	Stress	Normal	S^I	Stress	Normal	S^I
P1	8.22	17.25	1.16	64.56	68.33	0.33	3.92	5.28	1.88
P2	6.67	24.33	1.60	53.22	69.83	1.38	4.72	4.87	0.17
P3	8.50	14.33	0.88	69.28	66.67	-0.34	4.32	4.45	0.23
P4	7.67	11.17	0.63	53.67	73.67	1.59	5.09	4.97	-0.19
P5	8.94	15.11	0 .89	55.33	60.00	0.20	4.37	5.00	0.91
P1 x P2	4.93	20.83	1.67	47.58	60.33	1.24	4.55	5.32	1.06
P1 x P3	10.67	15.39	0.66	48.67	83.39	2.39	4.27	5.15	1.18
P1 x P4	8.83	15.61	0.96	70.33	72.33	0.08	4.48	5.88	1.73
P1 x P5	7.11	16.86	1.24	66.61	67.56	0.32	4.93	5.54	0.80
P2 x P3	12.00	14.08	0.33	57.50	80.00	1.65	4.50	5.34	1.12
P2 x P4	9.17	15.69	0.91	58.56	71.28	1.04	4.55	5.70	1.44
P2 x P5	9.17	15.56	0.89	60.00	74.0	1.12	4.35	5.55	1.57
P3 x P4	10.14	12.67	0.43	57.11	75.33	1.42	4.51	5.36	1.15
P3 x P5	9.22	16.67	0.98	61.17	79.33	1.23	4.67	5.10	0.56
P4 x P5	8.33	12.00	0.65	60.92	64.67	0.24	4.11	4.54	0.69
L.S.D 5%	2.38	3.46	0.39	13.03	11.47	1.17	0.53	0.58	0.73
L.S.D 1%	3.24	4.70	0.53	17.71	15.59	1.58	0.73	0.79	0.99

Table Extended To:

Total plant weight			Grain yield/ plant			Straw yield/ plant		
Stress	Normal	S^I	Stress	Normal	S^I	Stress	Normal	S^I
44.72	119.31	1.09	15.02	39.63	1.13	29.70	79.67	1.07
43.32	217.67	1.40	12.25	56.25	1.41	31.08	161.41	1.39
57.22	110.00	0.82	18.68	30.39	0.69	38.54	79.61	0.85
56.15	106.91	0.62	15.39	32.55	0.95	40.76	74.36	0.69
63.38	112.44	0.75	17.59	43.61	1.08	45.80	68.83	0.56
32.83	158.77	1.39	9.71	41.53	1.39	23.12	117.24	1.39
51.67	113.01	0.95	15.65	37.51	1.04	36.02	75.50	0.90
58.56	134.35	0.99	19.07	38.07	0.88	39.48	96.28	1.02
54.39	146.03	1.09	19.80	37.59	0.84	34.56	108.45	1.18
76.50	121.44	0.65	24.43	33.34	0.45	52.07	88.10	0.71
65.61	146.04	0.96	20.29	45.72	1.01	45.32	100.31	0.95
57.33	159.91	1.12	16.19	44.27	1.15	41.14	115.64	1.10
61.88	120.32	0.85	20.79	36.78	0.78	41.09	77.54	0.81
70.33	110.59	0.63	22.40	37.12	0.72	47.94	73.47	0.59
56.42	106.67	0.82	18.38	36.60	0.87	38.04	70.07	0.79
10.87	19.18	0.21	4.74	8.24	0.29	8.18	21.04	0.34
14.77	28.07	0.29	6.38	11.19	0.39	11.11	28.60	0.46

S^I = Drought susceptibility index

Table 5. Estimates of general combining ability effects of drought, irrigated and drought susceptibility index for all studied traits.

Genotype	Number of spikes/ plant			Number of kernels/ spike			100- kernel weight		
	Stress	Normal	S^I	Stress	Normal	S^I	Stress	Normal	S^I
P1	-0.55	1.17**	0.18**	1.20	-0.92	-0.12	-0.13**	0.18*	0.40**
P2	-0.46	2.83**	0.21**	-3.39*	-0.20	0.33*	0.07**	0.06	-0.03
P3	1.03**	-1.08*	-0.20**	1.32	3.53*	0.07	-0.05**	-0.20**	-0.18*
P4	0.00	-2.39**	-0.19**	0.07	0.61	0.06	0.13**	0.03	-0.16
P5	-0.02	-0.53	0.00	0.80	-3.02*	-0.33*	-0.02	-0.07	-0.04
L.S.D (gi) 5 %	0.57	0.83	0.09	3.11	2.74	0.28	0.02	0.14	0.17
1%	0.77	1.12	0.13	4.23	3.73	0.38	0.03	0.19	0.24
L.S.D (gi-gj)5%	0.90	1.31	0.15	4.92	4.33	0.44	0.03	0.22	0.27
1%	1.22	1.78	0.20	6.69	5.89	0.60	0.05	0.30	0.37

Table Extended To:

Total plant weight			Grain yield/ plant			Straw yield/ plant		
Stress	Normal	S^I	Stress	Normal	S^I	Stress	Normal	S^I
-7.61**	-0.37	0.13**	-1.71**	-0.35	0.09*	-5.90**	0.32	0.14**
-3.03*	32.59**	0.18**	-1.59**	5.85**	0.15**	-1.44	27.07**	0.19**
4.96**	-15.43**	-0.13**	2.05**	-4.41**	-0.20**	2.91**	-11.54**	-0.13**
2.09	-10.31**	-0.11**	0.44	-2.02*	-0.04	1.66	-8.81**	-0.09*
3.59**	-6.47**	-0.07*	0.81	0.92	-0.01	2.77**	-7.04**	-0.12**
2.60	4.60	0.05	1.15	1.97	0.07	1.95	5.03	0.08
3.53	6.25	0.07	1.56	2.68	0.09	2.66	6.84	0.11
4.11	7.27	0.08	1.81	3.11	0.11	3.09	7.95	0.13
5.58	9.88	0.11	2.46	4.23	0.15	4.20	10.81	0.17

Table 6. Estimates of specific combining ability effects of drought, irrigated and drought susceptibility index of wheat genotypes for all studied traits.

Genotype	Number of spikes/ plant			Number of kernels/ spike			100- kernel weight		
	Stress	Normal	S^I	Stress	Normal	S^I	Stress	Normal	S^I
P1 x P2	-2.70**	0.99	0.35**	-9.20**	-9.67**	0.12	0.12**	-0.12	-0.27
P1 x P3	1.55*	-0.54	-0.25*	-12.82**	9.66**	1.53**	-0.05*	-0.03	0.01
P1 x P4	0.74	0.99	0.04	10.09**	1.52	-0.78**	-0.01	0.47**	0.53**
P1 x P5	-0.96	0.39	0.13	5.65	0.38	-0.16	0.58**	0.23	-0.51**
P2 x P3	2.79**	-3.51**	-0.61**	0.60	5.56	0.34	-0.01	0.27	0.37*
P2 x P4	0.99	-0.59	-0.03	2.91	-0.24	-0.25	-0.13**	0.41**	0.67**
P2 x P5	1.01	-2.58**	-0.22*	3.63	6.11*	0.19	-0.18**	0.36*	0.69**
P3 x P4	0.48	0.30	-0.10	-3.24	0.08	0.37	-0.06*	0.32*	0.53**
P3 x P5	-0.43	2.44**	0.25*	0.09	7.71**	0.56	0.25**	0.16	-0.18
P4 x P5	-0.29	-0.92	-0.08	1.09	-4.04	-0.42	-0.49**	-0.62**	-0.07
LSD (Sij) 5 %	1.16	1.69	0.19	6.36	5.60	0.57	0.04	0.28	0.35
1%	1.58	2.29	0.26	8.64	7.61	0.77	0.06	0.39	0.48
LSD(Sij-Sik)5%	2.20	3.20	0.36	12.06	10.62	1.08	0.08	0.54	0.67
1%	3.00	4.35	0.49	16.39	14.43	1.47	0.11	0.73	0.91
LSD(Sij-Skl)5%	2.01	2.92	0.33	11.01	9.69	0.98	0.07	0.49	0.61
1%	2.74	3.97	0.45	14.97	13.17	1.34	0.10	0.67	0.83

Table 6. Extended To:

Genotype	Total plant weight			Grain yield/ plant			Straw yield/ plant		
	Stress	Normal	S^l	Stress	Normal	S^l	Stress	Normal	S^l
P1 x P2	-13.22**	-5.68	0.13*	-4.70**	-3.38	0.19*	-8.52**	-2.58	0.12
P1 x P3	-2.37	-3.41	0.01	-2.40*	2.87	0.19*	0.04	-5.71	-0.05
P1 x P4	7.39**	12.81**	0.02	2.64*	1.03	-0.13	4.74*	12.34*	0.03
P1 x P5	1.72	20.64**	0.09	2.99*	-2.38	-0.21**	-1.29	22.74**	0.21*
P2 x P3	17.89**	-27.94**	-0.34**	6.26**	-7.50**	-0.47**	11.62**	-19.87**	-0.29**
P2 x P4	9.86**	-8.46	-0.05	3.74**	2.48	-0.06	6.12**	-10.39	-0.08
P2 x P5	0.09	1.56	0.06	-0.74	-1.90	0.04	0.83	3.18	0.09
P3 x P4	-1.86	13.84**	0.15**	0.59	3.81	0.06	-2.45	5.46	0.10
P3 x P5	5.10	0.26	-0.11*	1.82	1.21	-0.04	3.28	-0.38	-0.10
P4 x P5	-5.95*	-8.77	0.06	-0.58	-1.70	-0.04	-5.37*	-6.51	0.07
LSD (Sij) 5 %	5.30	9.39	0.10	2.34	4.02	0.14	3.99	10.27	0.17
1%	7.21	12.76	0.14	3.18	5.46	0.19	5.42	13.96	0.22
LSD(Sij-Sik)5%	10.06	17.81	0.19	4.44	7.62	0.27	7.57	19.48	0.31
1%	13.68	24.20	0.27	6.03	10.36	0.37	10.29	26.48	0.43
LSD(Sij-Skl)5%	9.19	16.26	0.18	4.05	6.92	0.25	6.91	17.79	0.29
1%	12.49	22.09	0.25	5.51	9.41	0.33	9.39	24.18	0.39

Combining ability analysis

Analysis of variance for combining ability in stress and normal experiments as well as drought susceptibility index is presented in Table (3). Mean squares associated with general (GCA) and specific (SCA) were significant for all studied traits except GCA for number of kernels/ spike in stress experiment and drought susceptibility index and SCA for grain yield in normal experiment and straw yield/ plant in drought index. High GCA/ SCA ratios which largely exceeded the unity were detected for all the traits under study except the number of spikes/ plant in stress experiment and drought susceptibility index, number of kernels/ spike in both experiments and drought susceptibility index and 100 kernel weight in both experiments. Such results indicated that the additive and additive x additive types of gene action are responsible for the inheritance of these traits. The importance of additive genetic variance for wheat grain yield susceptibility index and its components as well as drought resistance was previously reported by Alkaddoussi *et al.* (1994), Saad *et al.* (1997), Khalifa *et al.* (1998), Abul Naas *et al.* (2000), Ghanem (2001), Abdel Hameed (2002), Hassan, (2002) and Muhammad and Muhammad (2003).

Estimates of GCA effects $(\hat{g}_i)$ for individual parents to each trait in stress and non stress experiment as well as drought susceptibility index are presented in Table (5). Highly significant positive $(\hat{g}_i)$ values would be of interest for all traits in stress and normal conditions, whereas highly significant and negative $(\hat{g}_i)$ values are preferred in the case of drought susceptibility index. Under stress condition, parent P1 ranked the second best combiner for 100- kernel weight, while P3 was the best general combiner for number of spikes/ plant, total plant weight, grain yield/ plant and straw yield/ plant. Parent P4 expressed the highest significant $(\hat{g}_i)$ effects for 100- kernel weight. Parent P5 ranked the second best combiner for total plant weight and straw yield/ plant

In normal experiment condition, parent P1 was the best combiner for 100- kernel weight and ranked the second best for number of spikes/ plant. Parent P2 expressed the most desirable $(\hat{g}_i)$ effects for number of spikes/ plant, total plant weight, grain yield/ plant and straw yield/ plant. Parent P3 was the best general combiner for number of kernels/ spike.

For drought susceptibility index, parent P3 was the best combiner for the number of spikes/ plant, 100- kernel weight, total plant weight, grain yield/ plant and straw yield/ plant. Parent P4 ranked the second best combiner for number of spikes/ plant, total plant weight and ranked the third best for straw yield/ plant. Parent P5 ranked the second best for straw yield/ plant and the third best for total plant weight.

In conclusion, parental parents P3 and P4 could be considered as good combiners for grain yield and most of its components.

Specific combining ability effects for all the studied traits in stress and non stress conditions and drought susceptibility index are presented in Table (6). In stress condition, the most desirable Sij effects were detected by the cross combinations P1 x P4 for number of kernels/ spike and P1 x P5 for 100- kernel weight; the cross P2 x P3 for number of spikes/ plant, total plant weight, grain yield/ plant and straw yield/ plant.

Under normal condition, one, three, four, three and two hybrids exhibited significant and positive Sij effects for number of spikes/ plant, number of kernels/ spike, 100- kernel weight, total plant weight and straw yield/ plant, respectively. However, the most desirable Sij effects were detected by the cross P1 x P3 for number of kernels/ spike; P1 x P4 for 100- kernel weight; P1 x P5 for total plant weight and straw yield/ plant; and P3 x P5 for number of spikes/ plant.

Regarding drought susceptibility index, three, one, one, two and two crosses expressed significant and negative Sij effects for number of spikes/ plant, number of kernels/ spike, 100- kernel weight, total plant weight, and grain yield/ plant, respectively. However, the most desirable SCA effects were obtained by the crosses P1 x P4 for number of kernels/ spike, P1 x P5 for 100- kernel weight; and P2 x P3 for number of spikes/ plant, total plant weight, grain yield/ plant and straw yield/ plant.

From the present results it could be concluded that the hybrid P2 x P3 seem to be the best among studied crosses as it expressed the most desirable Sij effects for most traits under stress condition and for drought susceptibility index. Therefore, it may be prospective in wheat breeding programs towards the development of new genotypes characterized by higher yield potentiality and resistance to drought condition.

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دراسات وراثية على المحصول ومكوناته ومعامل الحساسية للجفاف في القمح

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قسم بحوث القمح – معهد بحوث المحاصيل الحقلية– مركز البحوث الزراعية– الجيزة

أجريت هذه الدراسة بهدف تقييم السلوك الوراثي للمحصول ومكوناته تحت ظروف الري العادي وظروف الجفاف وكذلك معامل الحساسية للجفاف وذلك من خلال إجراء جميع الهجن التبادلية بين خمسة أصناف أو سلالات متباينة الصفات بالنسبة لتحمل الجفاف. تم تكوين الهجن الفردية خلال موسم ٢٠٠٢/ ٢٠٠٣. وفى موسم ٢٠٠٣/ ٢٠٠٤ تم تقييم الهجن الناتجة مع الآباء في تجربتين، الأولى تم ريها مرة واحدة بعد ٧٠ يوم من رية الزراعة (ظروف جفاف) والثانية تم ريها أربعة مرات (ظروف عادية) ، وذلك باستخدام تصميم قطاعات كاملة العشوائية في ثلاثة مكررات. تم تقدير معامل الحساسية للجفاف باستخدام معادلة Fischer and Maurer (1978) . كما تم تقدير القدرة على التآلف طبقا لمقترح Griffing (1956) الطريقة الثانية ، النموذج الأول. وقد درست الصفات التالية: عدد سنابل النبات، عدد حبوب السنبلة، وزن ١٠٠ حبة، الوزن الكلى للنبات، محصول الحبوب للنبات، محصول القش للنبات.

كان التباين الراجع إلى التراكيب الوراثية معنويا لجميع الصفات تحت الدراسة تحت ظروف الري العادي وظروف الجفاف وكذلك معامل الحساسية للجفاف. كان الأب P3 هو الأفضل لصفة عدد حبوب السنبلة ومحصول الحبوب للنبات تحت ظروف الجفاف ومع معامل الحساسية للجفاف. وكان الهجينين P2 x P3, P3 x P5 هما الأفضل بالنسبة لمعظم الصفات تحت ظروف الجفاف ومعامل الحساسية للجفاف على الترتيب.

كان التباين الراجع إلى كل من القدرة العامة والخاصة على التآلف معنويا لجميع الصفات تحت الدراسة ماعدا القدرة العامة على التآلف لصفة عدد حبوب السنبلة في تجربة الجفاف ومعامل الحساسية للجفاف، والقدرة الخاصة على التآلف لصفة محصول الحبوب في تجربة الري العادي ومحصول القش للنبات بالنسبة لمعامل الحساسية للجفاف. وقد كانت النسبة بين تباين القدرة العامة والقدرة الخاصة على التآلف تفوق الوحدة لمعظم الصفات ويشير ذلك إلى أهمية التأثير الوراثي المضيف additive والتفوق من النوع المضيف × المضيف additive x additive في توارث الصفات تحت الدراسة. وكان الأبوين P3, P4 هما الأفضل تحت ظروف الجفاف ومعامل الحساسية للجفاف حيث أظهرا قدرة عامة مرغوبة لصفة عدد حبوب السنبلة والوزن الكلى للنبات ووزن حبوب النبات وكذلك محصول

القش للنبات . تم الحصول على تأثيرات مرغوبة بالنسبة للقدرة الخاصة على التـآلف فـي ظروف الجفاف ولمعامل الحساسية للجفاف فى الهجين P2 x P3 لصـفة عـدد سـنابل النبات، الوزن الكلى للنبات، محصول الحبوب والقش للنبات. أعطـى الهجـين P1 x P5 افضل تأثيرات للقدرة الخاصة لصفة الوزن الكلى للنبات ومحصول القـش للنبـات تحـت ظروف الري العادي.