Egypt. J. Agron. Vol. 29, No. 1, pp. 69-83 (2007)

Effect of Wheat Genotypes, Drought and Soil Salinity on Growth, Yield and its Components

M.Sh. Reiad, M.Yasein, Afaf M.Tolba, F.S. Abd-El–Samie* and Abeer A. Ahmad
*Agron. Dept., Fac. Agric. Ain Shams Univ., Shoubra El-Kheima, Cairo, and *Agron. Dept., Fac. Agric., Fayoum Univ., Fayoum, Egypt.*

SIX promising lines of wheat and two check cvs. Giza 168 and Sakha 93 were used to study the effect of genotypes on yield and its components under the effect of soil salinity levels (1680, 3100 and 7900 ppm) and skipping one irrigation at heading stage or at dough-ripe stage. Experiments were carried out at Demo Research Station, Faculty of Agriculture, Fayoum University during 2002/2003 and 2003/2004 growing seasons. The tested lines proved to be superior than Giza 93 and Giza 168 in yield and its components. Lines number 1 and 5 surpassed the other lines in most yield component traits in both seasons, except that seed index was greater in line 3, tillering index in line 2 in both seasons and harvest index in line 2 in the 2nd season. Low soil salinity level was lesser in its harmful effect on yield and its components which increased gradually with increasing soil salinity level from 3100 to 7900 ppm; skipping irrigation at heading stage decreased the studied parameters followed by exposing to drought at dough ripe stage and normal irrigation, respectively, In relation to the three way interaction; higher measurements of number of tillers/plant, main stem spike length (cm), main stem spike weight (g), straw yield/plant (g) and biological yield/plant (g) in 2002/2003 season and main stem spike weight (g) in 2003/2004 were obtained from Line 5 when irrigated normally under Low soil salinity level.

Keywords: Wheat, Genotypes, Soil salinity, Skipping irrigation, Heading and dough-ripe stage, Growth, Yield.

Under Egyptian conditions, increasing wheat production is considered as one of the most important strategic goals in order to decrease the great gap between production and human consumption especially under the yearly increase in the population with a more rate than production. Solving these problems needs pressing hard to increase wheat yield. It can happen through two ways. One of that can go through producing highly productive varieties than that used under the recent cultivation (vertical expansing). Continuous breeding programs must continue for that purpose to produce more newly highly productive varieties having the ability to grow and produce much under the different environmental conditions such as difficult climatologically and soil conditions. Other way can attain through cultivation wheat under the new reclaimed lands (Horizontal expansing). In this case, cultivation of highly productive wheat varieties under stress conditions such as water stress and soil salinity is importantly needed. Therefore, great efforts have been directed by plant breeder and physiologists towards developing suitable wheat genotypes which have good growth performance, good quality, high production and tolerance for salinity and drought conditions. We hope that, cultivating these promising genotypes can meet the increasing demand for food production and minimizing the gap between production and consumption.

Genotype effect was studied by several investigators; it appears a great response since specific one surpassed others significantly in wheat yield and its components (El-Haddad *et al.*, 1993; Yousef and Hanna, 1998; El-Beially, 2001; Hassan *et al.*, 2002 and Abd Allah *et al.*, 2003). The response of wheat genotypes was shown to differ greatly to the increase in soil salinity levels; wheat yield and its components responded negatively due to increasing in the soil salinity levels (Francois *et al.*, 1994; Nour El- Din *et al.*, 2000; El-Beially, 2001; Kandil, 2001; Abd Allah *et al.*, 2003 and Soliman *et al.*, 2004).

Exposing wheat genotypes to drought at different growth stages tends to cause a decrease in the wheat yield and its components (Abd El-Gawad *et al.*, 1994; Hefnawy and Wahba, 2003; El-Haris, 2004 and Kassab *et al.*, 2004)

This investigation aimed to study productivity of some promising bread wheat genotypes produced from hybridization between Egyptian and Mexican varieties at F_9 under soil salinity and drought stress conditions.

Material and Methods

Three field experiments were carried out at Demo Research Station, Faculty of Agriculture, Fayoum University during 2002/2003 and 2003/2004 seasons. These experiments aimed to investigate the effect of certain environmental conditions on wheat yield and its components. Each experiment represent one of the salinity levels under investigation which considered as low, medium and high saline soils of the location of study.

Salinity treatments

a- Low soil salinity was 1680 ppm
b- Medium soil salinity was 3100 ppm
c- High soil salinity was 7900 ppm

Each experiment included 24 treatments which were the combination between three drought treatments and eight wheat genotypes as follows:

Drought treatments

a- Normal irrigation (without preventing)
b- Skipping irrigation at heading stage.
c- Skipping irrigation at dough-ripe stage.

Wheat genotypes

Eight genotypes were investigated in every experiment. Two of them were the two cultivars namely Sakha 93, Giza 168 and Six F_9 promising wheat lines derived from crosses between Giza 160, Giza 157 and three Mexican varieties *i.e.*, (MD 689 / B/ chere "S", Bow "S"//YD "S" / ZZ "S" and KvZ // con / pj bg62. The selected lines were kindly supplied by EL-Marakby *et al.* (1994).

The treatments of genotypes and drought were arranged in a split plot design in three replicates. The main plots were occupied with the drought treatments. Genotypes were allocated in the subplots. The experimental plot was consisted of 3 rows with two meters in length and 20 cm in between. Plants were individually spaced at 10 cm within every row. Wheat grains were sown on 21st and 22nd of November in the first and the second growing seasons, respectively. All cultural practices of growing wheat in the experimental location were followed as recommended. At harvesting which occurred on May, 15th and 9th in first and second season, respectively,10 guarded plants from every experimental plot were chosen at random and the following data of growth, yield and its components were recorded: plant height (cm), number of tillers/plant, number of spikes/plant, main stem spike length (g), number of spikelets/spike, number of grains/main spike, plant spikes weight (g), main stem spike weight (g), spike grain weight (g), seed index (g), grain yield/plant (g), straw yield/plant (g), biological yield/plant (g). Tillering index % (T.I) and Harvest Index % (H.I) were calculated by the following equations:

T. I % = Number of fertile tillers/plant/Total number of tillers/plant x100
H.I % = Grain yield / plant (g)/ Biological yield / plant (g) x100

In each season, combined analysis of variance between the three experiments was done according to Snedecor and Cochran (1992) for all the studied traits. The differences among means were tested using least significant difference (LSD).

Results and Discussion

Effect of wheat genotypes

Table 1 shows the response of wheat yield and its components to the effect of wheat genotypes. It was appeared that the obtained wheat lines studied were superior than the other check varieties, *i.e.*, Sakha 93 and Giza 168 in yield and its component characters, within the studied lines, the two lines; 1 and 5 surpassed the other lines in plant height (cm), number of tillers/plant, number of spikes/plant, main stem spike length (g), number of spikelets/spike, number of grains/main spike, plant spikes weight (g), main stem spike weight (g), spike grain weight (g), seed index (g), grain yield/plant (g), straw yield/plant (g), biological yield/plant (g), tillering index (%) and harvest index (%).This trend was true in both seasons of study. Seed index was greater in line 3; tillering index was superior in line 2 as compared with other studied lines. This was true in both seasons whilst line 2 was the greater in harvest index in the second studied season. It could be concluded that wheat yield and its components were adjusted much due to the wheat gene effect since lines 1, 5 were more effective in predicting more yield and yield components except that of line 3 in seed index, line 2 in tillering index and harvest index. These results were in agreement with those obtained by El-Haddad *et al.* (1993), Yousef & Hanna (1998), El-Beially (2001), Hassan *et al.* (2002) and Abd Allah *et al.* (2003).

TABLE 1. Performance of some wheat genotypes for yield and its components during 2002/2003 and 2003/2004 seasons

Studied characters	Season	Sakha	Giza	Lines						LSD
		93	168	1	2	3	4	5	6	5%
1-Plant height (cm)	S_1	78.42	82.39	94.37	84.96	78.68	81.05	85.69	86.42	3.1
	S_2	73.82	77.84	90.36	79.46	76.78	77.78	81.77	79.64	2.73
2-Number of tillers/plant	S_1	8.41	7.88	10.02	8.39	9.29	9.61	10.33	8.70	0.78
	S_2	5.94	5.68	5.99	5.58	5.81	5.96	6.26	6.02	-
3-Number of spikes/plant	S_1	7.8	7.35	9.09	7.98	8.34	8.77	9.48	8.22	0.76
	S_2	5.83	5.55	5.84	5.51	5.59	5.81	6.17	5.84	-
4-Main spike length (cm)	S_1	11.05	11.97	11.19	12.42	10.50	11.47	12.68	12.63	0.36
	S_2	10.3	11.09	9.97	11.19	10.03	10.31	11.44	11.27	0.40
5-Number of spikelets/ spike	S_1	20.41	21.15	22.87	21.78	18.49	20.65	22.46	22.07	0.65
	S_2	19.71	20.21	21.05	20.82	18.05	19.62	21.21	20.78	0.67
6-Number of grains/spike	S_1	49.15	57.27	63.64	60.47	51.00	54.75	61.16	60.73	3.57
	S_2	40.61	49.79	50.29	49.96	43.59	44.17	50.43	48.85	2.75
7-Plant spikes weight (g)	S_1	19.14	19.85	30.93	26.91	24.53	24.46	32.12	26.99	2.97
	S_2	12.43	12.21	14.97	14.24	13.61	13.32	15.94	14.22	1.34
8-Main spike weight (g)	S_1	3.16	3.48	4.34	4.07	3.71	3.57	4.21	3.95	0.26
	S_2	2.95	3.12	3.53	3.36	3.21	2.95	3.46	3.34	0.17
9-Spike grain weight (g)	S_1	2.33	2.55	3.13	2.91	2.75	2.60	2.94	2.9	0.21
	S_2	2.42	2.50	2.81	2.72	2.62	2.48	2.70	2.55	0.17
10-Seed index (g)	S_1	4.83	4.67	4.93	4.86	5.40	4.70	4.96	4.87	0.21
	S_2	5.83	5.05	5.55	5.51	5.96	5.60	5.42	5.24	0.27
11-Grain yield/plant (g)	S_1	11.22	12.18	18.27	15.57	15.15	14.35	19.12	15.64	1.98
	S_2	7.16	7.16	8.59	8.35	7.89	7.79	9.24	8.04	0.92
12-Straw yield/plant (g)	S_1	25.87	26.00	36.3	31.43	26.67	30.16	37.77	32.08	3.27
	S_2	17.61	16.07	19.35	17.37	16.18	16.70	19.32	17.53	1.46
13-Biological yield/plant (g)	S_1	37.1	38.18	54.58	47.00	41.82	44.51	56.9	47.72	4.66
	S_2	24.77	23.23	27.94	25.71	24.08	24.49	28.57	25.57	2.07
14-Tillering index (%)	S_1	92.75	93.27	90.72	95.11	89.77	91.26	91.77	94.48	3.19
	S_2	98.15	97.71	97.49	98.74	96.21	97.48	98.56	97	-
15-Harvest index (%)	S_1	30.24	31.90	33.47	33.13	36.23	32.24	33.6	32.77	2.1
	S_2	28.91	30.82	30.74	32.48	32.77	31.81	32.34	31.44	-

S_1= 2002/2003 S_2= 2003/2004

Effect of soil salinity level

Table 2 shows the wheat yield and its components in relation to the soil salinity level. Results obtained revealed that wheat yield and its components were much affected with the soil salinity level. Increase in soil salinity level from 1680 to 3100 and/or 7900 ppm induced a decrease in all characters studied *i.e.*, plant height, number of tillers/plant, number of spikes/plant, main stem spike length, number of spikelets/spike, number of grains/main spike, plant spikes weight, main stem spike weight, spike grain weight, seed index (g), grain yield/plant, straw yield/plant, biological yield/plant, tillering index (%) and harvest index (%). The rate of decrease was substantial at 7900 ppm level compared with 3100 ppm in number of tillers/plant, number of spikes/plant, number of grains/main spike, plant spikes weight, main stem spike weight, spike grain weight, grain yield/plant, straw yield/plant and biological yield/plant. This was true and significant in both seasons except tillering index in first season and harvest index in second one. This may reflects the response of the different physiological processes to salinity increasing such as, water absorption from soil, water translocation, cell division, cell enlargements and differentiation photosynthesis and respiration. All of these could result in that marked response of decrease. Similar results were obtained by El-Haddad *et al.* (1993), Soliman *et al.* (1997), Abd El-Salam & Sarhan (1999), Daoud & Khodier (2000), El-Emam (2000), Nour El- Din *et al.* (2000) El-Beially (2001), Kandil *et al.* (2001), Abd Allah *et al.* (2003); Francois *et al.* (1994) and Soliman *et al.* (2004). They concluded that increasing soil salinity decreased significantly wheat yield and most of its components.

TABLE 2. Effect of soil salinity levels on yield and its components of some wheat genotypes during 2002/2003 and 2003/2004 seasons

Growth season	2002/2003				2003/2004			
Soil salinity levels (ppm)	Low 1680 ppm	Medium 3100 ppm	High 7900 ppm	LSD 5%	Low 1680 ppm	Medium 3100 ppm	High 7900 ppm	LSD 5%
Studied characters								
Plant height (cm)	94.96	85.01	71.64	3.10	86.8	85.52	66.81	1.95
Number of tillers/plant	12.63	8.58	6.03	0.53	6.36	6.12	5.23	0.26
Number of spikes/plant	11.60	7.95.	5.58	0.56	6.32	5.96	5.02	0.27
Main spike length (cm)	13.34	11.36	10.51	0.34	11.5	11.11	9.49	0.37
Number of spikelets/spike	22.86	20.62	20.23	0.55	20.54	20.44	19.56	0.69
Number of grains/spike	70.59	63.11	38.10	3.8	55.14	52.63	33.85	2.75
Plant spikes weight (g)	41.52	23.78	11.55	2.35	16.56	16.53	8.52	1.25
Main stem spike weight (g)	4.83	3.91	2.70	0.26	3.76	3.61	2.35	0.17
Spike grains weight (g)	3.57	2.81	1.91	0.19	3.11	2.93	1.76	0.13
Seed index (g)	5.22	4.99	4.49	0.25	5.86	5.58	5.12	0.23
Grain yield/plant (g)	25.54	14.20	5.82	1.68	9.77	9.72	4.59	0.68
Straw yield/plant (g)	48.24	31.00	13.12	1.98	22.11	20.63	9.81	1.09
Biological yield/plant (g)	73.79	45.2	18.93	3.28	31.88	30.35	14.4	1.57
Tillering index (%)	91.84	92.7	92.5	-	99.37	97.38	95.98	1.17
Harvest index (%)	34.61	31.42	30.74	1.68	30.65	32.03	31.87	-

Effect of drought

Table 3 shows the response of wheat yield and its components to exposing plants to skipping irrigation at heading or dough ripe stage. Normal irrigation for wheat plants significantly resulted in higher plant height, number of tillers/plant, number of spikes/plant, main stem spike length, number of spikelets/spike, number of grains/main spike, plant spikes weight, main stem spike weight, spike grain weight, seed index (g), grain yield/plant, straw yield/plant and biological yield/plant except tillering index in first and second season and harvest index in second season as compared with that ones exposed to skipping one irrigation. Prevent irrigation at heading stage was shown to decrease the above mentioned traits but with more rate compared with dough ripe stage. Exposing wheat plants to drought during heading stage induced much decrease in the wheat yield and its components followed by that of dough ripe stage. Preventing irrigation at heading stage may caused a great decrease in some important processes affecting yield production such as cell division and enlargement mainly that of spikes, flowering, fertilization, kernels formation and food translocation to the formed kernels. These results are in agreement with those obtained by Wang *et al.* (1991), Dourgham (1991), Abd El-Gawad *et al.* (1993 & 1994), El-Noemani (1996), Abou - Khadrah *et al.* (1999), Kandil *et al.* (2001), Guttieri *et al.* (2001), Hefnawy & Wahba (2003), El-Haris (2004) and Kassab *et al.* (2004). Tillering index results exhibited no significant response. This indicates that forming fertile tillers were not affected because of its formation before exposing to drought at either heading or dough ripe stage. Harvest index was shown to be significant in first season only, a slight decrease obtained as exposing to drought at heading or dough ripe stage .

TABLE 3. Effect of drought treatment at heading and dough-ripe stages on yield and its components of some wheat genotypes during 2002/2003 and 2003/2004 seasons .

Growth season	2002/2003				2003/2004			
Skipping irrigation treatment	Normal	Heading Stage	Dough stage	LSD 5%	Normal	Heading stage	Dough stage	LSD 5%
Studied Characters								
Plant height (cm)	85.67	80.83	85.12	3.10	82.79	76.24	80.01	1.95
Number of tillers/plant	10.16	8.10	9.01	0.53	6.32	5.40	5.99	0.26
Number of spikes/plant	9.15	7.54	8.45	0.56	6.14	5.28	5.88	0.27
Main spike length (cm)	11.87	11.58	11.77	-	10.89	10.56	10.65	-
Number of spikelets/spike	21.55	20.72	21.44	0.55	20.51	19.67	20.37	0.69
Number of grains/spike	59.31	55.23	57.27	-	50.23	45.48	45.92	2.75
spikes weight /Plant (g)	30.02	21.83	25	2.35	15.07	11.68	14.85	1.25
Main spike weight (g)	4.05	3.65	3.74	0.26	3.43	3.05	3.24	0.17
Spike grains weight (g)	2.89	2.66	2.74	-	2.77	2.51	2.52	0.13
Seed index (g)	4.97	4.83	4.91	-	5.63	5.44	5.49	-
Grain yield/plant (g)	18.05	12.96	14.55	1.68	8.88	6.77	8.44	0.68
Straw yield/plant (g)	35.09	25.72	31.55	1.98	19.18	14.31	19.05	1.09
Biological yield/plant (g)	53.14	38.68	46.10	3.28	28.06	21.08	27.49	1.57
Tillering index (%)	90.06	93.09	93.78	-	97.15	97.78	98.16	-
Harvest index (%)	33.97	33.51	31.56	1.68	31.65	32.12	30.70	-

Effect of the interaction

Insignificant interaction obtained from the investigation was expelled. Accordingly we will concentrate only on the significant one as follow.

Effect of the interaction between genotype x drought

Table 4 shows the interaction between genotype and drought level on number of tillers/plant, number of spikes/plant and biological yield/plant in the first season. The different studied genotypes exposed to drought effect, showed depression in the mentioned studied characters.The higher depression at heading stage was more comparable with that of dough ripe stage. Line 5 showed superiority mainly in the above mentioned characters as compared with 1, 4 or 3 lines under investigation, since it gave more tillering, spiking and biological yield /plant mostly. Similar results were obtained by Kandil *et al.* (2001) who stated that the interaction between water stress and cultivars on biological yield was significant. Similar trend was also concluded by Ismail *et al.* (1999) for tillering and Hagras *et al.* (1993) and Yousef & Hanna (1998) for number of spikes plant.

TABLE 4. Response of some wheat genotypes to drought treatments at heading and dough –ripe stages on yield and its components during 2002/2003 season

Genotypes	Sakha	Giza	Lines						LSD
	93	168	1	2	3	4	5	6	5%
Irrigation treatments	Number of tillers/plant 2002/2003 season								
Normal irrigation	8.78	8.5	10.44	9.92	10.35	11.57	12.26	9.47	
Heading stage	7.99	7.3	9.68	7.35	8.01	8.34	8.68	7.47	1.34
Dough-ripe stage	8.77	7.83	9.93	7.9	9.52	8.91	10.06	9.17	
	Number of spikes/plant 2002/2003 season								
Normal irrigation	8.31	8.06	9.94	9.37	8.88	10.18	11.3	7.15	
Heading stage	7.61	7.04	8.41	7.9	6.86	7.58	7.97	6.93	1.31
Dough-ripe stage	8.12	7.49	8.93	7.48	9.27	8.55	9.18	8.58	
	Biological yield/plant (g) 2002 /2003 season								
Normal irrigation	40.70	44.55	60.01	57.03	48.63	51.29	66.12	56.44	
Heading stage	32.26	33.47	47.78	41.35	30.85	38.34	45.45	39.69	8.07
Dough-ripe stage	38.33	36.51	55.94	42.62	45.98	43.9	58.12	47.04	

Effect of the interaction between genotype x soil salinity levels:

Data in Table 5 show that increasing soil salinity level from 1680 to 3100 or 7900 ppm caused a decrease in the studied characters of yield and its components, *i.e.*, plant height (cm), number of tillers/plant, number of spikes/plant, main stem spike length (g), number of grains/main spike, plant spikes weight (g), main stem spike weight (g), spike grain weight (g), seed index (g), grain yield/plant (g), straw yield/plant (g), biological yield/plant (g) and tillering index.

TABLE 5. Response of some wheat genotypes at various soil salinity levels on yield and its components during 2002/2003 and/or 2003/2004 seasons.

Genotypes	Sakha 93	Giza 168	Lines 1	2	3	4	5	6	LSD 5%
Soil salinity levels (ppm)	Plant height (cm) 2002/2003 season								
Low 1680	88.05	91.8	107.56	98.39	85.71	91.82	99.74	96.62	
Moderate3100	77.68	83.43	99.9	87.82	81.66	81.45	82.52	86.45	5.37
High 7900	69.54	71.94	76.46	68.67	68.69	69.88	74.80	73.18	
	Plant height (cm) 2003/2004 season								
Low 1680	78.60	83.47	102.60	87.46	83.24	83.88	89.54	85.60	
Moderate3100	78.30	83.17	100.24	86.85	82.10	83.17	85.14	85.22	4.73
High 7900	64.60	66.90	68.23	64.08	64.99	66.30	70.63	68.09	
	Number of tillers/plant 2002/2003 season								
Low 1680	11.43	9.57	15.19	11.54	13.47	13.24	14.65	11.93	
Moderate3100	7.5	8.16	8.92	8.41	9.1	9.35	9.27	7.9	1.34
High 7900	6.31	5.9	5.94	5.21	5.31	6.23	7.07	6.28	
	Number of spikes/plant 2002/2003 season								
Low 1680	10.67	9.56	13.16	10.83	11.7	12.00	13.37	11.63	
Moderate3100	7.00	7.50	8.47	8.01	8.31	8.5	8.5	7.33	1.31
High 7900	5.73	5.00	5.64	5.10	4.99	5.80	6.59	5.80	
	Main spike length (cm) 2002/2003 season								
Low 1680	12.83	13.42	12.27	14.33	11.70	13.25	14.41	14.51	
Moderate3100	10.31	11.51	11.58	12.03	10.31	10.83	12.18	12.13	0.62
High 7900	10.00	10.98	9.71	10.9	9.48	10.33	11.43	11.25	
	Number of grains/spike2003 /2004 season								
Low 1680	48.83	59.01	58.07	57.95	51.62	50.66	59.63	55.38	
Moderate3100	47.08	55.75	53.73	56.43	50.54	48.8	53.99	54.71	4.75
High 7900	25.92	34.6	39.07	35.49	28.6	33.04	37.68	36.47	
	Plant spikes weight (g) 2002/2003 season								
Low 1680	29.04	28.01	53.75	43.33	38.92	38.47	55.16	45.47	
Moderate3100	18.38	21.96	26.16	26.2	24.5	23.86	26.49	22.71	5.15
High 7900	9.99	9.58	12.88	11.2	10.17	11.04	14.71	12.78	
	Main stem spike weight (g) 2003/2004 season								
Low 1680	3.66	3.60	4.08	4.02	3.90	3.43	4.15	3.90	
Moderate3100	3.28	3.45	3.87	3.69	3.57	3.40	3.46	3.50	0.3
High 7900	1:90	2.30	2.62	2.37	2.16	2.04	2.78	2.62	
	Spike grains weight (g) 2003/2004 season								
Low 1680	3.02	2.98	3.43	3.14	3.13	2.94	3.23	3.02	
Moderate3100	2.95	2.77	3.06	3.20	2.97	2.89	2.88	2.71	0.29
High 7900	1.29	1.76	1.95	1.84	1.74	1.62	1.98	1.90	

TABLE 5. Cont.

Genotypes	Sakha 93	Giza 168	Lines 1	2	3	4	5	6	LSD 5%
Soil salinity levels (ppm)	Seed index (g) 2002 / 2003 season								
Low 1680	5.23	5.1	5.24	5.08	5.57	4.92	5.44	5.31	
Moderate3100	5.07	4.86	5.06	4.94	5.45	4.67	5.00	4.87	0.36
High 7900	4.19	4.15	4.50	4.55	5.17	4.51	4.46	4.41	
	Seed index (g) 2003/2004 season								
Low 1680	6.58	5.12	6.04	5.72	6.26	6.15	5.47	5.52	
Moderate3100	6.13	5.03	5.65	5.61	5.81	5.75	5.46	5.22	0.46
High 7900	4.77	5.01	4.96	5.20	5.79	4.91	5.33	4.99	
	Grain yield/plant (g) 2002/ 2003 season								
Low 1680	17.96	18.75	33.02	25.81	24.84	23.03	33.49	27.44	
Moderate3100	10.79	13.02	15.23	15.59	15.69	14.41	16.14	12.77	3.44
High 7900	4.91	4.77	6.57	5.31	4.91	5.60	7.75	6.71	
	Straw yield/plant (g) 2002/2003 season								
Low 1680	39.41	34.6	60.15	50.41	40.99	47.98	62.62	49.79	
Moderate3100	25.14	30.77	34.66	32.31	28.50	30.00	33.75	32.86	5.66
High 7900	13.07	12.62	14.10	11.58	10.52	12.50	16.94	13.60	
	Straw yield/plant (g) 2003/2004 season								
Low 1680	23.75	19.39	24.30	21.95	21.08	20.68	23.93	21.82	
Moderate3100	18.89	18.89	22.81	21.89	19.96	20.45	21.36	20.82	2.52
High 7900	10.19	9.95	10.94	8.26	7.51	8.96	12.69	9.94	
	Biological yield/plant (g) 2002/2003 season								
Low 1680	57.37	53.34	93.17	76.22	65.83	71.00	96.11	77.23	
Moderate3100	35.93	43.79	49.89	47.89	44.20	44.44	49.89	45.63	8.07
High 7900	18.99	17.39	20.67	16.89	15.43	18.41	24.67	20.31	
	Biological yield/plant (g) 2003/2004 season								
Low 1680	32.46	28.57	34.43	32.13	31.56	30.29	33.77	32.00	
Moderate3100	27.09	27.50	33.55	32.09	29.87	29.49	32.91	30.16	3.59
High 7900	17.99	13.63	15.85	12.93	10.80	13.67	19.01	14.53	
	Tillering index (%) 2003/2004 season								
Low 1680	98.80	98.60	100.0	99.40	99.80	99.70	99.40	99.10	
Moderate3100	98.20	98.20	98.20	99.20	96.30	96.60	98.50	99.00	2.69
High 7900	97.40	96.20	93.90	96.90	93.30	96.30	96.90	92.99	

These decreases were true in all studied genotypes, but with a different rate among genotypes. This may indicates that role of gene effect can be helpful for reducing the harmful effect of salinity on the studied characters in both seasons. According to the response of the genotypes to increasing soil salinity level; it was decreased in all yield and its components as increasing soil salinity level, but Line 1 and or 5 appeared superior in all studied characters than others except seed index in both seasons since line 3 overweighed others. It could be concluded that line 1 and 5 have the ability to tolerate salinity hazard effect and produce much than the others which could be due to the gene effect. Similar results were obtained by Barakat & El-Haris (1998), Nour El- Din *et al.* (2000), El-Beially (2001) and Abd Allah *et al.* (2003) since they indicated that interaction between salinity level and cultivars caused a significant effect on plant height, no. of spikes/plant, spike length, seed index, grain yield/fed, straw yield and biological yield.

Effect of the interaction between genotype x soil salinity level x drought

Table 6 shows the three way interaction. Increasing soil salinity level from 1680 to 3100 or 7900ppm caused a decrease in number of tillers/plant, main stem spike length (g), straw yield/plant (g) and biological yield/plant (g) in 2002 / 2003 growth season, whilst in main stem spike weight (g) in 2003/2004 season (Table 6). This was true under the different drought treatments as well as genotypes tested. Higher measurements were obtained under normal irrigation followed by dough ripe and heading stage, respectively. The rate of decrease was differing from genotype to another. Higher measurements were obtained from line 5 under low soil salinity level as well as normal irrigation. This indicates that Line 5 considered as the more promising one under investigation in tillering, spike elongation and weighing, straw and biological yield.

TABLE 6. Response of some wheat genotypes to various soil salinity levels and drought treatments at heading and dough-ripe stages during 2002/2003 and 2003/2004 seasons

Soil salinity levels (ppm)	Genotypes / Skipping irrigation treatments	Sakha 93	Giza 168	Lines 1	2	3	4	5	6	LSD 5%
		Number of tillers/plant 2002/2003 season								
Low	Normal irrigation	12.37	12.03	15.92	13.85	16.25	16.10	18.29	13.74	
	Heading stage	9.79	8.23	14.50	10.20	10.93	11.50	12.07	9.95	
	Dough-ripe stage	12.13	8.43	15.16	10.58	13.23	12.11	13.60	12.10	
Moderate	Normal irrigation	7.65	9.03	9.15	9.82	10.22	12.11	9.82	8.52	
	Heading stage	6.90	7.35	8.48	6.67	7.43	7.74	8.44	7.13	2.33
	Dough-ripe stage	7.97	8.11	9.13	8.76	9.65	8.20	9.57	8.05	
High	Normal irrigation	7.28	6.33	6.25	6.10	5.68	7.03	8.67	7.37	
	Heading stage	5.40	5.37	5.50	4.73	4.57	5.17	5.53	5.33	
	Dough-ripe stage	6.24	6.03	6.07	4.79	5.67	6.50	7.00	6.15	
		Main stem spike length (cm) 2002/ 2003 season								
Low	Normal irrigation	13.35	13.82	12.4	14.52	12.19	14.02	14.86	14.87	
	Heading stage	12.39	12.99	12.17	13.95	11.05	12.55	14.14	14.21	
	Dough-ripe stage	12.76	13.47	12.25	14.52	11.87	13.18	14.25	14.44	
Moderate	Normal irrigation	10.99	11.99	11.82	13.06	10.78	11.73	12.39	12.26	
	Heading stage	9.67	10.62	11.19	10.98	9.60	10.16	11.88	12.01	1.07
	Dough-ripe stage	10.32	11.92	11.74	12.05	10.54	10.54	12.27	12.11	
High	Normal irrigation	10.13	11.31	9.99	10.93	9.91	10.92	11.53	11.39	
	Heading stage	9.77	10.81	9.24	10.87	9.10	9.81	11.37	11.13	
	Dough-ripe stage	10.11	10.83	9.89	10.90	9.44	10.25	11.40	11.22	
		Main stem spike weight (g) 2003 /2004 season								
Low	Normal irrigation	3.92	3.81	4.41	4.44	4.03	3.58	4.42	4.06	
	Heading stage	3.20	3.36	3.65	3.71	3.75	3.32	4.03	3.82	
	Dough-ripe stage	3.87	3.64	4.21	3.91	3.92	3.39	3.99	3.83	
Moderate	Normal irrigation	3.74	3.77	4.29	4.07	3.79	3.66	3.61	3.89	
	Heading stage	3.00	3.20	3.55	3.24	3.45	2.94	3.21	3.00	0.52
	Dough-ripe stage	3.11	3.37	3.76	3.77	3.46	3.60	3.56	3.62	
High	Normal irrigation	1.99	2.49	3.03	2.50	2.59	2.56	3.03	2.77	
	Heading stage	1.76	2.16	2.51	2.14	1.74	1.75	2.54	2.54	
	Dough-ripe stage	1.96	2.25	2.33	2.47	2.14	1.79	2.76	2.54	

TABLE 6. Cont.

Soil salinity levels (ppm)		Genotypes	Sakha 93	Giza 168	Lines 1	Lines 2	Lines 3	Lines 4	Lines 5	Lines 6	LSD 5%
		Irrigation skipping treatments	Straw yield/plant (g) 2002/2003 season								
	Low	Normal irrigation	44.3	45.84	69.66	60.8	51.23	56.37	75.52	62.38	
	Low	Heading stage	32.96	27.38	46.9	40.87	30.73	40.36	46.07	40.06	
	Low	Dough-ripe stage	40.97	30.57	63 9	49.56	41.01	47.21	66.28	46.92	
	Moderate	Normal irrigation	28.84	39.07	36.02	39.68	35.11	32.16	39.00	38.46	
	Moderate	Heading stage	20.29	22.75	33.56	24.14	18.90	26.13	29.69	26.16	9.80
	Moderate	Dough-ripe stage	26.28	30.49	34.40	33.11	31.50	31.70	32.57	33.95	
	High	Normal irrigation	14.16	13.06	17.05	15.14	11.85	14.23	19.75	14.46	
	High	Heading stage	11.53	11.99	12.05	9.80	8.84	11.06	13.33	12.45	
	High	Dough-ripe stage	13.53	12.80	13.19	9.80	10.88	12.21	17.75	13.9	
			Biological yield/plant (g) 2002/2003 season								
	Low	Normal irrigation	65.56	71.89	103.25	89.21	81.59	83.19	118.78	97.92	
	Low	Heading stage	47.04	40.32	74.83	64.83	45.61	57.99	70.34	62.92	
	Low	Dough-ripe stage	60.51	47.82	101.44	74.63	70.31	71.86	99.22	70.84	
	Moderate	Normal irrigation	39.63	53.33	52.28	60.00	52.29	49.54	58.46	50.46	
	Moderate	Heading stage	30.53	33.53	46.99	35.46	30.77	39.28	43.76	37.56	13.97
	Moderate	Dough-ripe stage	37.63	44.52	50.39	48.22	49.53	44.41	47.43	48.86	
	High	Normal irrigation	19.90	19.05	24.49	21.88	18.09	21.16	30.12	21.42	
	High	Heading stage	14.85	15.87	18.11	13.96	12.02	15.42	19.24	18.57	
	High	Dough-ripe stage	19.22	17.25	19.40	14.83	16.19	17.74	24.70	20.94	

References

Abd Allah, A.E., Moustafa, M.A. and Salem, M.A. (2003) Interactive effects of saline irrigation water and zinc application on growth and yield of seven wheat cultivars grown in calcareous soil. *J. Adv. Agric. Res.* **8**(3), 551.

Abd El-Gawad, A.A., Noureldin, Nemat A., Ashoub, M.A. and Kashabah, M.A. (1993) Studies on Consumptive use and irrigation scheduling in relation to nitrogen fertilization on wheat. II- Response of wheat yield and its attributes. Annals Agric. *Sci., Ain Shams Univ., Cairo*, **38** (1),173 .

Abd El-Gawad, A.A., El-Habbal, S., Edris, A.S.A. and Dorgham, Elham A. (1994) Effect of water stress during filling period and nitrogen fertilization on yield and its attributes of two wheat genotypes. Egypt. *J. Appl. Sci.* **9** (2), 323 .

Abd El-Salam, H.Z and Sarhan, S.H. (1999) Effect of soil salinity and alkalinity on yield and chemical composition of wheat plant. *J. Agric. Sci., Mansoura Univ.* **24** (5), 2673 .

Abou-Khadrah, S.H., Abdel-Hafez, S.A., Sorour, F.A. and El-Bably, A.Z. (1999) Effect of soil moisture stress on wheat production, its components and nutrient uptake.

Third Conf. of on-Farm Irrigation and Agroclimatology, January, **Vol.** 1 (2) Soil, water & Env. Res. Inst., ARC, Minist. of Agric. and Land Reclamation. pp. 25-37.

Barakat , M.N. and El-Haris, M.K. (1998) Agronomic evaluation of the progeny under salt stress conditions. *Alex. J. Agric. Res.* **43**(2) , 21 .

Daoud, A.M. and Khodier, M.M. (2000) Effect of salinity and moisture content of calcareous soil on the growth and water use of wheat (*Triticum aestivum* L.). *Adv. Agric. Res.* **5** (2), 1315 .

Dourgham, Elham A. (1991) Effect of water stress, irradiation and nitrogen fertilization on grain filling, yield and quality of certain wheat cultivars. *Ph.D. Thesis*, 143 pp. Fac. of Agric., Ain Shams Univ., Cairo, Egypt.

El-Beially, I.E.M.A. (2001) Effect of irrigation with saline water on growth, yield and its components of some wheat cultivars in sandy soil. *Al-Azhar J. Agric. Res.* **34**, 59 .

El-Emam, A.A.E.M. (2000) Effect of soil salinity and nitrogen fertilization on yield and quality of wheat seed. *M. Sc. Thesis*, Fac. of Agric., Al-Azhar Univ., Egypt.

El-Haddad, E.H., Amer, M.A. and Moustafa, M.A. (1993) Effect of salinity on the growth and yield of three wheat cultivars grown in calcareous soil. *Menofiya J. Agric. Res.* **18** (3), 1669 .

El-Haris, M.K. (2004) Deficit irrigation of wheat under sprinkler irrigation in the newly reclaimed soils of Egypt. *J. Agric. Sci. Mansoura Univ.*, **29**(4), 2183 .

El-Marakby, A.M., Mohamed, A.A. Yasein, M. and Tolba, Afaf M. (1994) Heritability estimates and selection for high-yielding and early-heading recombinants in segregating generations of five wheat crosses. *Ann. of Agric. Sci., Moshtohor,* **32** (3), 1089 .

El-Noemani, A.A. (1996) Available soil moisture depletion and nitrogen effects on growth, yield and grain quality of wheat (*Triticum aestivum, L.*). *Egypt J. Appl. Sci.* **11**(4), 1 .

Francois, L.E., Grieve, C.M., Maas, V. and Lesch, M. (1994) Time of salt stress affects growth and yield components of irrigated wheat. *Agron. J.* **86, 100** .

Guttieri, Mary J., Stark, J.C. O'brien, K. and Souza, E. (2001) Relative sensitivity of spring wheat grain yield and quality parameters to moisture deficit. *Crop Sci.* **41**(2), 327 .

Hagras, A.M., Salem, M.S.A. and Abd-Allah, M.M.S. (1993) Effect of irrigation levels on some growth characters, yield and yield components of ten wheat genotypes. *Egypt J. Appl. Sci.* **8** (10), 65 .

Hassan, A.I., Moselhy, N.M.M. and Abd El-Mabood, M.Sh. (2002) Evaluation of some wheat cultivars under two levels of irrigation water salinity in calcareous soils, South Sinai. *Zagazig J. Agric. Res.* **29** (1), 1 .

Hefnawy, F.A. and Wahba, M.F. (2003) Effect of drought stress during growth stages on durum wheat (*Triticum turgidum var durum*). *Egypt J. Appl. Sci.* **18** (2), 120 .

Ismail, M.I., Dumayri, M. Nachit, M. and Kafawin, O. (1999) The effect of water stress at various growth stages of durum wheat (*Triticum turgidum* L.) genotypes derived from crosses utilizing land race variety on yield related characters. *Dirasat Agric. Sci.* **26** (1), 65 .

Kandil, S.A., Abo-El-Kheir, M.S.A. and El-Zeiny, H.A. (2001). Response of some wheat cultivars to water stress imposed at certain growth stages. *Egypt J. Appl. Sci.* **16** (1), 82 .

Kassab, O.M., El-Zeiny, H.A. and Ibrahim, M.M. (2004) Effect of water deficit and micronutrients foliar application on the productivity of wheat plants. *Minufiya J. Agric. Res.* **29** (4), 925 .

Nour EL-din, Nemat, A., Hassanien, S.H. Salem, M.O.M. and Maamoun, Howaida, A. (2000) Wheat transplantation in Sinai 1- Effect of saline irrigation in the nursery on yield and its components of some cultivars . *Ann. of Agric. Sci. sp. Issue*, **3**, 917

Snedecor, G.W. and Cochran, W.G. (1992) "*Statistical Methods*". 8^{th} ed. Iowa State Univ., Press, Ames. Iowa, USA.

Soliman, Z.T., Eissa, Sekina I. and Khalaf, M.A. (1997) The sensitivity of some Egyptian wheat cultivars to soil salinity levels. *J. Agric. Sci., Mansoura Univ.* **22** (10), 3383 .

Soliman, M.S., Daoud, A.M. and Nashed, N. Sh. (2004) The effects of fertilization regime and salt stress on yield and antioxidants in wheat (*Triticum aestivum* L.). *Minufiya J. Agric. Res.* 29 (4), 1045 .

Wang, X., Mengyu, L., Xiaon, L., Hai, X.X. and Axuesen, M.X. (1991) Water use efficiency in Agric. *Proceeding of the binominal*. China-Israel. Workshop, April, 22-26, p.136.

Yousef, K.M.R and Hanna, N.S. (1998) Evaluation of some bread wheat varieties to yield and water relations at Fayoum Governorate. *Fayoum J. Agric. Res., & Dev.* 12(2), 216 .

(*Received* 11/3/2007;
accepted 25/7/2007)

تأثير التركيب الوراثى و مستوي ملوحة التربة ومعاملات الجفاف على محصول القمح ومكوناته

محمد شكرى رياض، محمد ياسين ، عفاف محمد طلبة ، فوزى عبد السميع* و عبير عبد العاطى
قسم المحاصيل- كلية الزراعه- جامعة عين شمس- شبرا الخيمة-القاهرة و*قسم المحاصيل- كلية الزراعه- جامعة الفيوم-الفيوم- مصر .

أجريت هذه الدراسة بمحطة بحوث دمو التابعة لكلية الزراعة جامعة الفيوم خلال الموسمين الزراعيين ٢٠٠٣/٢٠٠٢ ، ٢٠٠٣/ ٢٠٠٤ لتقييم ثمانية تراكيب وراثية من قمح الخبز (ستة سلالات مبشرة وصنفين قياسيين هما سخا ٩٣ ، جيزة ١٦٨) تحت مستويات مختلفة من ملوحة التربة (١٦٨٠ ، ٣١٠٠ ، ٧٩٠٠ جزء فى المليون) وثلاث معاملات رى (رى عادى – منع رية عند الطرد – منع رية عند طور النضج العجينى) على المحصول ومكوناته .وفيما يلى أهم النتائج التى تم الحصول عليها:

تفوقت السلالتين ١، ٥ فى المحصول ومكوناته والسلالة رقم٣ فى صفة دليل البذرة والسلالة رقم ٢ كانت الأفضل فى صفتى دليل التفريع و الحصاد.

أدى زيادة ملوحة التربة من ١٦٨٠ الى٣١٠٠ أ، ٧٩٠٠ جزء فى المليون لحدوث نقص فى المحصول ومكوناتة وكان ذلك وأضحاً فى التركيز العالى.

أدى منع الري عند مرحلة الطرد إلى حدوث نقص معنوى كبير لصفات إرتفاع النبات ، عدد الأفرع /نبات ، عدد السنابل / نبات ، عدد الحبوب /سنبلة، وزن السنابل / نبات ، وزن حبوب السنبلة الرئيسية ، محصول الحبوب / نبات ، محصول القش / نبات ، المحصول البيولوجى فى كلا الموسمين ، مع انخفاض معدل النقص عند طور النضج العجينى بالمقارنة بالرى العادى والتى كانت نتائجه الأفضل.

أوضح التفاعل الثلاثى بين التراكيب الوراثية ومستوى ملوحة التربة ومعاملات الجفاف تأثيراً معنوياً حيث تفوقت السلالة رقم ٥ عند مستوى الري العادي ومستوى ملوحة التربة المنخفض (١٦٨٠ جزء فى المليون) فى صفة عدد الأفرع / نبات، طول سنبلة الساق الرئيسى، محصول القش/ نبات والمحصول البيولوجى/ نبات فى الموسم الزراعى الأول ٢٠٠٣/٢٠٠٢ ووزن سنبلة الساق الرئيسى فقط فى الموسم الزراعى الثانى ٢٠٠٤/٢٠٠٣ مقارنة بباقى المعاملات .