Assiut J. of Agric. Sci., 38 (4) (1-36)

PERFORMANCE OF SOME BREAD WHEAT GENOTYPES UNDER DIFFERENT IRRIGATION REGIMES AND NITROGEN FERTILIZER

K.A. Hamam

Agronomy Dept., Fac. of Agric., Sohag University, Sohag, Egypt.

e-mail: *khalafhamam@yahoo.com*

Abstract: Twenty four wheat genotypes (*Triticum aestivum* L.), differ in yield performance were grown in a randomized complete block experimental design with three replications during two seasons 2004/2005 – 2005/2006 at Sohag University experimental Farm. The genotypes were evaluated under three water regimes (control treatment (I_1), stress treatment (I_2) and high stress treatment (I_3)) and two nitrogen fertilizer levels (70 Kg N and 100 Kg N/fed.). The analysis of variance for all parameters as affected by water regimes (I), two different N fertilizer levels (N) and the genotypes (G) and their interactions were carried and were fund to be significant. The treatments of nitrogen fertilizer (70 Kg N/fed.) and control irrigation treatment (I_1) over two years produced the highest grain yield from the five genotypes No. Giza 168, 9, 12, 18 and 21. While the five genotypes namely No. 5, 8, 18, 21 and 22 gave the highest yield when fertilizer with 70 Kg N/fed. with stress irrigation treatment (I_2), on other hand the five genotypes No. 14, 16, 18, 19 and 22 gave the highest yield when treated with 70 Kg N/fed. with high stress irrigation treatment (I_3). The result showed that application of 100 Kg N/fed. with regular (I_1) over two years the five genotypes No. Giza 168, 9, 12, 18 and 21 gave the highest yield, while the highest five genotypes were No. 5, 8, 16, 18 and 21 under 100 Kg N/fed . with stress irrigation treatment (I_2), on other hand the five genotypes No. 14, 16, 18, 19 and 22 gave the highest yield under 100 Kg N/fed and the highest stress irrigation treatment (I_3). The results showed that mean productivity (MP), geometric mean productivity (GMP) and stress tolerance index (STI) were more effective in identifying the high yielding genotypes under control treatment (I_1) and stress treatment (I_2) (group A genotypes). Under high stress treatment, none of the indices used were able to identify group A cultivars, although stress susceptibility index (SSI) was found to be more useful in discriminating the drought tolerance genotypes. It is concluded that the effectiveness of selection indices in differentiating drought tolerance genotypes varies with the high stress treatment. The correlations between control irrigation, drought stress, high drought stress and yield during two seasons were positive and highly significant (0.84**, 0.86** and 0.58**).

Keywords: Wheat; Drought; N fertilizer; Drought index; Wheat yield; *Triticum aestivum* L.

Introduction

Wheat (*Triticum aestivum* L.) is considered as important cereal crop not only in Egypt but also all over world. There is an increasing demand in wheat-world wide. Wheat is the important crop in Egypt covering nearly, 1287000 Hectare and produced 8308000 tones (F.A.O statistic production year book 2006). Wheat production in Egypt can be increased by extending the presently cultivated land to places with water availability in winter or season fluctuation in rainfall such as North and west Egypt. Insufficient water is the primary limitation to wheat production world-wide (Ashraf and Harris, 2005).The relative yield performance of genotypes in drought stressed and more favorable environments seems to be a common starting point in the identification of traits related to drought tolerance and the selection of genotypes for use in breeding for dry environments (Clarke *et al.*,1992). Several researchers have chosen the mid-way and believe in selection under both favorable and stress conditions (Fischer and Maurer, 1978; Clarke *et al.*, 1992; Nasir Ud-Din *et al.*, 1992; Fernandez, 1992 and Rajaram and Van Ginkle, 2001). Water deficit and changes in the environmental conditions may reduce growth and impair metabolic processes (Hsiao, 1973). Drought avoidance involved rapid phonological development, leaf rolling, leaf shading, reduced leaf area, and increased stomata and cuticular resistance (Morgan, 1984; Turner, 1986). The response of plant to stresses depends on its genetic potential to adaptation to the duration and intensity of exposure drought and heat well as stage of growth. Drought resistance in crops could be attributed to either avoiding or tolerating drought. Avoiding drought could be achieved by reducing water loss and /or maintaining water uptake (Clarke, *et al*, 1984). Selection in the target stress condition has been highly recommended too (Rathjen, 1994). It is concluded that the effectiveness of selection indices depends on the stress severity supporting the idea that only under moderate stress condition, potential yield greatly influences yield under stress (Blum, 1996; Panthuwan *et al.,* 2002). Escape and avoidance traits are likely to play an important role in adaptation to specific environm-ents (Monneveux and Belhassen, 1996). In Upper Egypt, most of new reclaimed areas (Eastern and Western desert and Toshky) are located in the desert where the availability of irrigation water is the most limiting factor. Therefore, drought stress in these areas is becoming the main problem and considered as a valid breeding target for breeders and biologists. The goals of this study are: (1) to obtain drought tolerance genotypes for bread wheat. (2) to find the best level of nitrogen fertilizer under three water regimes and bread wheat genotypes.

Materials and Methods

The present study was carried out during the two winter seasons of 2004/2005 and 2005/2006 at the Experimental Farm of Faculty of Agriculture, Sohag University. Twenty four genotypes were chosen on the basis of their diversity in the origin (Table 1) were grown in a split-split plot arrangement of treatment with three replicates were used in a randomized complete block design. The levels of irrigation treatments, nitrogen levels and genotypes were randomly assigned to the main plot, sub-plot and sub-subplot, respectively. The genotypes were evaluated under water regimes and nitrogen fertilizer levels. During the two successive seasons, 24 wheat genotypes were sown on the 20th November of both seasons. Each genotype was sown in plot of 5.25 m^2 area. The seeds were planted in drills at rate of 75 Kg/fed. The first treatment was gave normal irrigation as control treatment (I_1), while in the second treatment was irrigated and withholding the irrigation at the tillering and heading stage as stress treatment (I_2), and the third treatment was irrigated and withholding the irrigation at the tillering, heading and grain filling stage as high stress treatment (I_3). The experiment was fertilizer with two nitrogen levels. The first and second levels were 70 Kg/ fed. (N70) and 100 Kg/fed. (N100) nitrogen fertilizer per feddan, respectively. Nitrogen fertilizer was applied as broadcast in two equal doses before the 1st and the 3rd irrigation. Nitrogen source was ammonium nitrate (NH_4NO_3, 33.5%N). The recommended cultural practices of wheat production were applied throughout the growing season. According to Fernandez (1992), genotypes can be divided into four groups based on their yield response to stress conditions: (1) genotypes producing high yield under both water stress and non-stress conditions (group A), (2) genotypes producing high yield under non-stress (group B) (3) genotypes producing high yield under stress conditions (group C)

Table (1): Brief description of the name and the origin of the genotypes used and yield for twenty four genotypes under three water regimes with two nitrogen fertilizer levels

T	Origin	Name	Grain yield ardab/ fed.					
			I_1	I_2	I_3	N70	N100	mean
1	Afghanistan	TRI2586	15.30	8.83	6.03	9.40	10.70	10.05
2	Afghanistan	TRI2609	12.63	8.98	3.38	7.83	8.82	8.33
3	Egypt	Sedes 1	15.05	8.13	5.75	9.00	10.28	9.64
4	Egypt	Giza 168	20.68	6.08	2.78	9.58	10.10	9.84
5	China	TRI2612	16.78	15.55	2.58	11.18	12.08	11.63
6	China	TRI2593	11.13	7.00	4.13	6.93	7.90	7.42
7	Ethiopian	TRI7307	16.08	6.45	2.88	7.90	9.03	8.47
8	Ethiopian	TRI7268	17.85	12.53	2.38	10.20	11.63	10.92
9	Germany	line 254	23.65	8.25	3.28	11.40	12.05	11.73
10	Germany	Passt	10.85	6.28	1.88	5.90	6.77	6.33
11	ICARDA	GOUMRIA-19	7.95	6.03	3.33	5.55	5.98	5.77
12	ICARDA	PREW	22.28	7.80	3.60	10.77	11.68	11.23
13	ICARDA	HAAMA-18	9.25	4.83	2.45	5.17	5.85	5.51
14	ICARDA	CROC-1/AE.SQUARROSA (224)//OPATA	15.03	11.45	9.25	11.10	12.72	11.91
15	ICARDA	QIMMA-4	9.38	5.93	4.10	6.23	6.70	6.47
16	Indian	TRI2684	14.40	11.55	9.70	11.12	12.65	11.88
17	Indian	TRI2730	12.28	9.53	5.10	8.37	9.57	8.97
18	Iran	TRI5643	22.28	18.23	7.60	15.72	16.35	16.03
19	Iran	TRI5641	17.88	11.18	9.90	12.55	13.42	12.98
20	Iran	TRI5652	15.00	11.03	5.30	9.73	11.15	10.44
21	Mongolia	TRI5652	22.95	18.35	6.18	15.52	16.13	15.83
22	Mongolia	TRI8397	19.75	11.23	8.43	12.67	13.60	13.13
23	Spain	TRI29405	13.25	11.00	5.35	9.20	10.53	9.87
24	Spain	TRI29409	10.85	8.13	7.13	8.42	8.98	8.70
I_1 =	Control irrigation treatment.							
I_2 =	Irrigated and withholding the irrigation at the tillering and heading stage as stress treatment.							
I_3 =	Irrigated and withholding the irrigation at the tillering, heading and grain filling stage as high stress treatment.							
N70=	Treatment 70 kg nitrogen fertilizer /feddan.							
N100=	Treatment 100 kg nitrogen fertilzer /feddan.							

and (4) genotypes with poor performance under both stress and non-stress conditions (group D).

Drought resistance indices were calculated using the following relationships:

(1) Stress susceptibility index $SSI = 1 - (Y_S / Y_P) / 1 - (\bar{Y}_S / \bar{Y}_P)$ (Fischer and Maurer, 1978) where Y_S is the yield of genotype under stress, Y_P the yield of genotype under irrigated condition, $\bar{Y}_S$ and $\bar{Y}_P$ are the mean yields of all genotypes under stress and non-stress conditions, respectively, and $1 - (\bar{Y}_S / \bar{Y}_P)$ is the stress intensity. (2) Mean productivity $MP = (Y_P + Y_S)/2$ (Hossain et al., 1990). (3) Tolerance $TOL = Y_P - Y_S$ (Hossain et al., 1990). (4) Stress tolerance index $STI = (Y_P + Y_S)/\bar{Y}_P{}^2$ (Fernandez, 1992). (5) Geometric mean productivity $GMP = (Y_P * Y_S)^{0.5}$ (Fernandez, 1992). (6) Yield index $YI = Y_S / \bar{Y}_S$ (Gavuzzi et al., 1997). (7) Yield stability index $YSI = Y_S / Y_P$ (Bouslama and Schapaugh, 1984). The data were recorded on plot basis for each genotype and each replicate to measure the following traits: - (1) Leaf area: leaf length (cm) x width (cm) x 0.75 was measured according to (Jatimliansky et al. 1984); (2) Days to heading: number of days observed from sowing until the upper most spikes appeared beyond the auricles of the flag leaf sheath (50% heading on plants basis). (3) Plant height (cm): The distance from the base of the culm to the tip of the spike of the main culm; (4) Number of spikes / plant: Tiller with fertile spike; (5) Number of kernels / spike: Average number of kernels measured in a 5 spikes sample. (6) 1000-kernel weight: It was obtained as the weight of 1000-kernel, which were chosen randomly; (7) Yield: It was determined as the weight of grains of each experimental plot. (8) Biomass: The total dry matter yield produced by a crop during the growing season of each experimental plot (excluding roots). The significance of differences between genotypes means, irrigation treatments and fertilizer levels were calculated by LSD method according to Waller and Duncan (1969). The data of season 2004/2005 – 2005/2006 was subjected to statistical analysis performed by the SAS software (SAS Institute 1999).

Results and Discussion

The combined of analyses of variance for leaf area, plant height, number of spikes / plant, number of kernels / spike, days to heading, 1000-kerenl weight, yield and biomass are presented in Table (2). The differences between the three water irrigation (I), the two nitrogen fertilizer levels (N) and

between genotypes (G) were significant for the measured parameters. The interaction between (I*N), (I*G) and (N*G) were significant for all parameters. The interaction between (I*N*G) were highly significant for all parameters except for days to heading.

The performance of wheat genotypes under nitrogen levels and water regimes:

Leaf area: The average of leaf area under I_1, I_2 and I_3 were 29.26, 25.65 and 17.42 cm^2 with N70 treatment compared to 32.20, 28.21 and 19.16 cm^2 with N100 treatment. The data in Table (3) showed that, N70 and I_1 treatment the lowest leaf area values were of genotypes No. 7, 18, 20, 21 and 22 with an average 22.70, 14.20, 19.55, 19.55 and 21.95 cm^2 respectively over two years, while under N70 and I_2 treatment the genotypes No. 1, 5, 7, 18 and 21 gave lowest leaf area with an average 14.70, 11.65, 15.25, 14.30 and 19.60 cm^2 respectively. On the other hand the lowest leaf values area were produced from genotypes Giza 168, 5, 7, 13 and 17 with an average 9.80, 10.30, 9.50, 9.80 and 12.40 cm^2 under N70 and I_3 treatment respectively.

However, under N100 and I_1 treatments the genotypes No. 10, 12, 17, 19 and 20 gave lowest leaf area with an average 25.00, 15.60, 21.55, 21.55 and 24.10 cm^2 respectively over two years. While the lowest leaf area values were produced from genotypes No. 1, 5, 7, 18 and 21 with an average 16.20, 12.80, 16.75, 15.75 and 21.55 cm^2 under N100 and I_2 treatment respectively, on the other hand the genotypes No. Giza 168, 5, 7, 13 and 17 gave lowest leaf area with an average 10.75, 11.30, 10.40, 10.80 and 13.65 cm^2 under N100 and I_3 treatment respectively. Drought caused a significant reduction of the leaf area and a remarkable decrease of plant dry matter accumulation. Drought stress caused reduction in the leaf area during water deficit, for the same treatment which had the highest leaf area under well-watered conditions. The genotypic and drought induced variability in leaf area in the present study were interrelated but were not closely associated with biomass production. Leaf area reduction was the main drought avoidance strategy in some genotypes. Under water deficit stress, loss of leaves and reduced expansion of younger leaves caused a decrease in the leaf area ratio in the stressed plants. As different environmental factors may affect leaf morphology in the same direction and act simultaneously, it may be difficult to identify the most important ones (Fonseca *et al.* 2000). The results are an agreement with Maggio, *et al.* (2005); they reported a 50% leaf area reduction of non-irrigated control plants, coincided with a 50% reduction in above ground dry mass. Water stress reduced leaf

Table (3): Mean performance of leaf area for 24 bread wheat genotypes under water regimes conditions and two nitrogen fertilizer levels over two seasons.

T	Leaf area (cm^2)						
	N70			N100			mean
	I_1	I_2	I_3	I_1	I_2	I_3	
1	47.30	14.70	13.55	52.05	16.20	14.90	26.45
2	34.95	20.15	12.70	38.50	22.15	14.00	23.74
3	26.10	20.45	13.30	28.70	22.45	14.65	20.94
4	22.90	23.55	9.80	25.20	25.90	10.75	19.68
5	40.90	11.65	10.30	44.95	12.80	11.30	21.98
6	34.05	27.15	17.70	37.45	29.85	19.40	27.60
7	22.70	15.25	9.50	25.00	16.75	10.40	16.60
8	23.05	27.15	22.05	25.35	29.80	24.30	25.28
9	24.95	27.10	21.05	27.45	29.80	23.20	25.59
10	39.80	37.35	30.55	43.75	41.10	33.60	37.69
11	23.60	23.60	20.65	25.95	25.95	22.70	23.74
12	34.95	30.65	19.75	38.45	33.70	21.75	29.88
13	31.80	25.25	9.80	35.00	27.80	10.80	23.41
14	36.50	38.90	28.95	40.15	42.80	31.90	36.53
15	33.90	34.10	16.10	37.35	37.50	17.75	29.45
16	31.55	44.00	18.35	34.75	48.40	20.20	32.88
17	32.45	32.80	12.40	35.70	36.10	13.65	27.18
18	14.20	14.30	19.45	15.60	15.75	21.40	16.78
19	29.00	29.40	17.15	31.95	32.35	18.85	26.45
20	19.55	19.90	19.10	21.55	21.90	21.00	20.50
21	19.55	19.60	20.45	21.55	21.55	22.50	20.87
22	21.95	22.40	14.95	24.10	24.60	16.45	20.74
23	25.65	24.50	22.55	28.20	26.95	24.80	25.44
24	31.00	31.70	17.85	34.10	34.85	19.60	28.18
mean	29.26	25.65	17.42	32.20	28.21	19.16	
			LSD 0.05		*LSD* 0.01		
Genotypes (G)			2.59		3.40		
Water regimes (I)			0.92		1.20		
Nitrogen (N)			0.73		0.96		
G*I			1.20		1.58		
G*N			1.20		1.58		
G*I*N			1.20		1.58		

area and leaf number considerably (Anyia and Herzog, 2004).

Days to heading: The average of days to heading at the stress treatment was early by about three days compared to control treatment, on other the hand difference in days to heading between I_1 and I_3 was six days. The data in Table (4) showed under N70 with the three water regimes, that the genotype No. 10 followed by 12, 13, 20 and 22 were the earliest under both treatments. The earliness in heading reached 65.45, 65.60, 63.09, 65.26 and 65.26 days under I_3 as compared to control irrigation treatment for all genotypes.

Under N100 and I_1 treatment the genotypes No. 10, 12, 17, 19 and 20 gave earliest heading date with an average 68.33, 69.02, 69.02, 69.02 and 68.33 days respectively over two years, while under N100 and I_2 treatment the earliest heading date were genotypes No. 10, 12, 13, 20 and 22 with an average of 68.33, 69.02, 70.38, 68.33 and 69.36 days respectively. On other hand under N100 and I_3 treatment the genotypes No. 13, 10, 20, 22 and 12 gave earliest heading date with an average of 60.79, 64.23, 63.89, 63.21 and 62.87 days respectively. Heading was delayed as the nitrogen dose increased which are normal phenomena. The increase in adaptation to dry environments in many crops has been linked to earlier flowering (Turner, 1979). Earliness could be the most effective drought escape mechanism, especially when the crop is grown in a stored moisture environment (Ceccarell, 1986). The duration of the entire cycle was similar for the genotypes, but the some genotypes had a longer vegetative phase and a shorter grain filling period compared to the other modern genotypes. Earlier heading was also reported by Guarda *et al.* (2004) as a characteristic of modern Italian varieties of *T. aestivum.*

Plant height (cm): The results revealed that the plant height of the genotypes showed variable response to N fertilizer levels and water regimes. The data in Table (5) showed that, under N70 and I_1 treatment the tallest genotypes were No. 12, 13, 16, 22 and 24 with an average 139.65, 165.80, 162.75, 140.20 and 141.15 cm, respectively over two years. While under N70 and I_2 treatment the tallest genotypes No. 13, 18, 20, 21 and 22 with an average 134.60, 126.60, 126.10, 142.15 and 150.75 cm respectively. On the other hand under N70 and I_3 treatment the genotypes No. 16, 17, 18, 22 and 23 gave the tallest plant height with an average 109.50, 122.55, 115.10, 110.10 and 120.05 cm respectively.

The result reported under N100 and I1 the tallest plant height were genotypes No. 12, 13, 16, 22 and 24 with an average 153.60, 182.40, 179.05 , 154.20 and 155.25 cm

Table (4): Mean performance of days to heading for 24 bread wheat genotypes under water regimes conditions and two nitrogen fertilizer levels over two seasons.

	Days to heading						
	N70			N100			
	I_1	I_2	I_3	I_1	I_2	I_3	Mean
1	74.48	69.70	65.94	74.48	69.36	65.94	69.98
2	73.27	71.91	70.88	74.30	72.78	71.75	72.48
3	74.48	72.56	70.91	75.17	73.12	71.75	73.00
4	74.64	74.47	69.70	75.17	72.09	70.38	72.74
5	75.68	73.63	71.59	76.19	74.14	72.09	73.89
6	69.70	67.48	64.58	70.38	67.99	64.92	67.51
7	73.80	69.54	65.64	74.48	70.04	66.28	69.97
8	69.70	67.48	64.58	70.38	67.99	65.26	67.56
9	74.83	69.70	67.65	75.51	70.38	68.33	71.07
10	67.48	65.45	63.55	68.33	65.94	64.23	65.83
11	69.54	67.51	65.60	70.04	67.99	66.28	67.83
12	68.49	65.60	62.18	69.02	66.28	62.87	65.74
13	69.71	63.09	60.24	70.38	63.21	60.79	64.57
14	73.63	71.15	68.92	74.14	72.09	69.36	71.55
15	74.83	69.70	66.83	75.51	70.38	67.31	70.76
16	69.02	66.63	64.92	69.36	67.31	65.60	67.14
17	68.33	67.65	65.26	69.02	68.33	65.94	67.42
18	68.84	67.99	66.28	69.36	68.68	66.97	68.02
19	68.33	67.65	64.58	69.02	68.33	65.26	67.19
20	67.65	65.26	63.21	68.33	65.94	63.89	65.71
21	68.68	67.99	64.92	69.36	68.68	65.60	67.54
22	68.68	65.26	62.53	69.36	65.94	63.21	65.83
23	74.48	71.41	67.65	75.17	72.09	68.33	71.52
24	74.83	72.78	69.36	75.51	73.46	70.04	72.66
mean	71.38	68.81	66.15	72.00	69.27	66.77	
			LSD 0.05		*LSD* 0.01		
Genotypes (G)			0.94		1.24		
Water regimes (I)			0.33		0.44		
Nitrogen (N)			0.14		0.19		
G*I			1.25		1.65		
G*N			1.25		1.65		
G*I*N			1.25		1.65		

Table (5): Mean performance of plant height for 24 bread wheat genotypes under water regimes conditions and two nitrogen fertilizer levels over two seasons.

	Plant height (cm)						
	N70			N100			mean
	I_1	I_2	I_3	I_1	I_2	I_3	
1	100.35	96.15	65.40	110.40	105.75	71.90	91.66
2	105.75	85.45	75.20	116.30	94.00	82.75	93.24
3	110.15	100.55	65.40	121.15	110.55	71.95	96.63
4	96.20	95.50	70.35	105.80	105.05	77.40	91.72
5	114.60	81.40	65.45	126.05	89.50	71.95	91.49
6	111.75	96.55	70.30	122.90	106.20	77.35	97.51
7	101.10	100.35	72.30	111.20	110.40	79.55	95.82
8	103.50	95.45	60.30	113.85	105.00	66.35	90.74
9	130.65	124.60	65.30	143.70	137.05	71.80	112.18
10	120.80	107.55	75.35	132.90	118.30	82.90	106.30
11	124.60	121.55	90.35	137.05	133.75	99.40	117.78
12	139.65	125.60	75.25	153.60	138.15	82.75	119.17
13	165.80	134.60	75.25	182.40	148.05	82.80	131.48
14	125.10	95.40	90.65	137.60	104.90	99.70	108.89
15	124.50	94.75	81.35	136.95	104.20	89.50	105.21
16	162.75	117.55	109.50	179.05	129.30	120.45	136.43
17	135.20	124.50	122.55	148.75	136.95	134.80	133.79
18	122.55	126.60	115.10	134.85	139.25	126.60	127.49
19	125.10	100.50	75.15	137.60	110.55	82.65	105.26
20	102.50	126.10	105.05	112.75	138.70	115.60	116.78
21	120.10	142.15	104.10	132.15	156.35	114.50	128.23
22	140.20	150.75	110.10	154.20	165.80	121.10	140.36
23	97.35	122.15	120.05	107.10	134.35	132.05	118.84
24	141.15	112.10	90.15	155.25	123.35	99.20	120.20
mean	121.73	111.58	85.41	133.90	122.73	93.96	
			LSD 0.05		*LSD* 0.01		
Genotypes (G)			6.07		7.98		
Water regimes (I)			2.15		2.15		
Nitrogen (N)			1.59		2.10		
G*I			1.10		1.44		
G*N			1.25		1.65		
G*I*N			1.25		1.65		

respectively over two years. While under N100 and I_2 treatment the tallest plant height were genotypes No. 13, 18, 20, 21 and 22 with an average 148.05, 139.25, 138.70, 156.35 and 165.80 cm respectively. On the other under N100 and I_3 treatment hand the genotypes No. 16, 17, 18, 22 and 23 gave tallest plant height with an average 120.45, 134.80, 126.60, 121.10 and 132.05 cm respectively. Our results are in agreement with the result were found by Shivani *et al* (2001).

Number of spikes / plant: The results in Table (6) showed variable affected of N fertilizers and water regimes on the number of spikes / plant**.** Under N70 and I_1 treatment the genotypes No. 2, 5, 8, 19, 23 and 24 had the highest number of spikes / plant with an average 14.50, 13.55, 14.00, 14.00, 13.20 and 13.20 spikes respectively over two years. While under N70 and I_2 treatment the genotypes No. 8, 11, 19, 23 and 24 gave highest number of spikes / plant with an average 14.00, 13.05, 14.00, 13.20 and 13.20 spikes respectively. On the other hand under N70 and I_3 treatment the highest number of spikes / plant was genotypes No. 1, Sedes 1, Giza 168, 8 and 24 with average 11.10, 10.80, 10.25, 11.50 and 11.15 spikes respectively.

The result obtained under N100 and I_1 treatment the highest number of spikes / plant were genotypes No. 2, 5, 8, 19, 23 and 24 with an average 15.95, 14.90, 15.40, 15.40, 14.50 and 14.50 spikes over two years respectively. While under N100 and I_2 the genotypes No. 8, 11, 19, 23 and 24 gave highest number of spikes / plant with an average 13.75, 13.20, 14.30, 13.25 and 13.20 spikes respectively. On the other hand N100 and I_3 treatment the highest number of spikes / plant were genotypes No. 1, Sedes 1, Giza 168, 8 and 24 with an average 12.20, 11.85, 11.30, 12.65 and 12.30 spikes under respectively. Kheiralla et al (1989) reported that exposing wheat genotypes to drought during tillering, tillering with spike initiation and jointing with heading significantly reduced number of spikes/m^2. The results are in harmony with those Kheiralla and Ismail (1995) and El–Morshidy et al (2000). In the same way, water deficit around anthesis may lead to a loss in yield by reducing spike and spikelet number and the fertility of surviving spikelets (Giunta *et al.*, 1993).

Number of kernels / spike: The results in Table (7) number of kernels / spike showed variations between N fertilizer and water regimes**.** Under N70 and I_1 treatment the highest number of kernels / spike genotypes Sedes 1, 6, 7, 13 and 18 with an average 54.50, 74.35, 55.85, 53.35 and 52.80 kernel respectively over two years. While under N70 and I_2 treatment the genotypes Giza 168, 5, 6, 15 and 20 gave highest

Table (6): Mean performance of number of spikes / plant for 24 bread wheat genotypes under water regimes conditions and two nitrogen fertilizer levels over two seasons.

T	Number of spikes / plant						
	N70			N100			mean
	I_1	I_2	I_3	I_1	I_2	I_3	
1	11.05	11.05	11.10	12.15	12.15	12.20	11.62
2	14.50	11.05	9.30	15.95	12.15	10.20	12.19
3	11.10	11.00	10.80	12.25	12.10	11.85	11.52
4	12.00	10.25	10.25	13.20	11.25	11.30	11.38
5	13.55	10.05	10.05	14.90	11.05	11.05	11.78
6	11.50	10.55	10.00	12.65	11.60	11.00	11.22
7	12.00	11.00	9.50	13.20	12.10	10.45	11.38
8	14.00	12.50	11.50	15.40	13.75	12.65	13.30
9	12.50	9.00	8.50	13.75	9.90	9.35	10.50
10	10.55	8.05	9.75	11.60	8.85	10.75	9.93
11	13.05	12.00	9.00	14.35	13.20	9.90	11.92
12	11.00	10.60	9.05	12.10	11.65	9.95	10.73
13	10.05	10.00	9.05	11.05	11.00	9.95	10.18
14	11.50	11.00	9.00	12.65	12.10	9.90	11.03
15	11.00	10.50	9.05	12.10	11.55	9.95	10.69
16	11.00	10.50	9.00	12.10	11.55	9.90	10.68
17	10.55	9.10	6.00	11.60	10.00	6.60	8.98
18	13.15	10.50	9.00	14.30	11.55	9.90	11.40
19	14.00	13.00	9.25	15.40	14.30	10.20	12.69
20	11.10	10.00	8.70	12.25	11.00	9.60	10.44
21	13.00	9.10	8.90	14.30	10.00	9.75	10.84
22	11.20	10.20	9.20	12.35	11.25	10.20	10.73
23	13.20	12.05	10.15	14.50	13.25	11.20	12.39
24	13.20	12.00	11.15	14.50	13.20	12.30	12.73
mean	12.07	10.63	9.47	13.28	11.69	10.42	
			LSD 0.05		*LSD* 0.01		
Genotypes (G)			0.47		0.62		
Water regimes (I)			0.17		0.22		
Nitrogen (N)			0.12		0.15		
G*I			1.06		1.39		
G*N			1.06		1.39		
G*I*N			1.06		1.39		

Table (7): Mean performance of number of kernels / spike for 24 bread wheat genotypes under water regimes conditions and two nitrogen fertilizer levels over two seasons.

	Number of kernels / spike						
	N70			N100			mean
	I_1	I_2	I_3	I_1	I_2	I_3	
1	47.50	30.60	27.70	52.30	33.55	30.30	36.99
2	40.60	24.00	21.35	44.55	26.65	23.65	30.13
3	54.50	34.00	29.00	59.85	37.40	31.90	41.11
4	49.50	47.35	46.35	54.55	52.35	51.05	50.19
5	46.50	43.35	38.35	51.25	47.65	42.10	44.87
6	74.35	45.90	43.50	81.70	50.55	47.85	57.31
7	55.85	35.35	31.35	61.35	38.80	34.40	42.85
8	43.35	21.85	32.00	47.60	23.90	35.25	33.99
9	48.25	33.35	27.25	53.10	36.65	30.00	38.10
10	49.00	37.45	27.70	53.90	41.00	30.55	39.93
11	35.25	30.35	23.80	38.75	33.35	26.40	31.32
12	50.80	36.65	32.50	56.10	40.65	35.70	42.07
13	53.35	33.80	28.60	58.65	37.40	31.40	40.53
14	45.35	37.35	32.15	49.80	41.00	35.65	40.22
15	45.00	40.10	33.35	49.50	44.45	36.60	41.50
16	45.85	37.60	16.75	50.35	41.30	18.45	35.05
17	39.05	29.55	25.10	43.20	32.70	27.50	32.85
18	52.80	37.60	23.50	58.30	41.30	25.80	39.88
19	40.25	36.00	31.75	44.30	39.35	34.90	37.76
20	45.25	43.75	36.25	49.80	48.10	39.90	43.84
21	42.20	38.50	26.60	46.20	42.35	29.20	37.51
22	41.00	22.70	20.25	45.10	24.70	22.30	29.34
23	47.25	28.00	12.55	52.00	30.80	14.00	30.77
24	34.25	32.55	24.25	37.70	36.05	26.70	31.92
mean	46.96	34.90	28.83	51.66	38.42	31.73	38.75
			LSD 0.05		*LSD* 0.01		
Genotypes (G)			2.25		2.96		
Water regimes (I)			0.79		1.05		
Nitrogen (N)			0.59		0.79		
G*I			0.87		1.14		
G*N			0.87		1.14		
G*I*N			0.87		1.14		

number of kernels / spike with an average 47.35, 43.35, 45.90, 40.10 and 43.75 kernel respectively. On the other hand under N70 and I_3 treatment the highest genotypes Giza 168, 5, 6, 15 and 20 with an average 46.35, 38.35, 43.50, 33.35 and 36.25 kernel respectively.

The result reported under N100 and I_1 treatment the highest number of kernels / spike was genotypes Sedes 1, 6, 7, 13 and 18 with an average 59.85, 81.70, 61.35, 58.65 and 58.30 kernel respectively over two years. While under N100 and I_2 treatment the highest genotypes No. Giza 168, 5, 6, 15 and 20 gave highest number of kernels / spike with an average 52.35, 47.65, 50.55, 44.45 and 48.10 kernels respectively. On the other hand under N100 and I_3 treatment the highest number of kernels / spike was genotypes Giza 168, 5, 6, 15 and 20 with average 51.05, 42.10, 47.85, 36.60 and 39.90 kernels respectively**.** Under different drought treatments, Giunta et al. (1993) and Zhong-hu and Rajaram (1994) found that kernels / spike and spikes / square meter were the yield components most sensitive to drought while kernel weight remains relatively stable due to high remobilization of stored pre anthesis assimilates.

1000-kernel weight: The results of 1000- kernel weight in Table (8) indicated large variations in the response to N fertilizer levels and water regimes**.** Under N70 and I_1 treatment the heaver kernel weight resulted in genotypes No. 1, 5, 6, 13 and 23 with an average 51.37, 49.09, 45.90, 48.55 and 43.14 g. respectively over two years. While under N70 and I_2 treatment the genotypes No. 1, 5, 8, 13 and 23 gave highest 1000- kernel weight with an average 46.82, 41.30, 46.47, 44.44 and 41.87 g. respectively. On the other hand under N70 and I_3 treatment the highest 1000- kernel weight were genotypes No. 5, 6, 8, 13 and 14 with an average 38.22, 39.95, 43.55, 40.52 and 38.23 g. respectively.

However adding 100 Kg N and I_1 treatment the highest genotypes No. 1, 5, 6, 13 and 23 gave highest 1000- kernel weight with an average 54.37, 51.54, 48.20, 50.98 and 45.30 g. respectively over two years. While under N100 and I_2 treatment the highest 1000- kernel weight were genotypes No. 1, 5, 8, 13 and 23 with an average 49.16, 43.37, 48.79, 46.66 and 43.97 g. respectively. On the other hand under N100 and I_3 treatment the genotypes No. 5, 6, 8, 13 and 14 gave highest 1000- kernel weight with an average 39.15, 40.94, 44.61, 41.51 and 39.17 g. respectively. The results are in agreement with those obtained by Ismail (1995) and El–Morshidy et al (2000). In addition, drought stress from anthesis to maturity, especially if accompanied by high temperatures, hastens leaf senescence, reduces the duration and rate of grain filling, and hence

Table (8): Mean performance of 1000-kernel weight for 24 bread wheat genotypes under water regimes conditions and two nitrogen fertilizer levels over two seasons.

	1000-kernel weight (g)						
	N70			N100			mean
	I_1	I_2	I_3	I_1	I_2	I_3	
1	51.37	46.82	34.37	54.37	49.16	35.22	45.22
2	36.00	31.02	26.02	37.81	32.57	26.66	31.68
3	41.45	33.29	29.96	43.53	34.95	30.70	35.65
4	37.42	36.07	35.24	39.29	37.88	36.11	37.00
5	49.09	41.30	38.22	51.54	43.37	39.15	43.78
6	45.90	36.32	39.95	48.20	38.14	40.94	41.57
7	38.82	35.87	33.36	40.76	37.66	34.18	36.77
8	37.85	46.47	43.55	39.75	48.79	44.61	43.50
9	40.55	38.82	36.44	42.58	40.76	37.33	39.41
10	33.69	29.42	28.32	35.37	30.89	29.02	31.12
11	34.40	27.45	27.62	36.12	28.83	28.30	30.45
12	34.80	27.12	19.94	36.55	28.48	20.43	27.88
13	48.55	44.44	40.52	50.98	46.66	41.51	45.44
14	42.72	34.49	38.23	44.86	36.21	39.17	39.28
15	39.79	37.74	36.23	41.78	39.63	37.12	38.71
16	42.70	39.37	34.63	44.84	41.34	35.48	39.72
17	38.52	33.35	32.54	40.45	35.02	33.34	35.54
18	40.02	33.32	26.73	42.02	34.99	27.39	34.08
19	34.37	31.69	30.10	36.09	33.27	30.84	32.72
20	35.94	33.49	32.13	37.74	35.16	32.92	34.56
21	39.95	26.04	22.89	41.95	27.34	23.45	30.27
22	39.35	36.32	34.42	41.32	38.14	35.27	37.47
23	43.14	41.87	32.41	45.30	43.97	33.20	39.98
24	32.32	27.92	26.14	33.94	29.32	26.78	29.40
mean		35.41	32.50	41.96	37.19	33.30	
			LSD 0.05		*LSD* 0.01		
Genotypes (G)			1.25		1.65		
Water regimes (I)			0.44		0.58		
Nitrogen (N)			0.34		0.45		
G*I			0.97		1.28		
G*N			0.87		1.14		
G*I*N			0.87		1.14		

reduces mean kernel weight (Royo et al., 2000).

Yield: The effects of N levels and water regimes on the wheat grain yield are presented in Table (9). The results indicated large variations between N fertilizer levels and water regimes; under N70 and I_1 treatment the highest yield was genotypes Giza 168, 9, 12, 18 and 21 with an average of 20.15, 23.40, 21.70, 21.80 and 22.50 ard/fed. respectively over two years. While under N70 and I_2 treatment the genotypes No. 5, 8, 18, 21 and 22 gave highest yield with an average of 14.50, 11.70, 8.20, 18.30 and 10.85 ard/fed. respectively. On the other hand under N70 and I_3 treatment the highest yield were genotypes No. 14, 16, 18, 19 and 22 with an average of 8.60, 9.10, 7.15, 9.55 and 8.10 ard/fed. respectively.

The result showed under N100 and I_1 treatment the genotypes Giza 168, 9, 12, 18 and 21 gave the highest yield with an average of 21.20, 23.90, 22.85, 22.75 and 23.40 ard/fed. respectively over two years. While under N100 and I_2 treatment the highest yield were genotypes No. 5, 8, 16, 18 and 21 with an average of 17.95, 19.05, 15.35, 22.75 and 23.40 ard/fed. respectively, On the other hand under N100 and I_3 treatment the genotypes No. 14, 16, 18, 19 and 22 gave highest yield with an average of 9.90, 10.30, 8.05, 10.25 and 8.75 ard/fed. respectively. The final yield was more reduced when drought was imposed at pollination and flowering stages than vegetative or pod filling stages (Pimentel *et al.* 1999). The results obtained are in agreement by El–Morshidy et al (2000). When the strategy of breeding program is to improve yield in a small stress or non-stress environment, it may be possible to explain local adaptation to increase grains from selection conducted directly in that environment (Atlin et al., 2000; Hohls, 2001).

Biomass: The result in Table (10) showed that with application of 70 Kg N with I_1 treatment treatments, the heaviest biomass were produced from genotypes No. 9, 12, 13, 21 and 22 with an average 13.65, 16.7, 12.9, 12.35 and 13.33 kg respectively over two years. While under N70 and I_2 treatment the genotypes No. 5, 8, 17, 19 and 22 gave heaviest biomass with an average 9.75, 8.90, 10.93, 10.93 and 10.88 kg respectively. On the other hand N70 and I_3 treatment the heaviest biomass were genotypes No. 12, 17, 19, 20 and 23 with an average 5.73, 6.68, 6.88, 6.40 and 6.38 kg under respectively.

While under N100 and I_1 treatment the genotypes No. 9, 12, 13, 21 and 22 gave heaviest biomass with an average 15.30, 18.68, 14.43, 13.83 and 14.90 kg respectively over two years. However under N100 and I_2 treatment the heaviest biomass were genotypes No. 5, 8, 17, 19

Table (9): Mean performance of yield for 24 bread wheat genotypes under water regimes conditions and two nitrogen fertilizer levels over two seasons

	Yield (ardab/fed.)						
	N70			N100			
	I_1	I_2	I_3	I_1	I_2	I_3	mean
1	14.30	8.30	5.60	16.30	9.35	6.45	10.05
2	11.85	8.50	3.15	13.40	9.45	3.60	8.33
3	14.05	7.55	5.40	16.05	8.70	6.10	9.64
4	20.15	5.90	2.70	21.20	6.25	2.85	9.84
5	15.60	14.50	3.45	17.95	16.60	1.70	11.63
6	10.40	6.55	3.85	11.85	7.45	4.40	7.42
7	14.95	6.05	2.70	17.20	6.85	3.05	8.47
8	16.65	11.70	2.25	19.05	13.35	2.50	10.92
9	23.40	7.70	3.10	23.90	8.80	3.45	11.73
10	10.10	5.85	1.75	11.60	6.70	2.00	6.33
11	7.65	5.80	3.20	8.25	6.25	3.45	5.77
12	21.70	7.25	3.35	22.85	8.35	3.85	11.23
13	8.65	4.55	2.30	9.85	5.10	2.60	5.51
14	14.00	10.70	8.60	16.05	12.20	9.90	11.91
15	9.05	5.70	3.95	9.70	6.15	4.25	6.47
16	13.45	10.80	9.10	15.35	12.30	10.30	11.88
17	11.45	8.90	4.75	13.10	10.15	5.45	8.97
18	21.80	18.20	7.15	22.75	18.25	8.05	16.03
19	17.30	10.80	9.55	18.45	11.55	10.25	12.98
20	14.00	10.25	4.95	16.00	11.80	5.65	10.44
21	22.50	18.30	5.75	23.40	18.40	6.60	15.83
22	19.05	10.85	8.10	20.45	11.60	8.75	13.13
23	12.35	10.25	5.00	14.15	11.75	5.70	9.87
24	10.50	7.85	6.90	11.20	8.40	7.35	8.70
mean	14.79	9.28	4.86	16.25	10.24	5.34	10.13
			LSD 0.05		*LSD* 0.01		
Genotypes (G)			1.15		1.51		
Water regimes (I)			0.41		0.53		
Nitrogen (N)			0.32		0.43		
G*I			0.97		1.27		
G*N			0.87		1.14		
G*I*N			0.87		1.14		

Table (10): Mean performance of biomass for 24 bread wheat genotypes under water regimes conditions and two nitrogen fertilizer levels over two seasons.

	Biomass (Kg)						
	N70			N100			
	I_1	I_2	I_3	I_1	I_2	I_3	mean
1	8.33	5.28	2.15	9.33	5.85	2.40	5.55
2	8.28	7.30	3.68	9.23	8.28	4.18	6.82
3	8.08	6.73	4.53	9.08	7.55	5.10	6.84
4	9.63	5.83	2.80	10.75	6.55	3.15	6.45
5	10.45	9.75	2.40	11.70	10.93	2.70	7.99
6	6.28	3.28	2.35	7.03	3.68	2.65	4.21
7	6.60	5.35	3.63	7.38	5.98	4.05	5.50
8	10.18	8.90	3.40	11.40	10.00	3.78	7.94
9	13.65	7.23	3.60	15.30	8.10	4.05	8.65
10	9.23	7.20	3.68	10.33	8.05	4.15	7.10
11	10.68	8.13	4.15	11.95	9.08	4.65	8.10
12	16.70	6.70	5.73	18.68	6.93	6.40	10.19
13	12.90	6.10	2.78	14.43	6.85	3.10	7.69
14	7.45	5.20	3.13	8.35	5.80	3.48	5.57
15	7.83	7.10	4.43	8.75	7.98	4.95	6.84
16	7.70	6.10	3.15	8.63	6.83	3.48	5.98
17	11.60	10.93	6.68	12.98	12.23	7.48	10.31
18	6.40	5.40	4.40	7.20	6.05	4.90	5.73
19	11.35	10.93	6.88	12.68	12.23	7.68	10.29
20	11.80	7.90	6.40	13.20	8.88	7.18	9.23
21	12.35	6.30	4.58	13.83	7.08	5.13	8.21
22	13.33	10.88	4.63	14.90	12.23	5.18	10.19
23	11.23	8.33	6.38	12.58	9.25	7.15	9.15
24	10.75	6.30	5.20	12.03	7.03	5.85	7.86
mean	10.11	7.21	4.19	11.32	8.06	4.70	
			LSD 0.05		*LSD* 0.01		
Genotypes (G)			0.63		0.82		
Water regimes (I)			0.22		0.29		
Nitrogen (N)			0.18		0.24		
G*I			0.56		0.73		
G*N			0.56		0.73		
G*I*N			0.56		0.73		

and 22 with an average 10.93, 10.00, 12.23, 12.23, 12.23 and 12.23 kg respectively. On the other hand under N100 and I_3 treatment the heaviest biomass were genotypes No. 12, 17, 19, 20 and 23 with an average 6.40, 7.48, 7.68, 7.18 and 7.15 kg respectively. Resulting in higher N concentration; this trend was reversed in more favorable control treatment years, in essence, a dilution effect in the biomass. Uptake of N in the wheat grain and straw, which is function of N concentration in the biomass, grain and straw. However, given the limited amount of biomass produced, it is still premature to make any conclusions regarding the influence of stubble grazing management on grain and straw quality. Ryan, *et al.* (2008) reported fallow produced the highest yields, and is a hedge against the effects of drought; it produces grain and straw of low nutritional value with respect to protein, as a result of dilution of available soil N in the increased biomass. Anyia and Herzog (2004) water deficit treatment reduced mean water use by 21%. This caused between 11 and more than 40% reduction of biomass across the genotypes. Reductions in biomass were due to decline in leaf gas exchange and leaf area during water deficit.

Cluster analysis: The objective of cluster analysis was to define the degree of relatedness in yielding ability under I_1, I_2 and I_3 in wheat genotypes. The cluster analysis, based on Euclidean distances using yield characters among wheat genotypes graphically illustrated as dendrogram (tree diagram). Group average hierarchical cluster analysis using SPSS (version 10) program was used to develop dendrogram subgroups, (SPSS, 1995). The dendrogram of yield analysis under control irrigation has categorized the twenty four studied wheat genotypes into groups; first contains two subgroups within each group "A" and "B" were detected at 25 Euclidean distances (Fig., 1) and this cluster was further spirited into six subgroups under control irrigation treatment (I_1) within each group A1, A2, B1, B2, B3 and B4 detected in genotypes No. (12, 18, 21 and 9), (4 and 22), (8, 19, 5 and 7), (14, 20, 3, 1 and 16), (10, 24, 6, 2, 17 and 23) and (13, 15 and 11) respectively. While under stress treatment (I2) two subgroups within each group "A" and "B" were detected at 25 Euclidean distances (Fig., 2), four subgroups within each group A1, B1, B2 and B3 detected in genotypes No. (18, 21 and 5), (14, 16, 20, 23, 19, 22 and 8), (3, 24, 9, 12, 1, 2 and 17) and (4, 11, 15, 7, 10, 6 and 13) respectively.

On the other hand under high stress treatment (I_3) two subgroups within each group "A" and "B" were detected at 25 Euclidean distances (Fig., 3), five subgroups within each group A1, A2, B1, B2 and B3 detected in genotypes No.

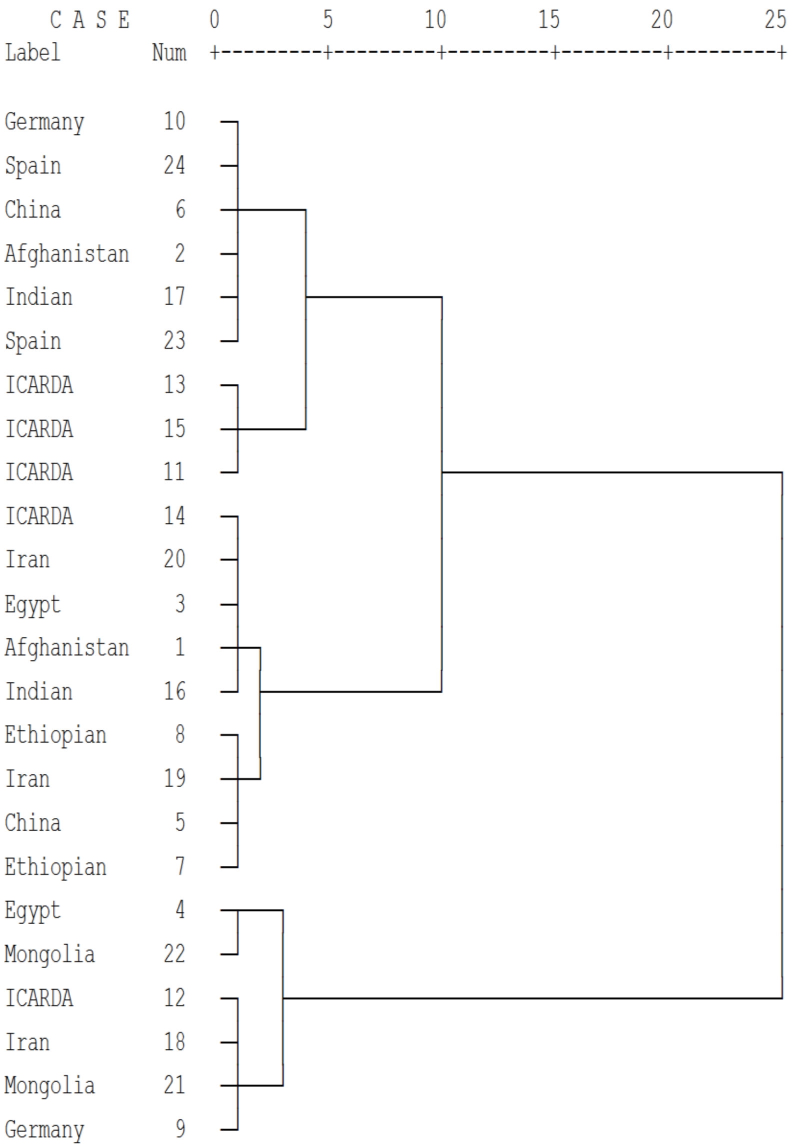

Fig. (1): Dendorogram of twenty four bread wheat genotypes based on the data classified from yield means under control irrigation (I_1) condition.

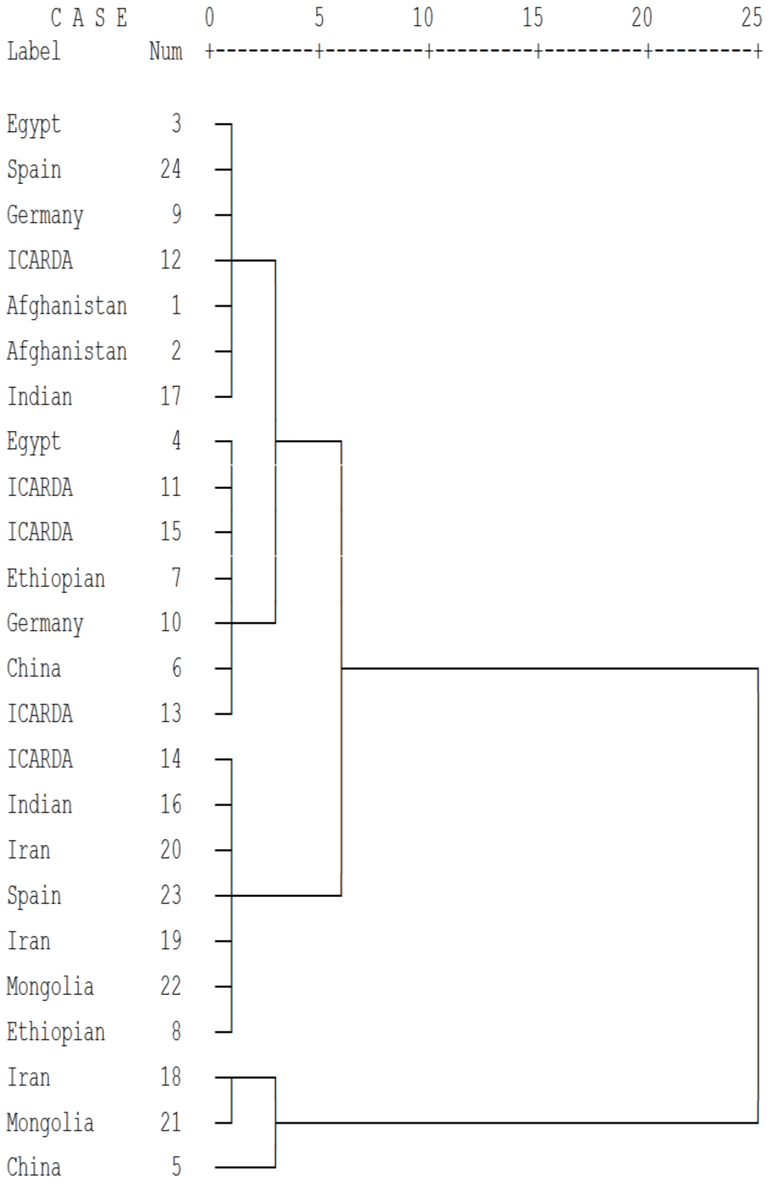

Fig.(2): Dendorogram of twenty four bread wheat genotypes based on the data classified from yield means under drought stress (I_2) condition.

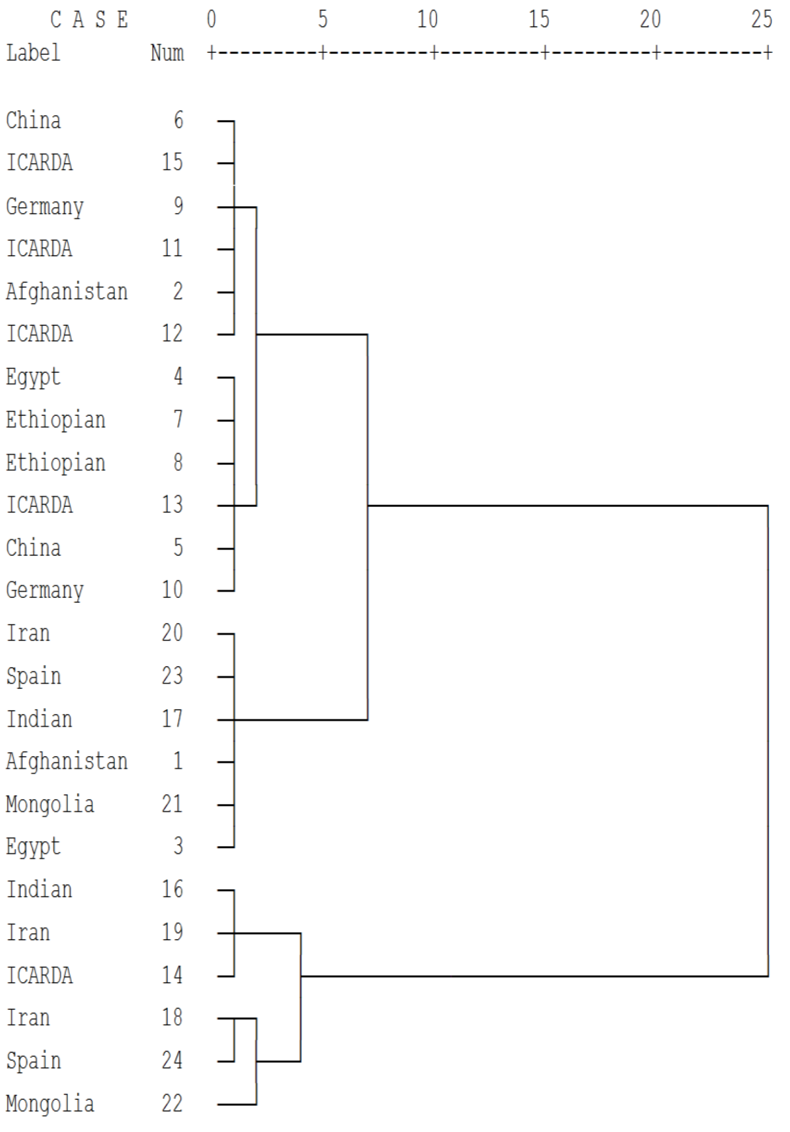

Fig.(3): Dendorogram of twenty four bread wheat genotypes based on the data classified from yield means under high drought stress (I_3) condition.

(16, 19 and 14), (18, 24 and 22), (20, 23, 17, 1, 21 and 3), (6, 15, 9, 11, 2 and 12) and (4, 7, 8, 13, 5 and 10) respectively, Table (1). The first contains the high yielding subgroup A1 of the twenty four genotypes under different water regimes. The genetic divergence can provide visual idea about variables presented in wheat genotypes in additions to assuring the continued genetic improvement (Martin et al 1991). The present study are in agreement with those obtained Sharma et al (1998) and Menshawy et al (2004 and 2007).

Genotypes groups under stress treatments: There were four group genotypes can be divided into four groups based on their yield response to stress conditions. Data presented in Table (1) show during over the two season (2004/2005 and 2005/2006) the genotypes it is observed the bread wheat genotypes No. 18, 21 and 22 gave the highest grain yield under both I_2 and I_1 conditions (group A), with an averages (18.23, 18.35 and11.23), (22.28, 22.95 and 19.75) ardab/ fed. respectively. On other hand under I_1 (group B) the genotype No. 4, 9, 12, 18, 21 and 22 gave the grain yield with an averages 20.68, 23.65, 22.28, 22.28, 22.95 and 19.75 ard/fed. respectively. The genotypes No. 5, 8, 14, 16, 18 and 21 gave the highest grain yield under I_2 (group C) with an averages 15.55, 12.53, 11.45, 11.55, 18.23 and 18.35 ardab/fed. respectively. On other hand the genotypes No. 10, 11, 13 and 15 gave the lowest grain yield under both I_2 and I_1 conditions with an averages (10.85, 7.95, 9.25 and 9.38), (6.28, 6.03, 4.83 and 5.93) ard/fed. respectively (group D). The same genotypes groups it is observed (group A and B) under stress treatment (I_2) and high stress treatment (I_3). The genotypes No. 14, 16, 18, 19, 22 and 24 gave the highest grain yield under I_2 (group C) with an averages (10.85, 7.95, 9.25 and 9.38), (1.88, 3.33, 2.45 and 4.10) ard/fed. respectively. On other hand the genotypes No. 10, 11, 13 and 15 gave the lowest grain yield under both I_1 and I_3 (group D) with an averages 1.88, 2.45 and 3.33 ardab/ fed. respectively. The genotypes were divided into four groups based on their yield response to stress conditions according to Fernandez (1992). Thus, indirect selection for a drought-prone environment based on the results of optimum condition will not be efficient. These results are in agreement with those of Bruckner and Frohberg (1987) and Ceccarelli and Grando (1991) who found that landraces of barley and wheat with low yield potential were more productive under stress condition. The lack of response to improved environmental conditions may be related to a lack of adaptation to high-moisture conditions (Clarke et al., 1992).

The performance of wheat genotypes under nitrogen levels: Fertilizer dose had a minor effect on average yield in stress treatment, and dramatically increased yield in control irrigation. Fertilizer increased inter-seasonal variation in yield in stress treatment. Fertilizer application increased yield from to 9.64 ardab/fed. on average at N70 to 16.03 ardab/fed. at N100 Table (1). Genotypes No. 9, 18, 19, 21 and 22 had the best five overall yield were responsible for about N70, while under N100 had the best five overall yield were genotypes No.14, 18, 19, 21 and 22. Computing the covalence showed that five genotypes No. 6, 10, 11 13, and 15 showed a very low yield under N 70 and N 100 Table (11 and 12). Compares distribution of frequencies of simulated grain yield for wheat crops grown with N70 and N100. In two seasons at control treatment (I_1), stress treatment (I_2) and high stress treatment (I_3), fertilizer rates increased yield in relation to current practice. Fertilizer also increased yield with N 70 in genotypes No. 4, 9, 12, 18 and 22 at I_1, genotypes No. 5, 8, 18, 21 and 22 at I_2, genotypes No.1 4, 16, 18, 19 and 22 at I_3, but larger proportions of crops benefited from fertilization as control treat (I_1) increased. Comparison of crops at N100 kg fed, in genotypes No. 4, 9, 12, 18 and 21 at I_1, genotypes No. 5, 8, 16, 18 and 22 at I_2, genotypes No.1 4, 16, 18, 19 and 22 at I_3. Also compared with crops receiving rate of fertilizer N100 increased yield from 4 - 15% compare with N 70 Table (1). The grain yield observed were within the range expected under dry land cropping conditions but 20–30% lower as compared to the corresponding yields at zero, 75 and 150 kg N ha reported by Ortiz-Monasterio et al. (1997). Regarding the response of the check varieties to N input a 47.4 and 4.8% yield increase was observed from 0 to 90 kg ha N and from 90 to 180 kg N ha, respectively, as compared to corresponding 57.9 and 25.6% increases reported by Ortiz-Monasterio et al. (1997).

Resistance indices of the genotypes: The genotypes No. 5, 16, 18, 21 and 23 had a high YSI are expected to have high yield under both I_2 and I_1 conditions. While under both I_3 and I_1 conditions the genotypes No. 14, 15, 16, 19 and 24 had a high YSI are expected to have high yield. In the present study, however, genotypes with the highest YSI exhibited the high yield under both I_1, I_2 and I_3 conditions (Tables 1, 11 and 12). YSI, as Bouslama and Schapaugh (1984) reported, evaluates the yield under stress of a genotype relative to its non-stress yield, and should be an indicator of drought resistant genetic materials. Bansal and Sinha (1991) used this method to assess the stability of wheat accessions over variable environments. Resistance indices

Table (11): Tolerance indices of the twenty four bread wheat genotypes under stress treatment over two seasons.

Genotypes	Stress treatment (I_2)						
	SSI	MP	TOL	STI	GMP	YSI	YI
1	1.14	12.06	6.48	0.100	11.620	0.58	0.90
2	0.78	10.80	3.65	0.090	10.645	0.71	0.92
3	1.24	11.59	6.93	0.096	11.058	0.54	0.83
4	1.90	13.38	14.60	0.111	11.207	0.29	0.62
5	0.20	16.16	1.23	0.134	16.151	0.93	1.59
6	1.00	9.06	4.13	0.075	8.825	0.63	0.72
7	1.61	11.26	9.63	0.094	10.183	0.40	0.66
8	0.80	15.19	5.33	0.126	14.952	0.70	1.28
9	1.76	15.95	15.40	0.132	13.968	0.35	0.85
10	1.14	8.56	4.58	0.071	8.251	0.58	0.64
11	0.65	6.99	1.93	0.058	6.921	0.76	0.62
12	1.75	15.04	14.48	0.125	13.181	0.35	0.80
13	1.29	7.04	4.43	0.058	6.681	0.52	0.49
14	0.64	13.24	3.58	0.110	13.116	0.76	1.17
15	0.99	7.65	3.45	0.064	7.453	0.63	0.61
16	0.53	12.98	2.85	0.108	12.897	0.80	1.18
17	0.60	10.90	2.75	0.091	10.813	0.78	0.98
18	0.49	20.25	4.05	0.168	20.148	0.82	1.87
19	1.01	14.53	6.70	0.121	14.133	0.63	1.14
20	0.71	13.01	3.98	0.108	12.860	0.74	1.13
21	0.54	20.65	4.60	0.171	20.522	0.80	1.88
22	1.16	15.49	8.53	0.129	14.889	0.57	1.15
23	0.46	12.13	2.25	0.101	12.073	0.83	1.13
24	0.68	9.49	2.73	0.079	9.389	0.75	0.83
mean	1.00	12.64	5.76	0.105	12.308	0.63	1.00

Table (12) : Tolerance indices of the twenty four bread wheat genotypes under high stress treatment over two seasons.

Genotypes	High stress treatment (I_3)						
	SSI	MP	TOL	STI	GMP	YSI	YI
1	0.90	10.66	9.28	0.09	9.60	0.39	1.18
2	1.09	8.00	9.25	0.07	6.53	0.27	0.66
3	0.92	10.40	9.30	0.09	9.30	0.38	1.13
4	1.29	11.73	17.90	0.10	7.57	0.13	0.54
5	1.26	9.68	14.20	0.08	6.57	0.15	0.50
6	0.94	7.63	7.00	0.06	6.77	0.37	0.81
7	1.22	9.48	13.20	0.08	6.80	0.18	0.56
8	1.29	10.11	15.48	0.08	6.51	0.13	0.47
9	1.28	13.46	20.38	0.11	8.80	0.14	0.64
10	1.23	6.36	8.98	0.05	4.51	0.17	0.37
11	0.87	5.64	4.63	0.05	5.14	0.42	0.65
12	1.25	12.94	18.68	0.11	8.95	0.16	0.71
13	1.10	5.85	6.80	0.05	4.76	0.26	0.48
14	0.57	12.14	5.78	0.10	11.79	0.62	1.81
15	0.84	6.74	5.28	0.06	6.20	0.44	0.80
16	0.49	12.05	4.70	0.10	11.82	0.67	1.90
17	0.87	8.69	7.18	0.07	7.91	0.42	1.00
18	0.98	14.94	14.68	0.12	13.01	0.34	1.49
19	0.66	13.89	7.98	0.12	13.30	0.55	1.94
20	0.96	10.15	9.70	0.08	8.92	0.35	1.04
21	1.09	14.56	16.78	0.12	11.90	0.27	1.21
22	0.85	14.09	11.33	0.12	12.90	0.43	1.65
23	0.89	9.30	7.90	0.08	8.42	0.40	1.05
24	0.51	8.99	3.73	0.07	8.79	0.66	1.40
mean	1.00	10.31	10.42	0.09	8.90	0.33	1.00

were calculated on the basis of yield of genotypes over the two years. As shown in Tables (1 and 11), the results suggest that selection based on TOL will result in reduced yield under I_1 conditions. The greater TOL value, reduction the yield in genotypes No. 4, 7, 9, 12 and 22 under I_2 condition and the higher sensitivity to drought. While high yield reduction in genotypes No. 4, 8, 9, 12 and 21 under I_3. Similar results were reported by Rosielle and Hamblin (1981), Clarke et al. (1992) and Sio-Se Mardeh et al (2006). Rizza et al. (2004) however showed that a selection based on minimum yield decrease under stress with respect to favorable conditions (TOL) failed to identify the best genotypes. Yields under irrigated condition were about three times or more high than yields under stress in the present study. Since MP is a mean production under both stress and non-stress conditions Table (11 and 12). For this reason, MP was not able to differentiate genotypes belonging to group A genotypes No. 5, 18 and 21. As described by Hohls (2001) selection for MP should increase yield in both stress and non-stress conditions. This is the condition found in present study. Genotypes No. 4, 9 and 12 under I_2 and I_3, for example, with relatively low yields under stress conditions, exhibited high MP values. The MP can be related to yield under stress only when stress is not too high stress and the difference between yield under stress and non-stress conditions is not too much. Genotypes with a high MP would belong to group A in these situations. Hossain et al. (1990) used MP as a resistance criterion for wheat genotypes in moderate stress conditions.

In the present study, the mean SSI over two years appeared to be a suitable selection index to distinguish resistant genotypes The genotypes No 5, 16, 18, 21 and 23 high yield under I_2 produced nearly yield to I_1 conditions and showed the lowest SSI, while high yield under I_3 produced a nearly yield to I_1 conditions and showed the lowest SSI in genotypes No 14, 15, 16 and 24. The genotypes No. 5, 16, 21 and 23 with a lower SSI were identified as resistant genotypes whereas the genotypes No. 4, 9 and 13, with the highest SSI were sensitive (Tables 1, 11 and 12). Winter et al. (1988) also reported that tall wheat cultivars had a lower SSI. Suggesting that SSI was adversely these traits can contribute to increased yield under stress and reduce stress susceptibility (Fernandez, 1992). SSI has been widely used by researchers to identify sensitive and resistant genotypes (Fischer and Maurer, 1978; Winter et al., 1988 and Clarke et al., 1984, 1992). Table (11 and 12) showed that STI, GMP and MP were able to identify cultivars producing high yield in both conditions. The MP, GMP and STI and SSI are suggested as useful indicators for wheat breeding. However under less drought stress condition, We conclude that GMP and STI are able to discriminate group A. YI, proposed by Gavuzzi et al. (1997), this index ranks cultivars only on the basis of their yield under stress Tables (1, 11 and 12) and so discriminate genotypes of group B.

The simple Pearson's correlation: There are three levels of correlation <0.2 was considered as weak, from >0.2 to <0.5 was moderate, and more than >0.5 was strong (Hamam 2004) and (Hamam and Salman 2007). Yield was strongly correlated with control irrigation, drought stress and high drought stress condition during two seasons (0.84**, 0.86** and 0.58**) respectively. Also, due to positive correlations, it is necessary to obtained high yield of the genotypes under control irrigation and the yield was decreased with decreased amount of irrigation water. Strong positive correlation (0.99** and 0.99**) between N70, N100 and the yield were found. Biomass was strongly associated with plant height and No. of kernels / spike under I_3. While it was moderately correlated with heading date, plant height, No. of kernels / spike and yield under I_2 (Table 13). Yield under I_1 and I_2 was moderate correlated with leaf area, No. of spikes / plant and biomass and weak under I_3 for these four traits and other traits except plant height and No. of kernels / spike were moderate correlated under I_3 and N70 and strong under I_3 and N100. The correlation were moderate for 1000 kernel weight with leaf area, days to heading, number of spikes / plant and number of kernels / spike under I_1, while it was weakly correlated with other traits under I_2 and I_3, except moderate correlated with plant height and number of kernels / spike. Weak correlation was detected for number of kernels / spike with leaf area, heading to date and plant height under I_1, while moderate correlated with number of spikes / plant under I_1 and I_2. Moderate association was detected for number of spikes / plant with leaf area, heading to date and plant height under I_1, I_2 and I_3, while weak correlated with leaf area under I_2 and I_3. Plant height was resulted weak and moderate correlation with leaf area and heading date under I_1 respectively, while strong positive correlated with heading to date. Heading was positive and moderate correlated with leaf area to date under I_1, while negative and moderate under I_2, on other hand negative and weak under I_3. There is little difference between correlation under N70 and N100 with the different water regimes. The results obtained are in agreement with this obtained by Pillen et al (2003) and Hamam and Salman (2007) they found that a high potential yield under optimum condition necessarily result to improved yield under stress condition. The present study is in agreement with these obtained

by (Fischer and Maurer, 1978; Richards, 1996; Van Ginkel et al., 1998). Van Ginkel et al. (1998) also found that many kernels / spike was critical to high yield only in irrigated condition and it was negatively correlated with yield under late season drought condition.

Conclusions: The genotypes No.5, 8, 14, 16, 18, 19, 21 and 22 under both drought stress and high drought stress conditions highly yield compare with Sedes 1 and Giza 168 (local check). The results of this study suggested that wheat genotypes No. 14, 16, 18, 19 and 22 can be selected to grow under both drought stress and high drought stress conditions, while the wheat genotypes No. 5, 8 and 21 may be useful for further cross breeding programmer.

However, our selection based on the tolerance indices calculated from the yield under different conditions, we are looking for the genotypes adapted for a wide range of environments. The findings of this study showed that the breeders should choose the indices on the basis of high stress treatment in the target condition.

References

Anyia A. O. and H. Herzog. 2004. Water-use efficiency, leaf area and leaf gas exchange of cowpeas under mid-season drought. European Journal of Agronomy, 20 (4): 327-339.

Ashraf, M., and P.J.C. Harris. 2005. Abiotic Stresses: Plant resistance through breeding and molecular approaches. Haworth Press Inc., New York.

Atlin, G.N., Baker, R.J., McRae, K.B., and X. Lu. 2000. Selection response in subdivided target regions. Crop Sci. 40: 7–13.

Bansal, K.C. and S.K. Sinha. 1991. Assessment of drought resistance in 20 accessions of *Triticum aestivum* and related species. Part I: total dry matter and grain yield stability. Euphytica 56: 7–14.

Blum, A. 1996. Crop responses to drought and the interpretation of adaptation. Plant Growth Regul. 20: 135–148.

Bouslama, M. and W.T. Schapaugh. 1984. Stress tolerance in soybean. Part 1: evaluation of three screening techniques for heat and drought tolerance. Crop Sci. 24: 933–937.

Bruckner, P.L. and R.C. Frohberg. 1987. Stress tolerance and adaptation in spring wheat. Crop Sci. 27: 31–36.

Ceccarelli, S. 1986. Tolerance to climatic stresses. Proceeding of the 5th Int. Barley Genetic symposium, Okayama 6 – 12 Oct., 1986

Ceccarelli, S. and S. Grando. 1991. Selection environment and environmental sensitivity in barley. Euphytica 57: 157–167.

Clarke, J.M., De Pauw, R.M. and T.M. Townley-Smith. 1992. Evaluation of methods for quantification of drought tolerance in wheat. Crop Sci. 32: 728–732.

Clarke, J.M., Towenley-Smith, T.M., McCaig, T.N., and D.G. Green. 1984. Growth analysis of spring wheat cultivars of varying drought resistance. Crop Sci. 24: 537–541.

El–Morshody, M. A.; E.E.M. Elorong; A. M. Tamam and Y. G. Abd El-Gawad. 2000. Analysis of genotype x environment interaction and assessment of stability parameters of grain yield and its components of some wheat genotypes (*Triticum asetivum*) under new valley conditions. Assiut J. of Agric. Sci. 1: 13 – 34.

F.A.O. 2006. The FAOSTAT ProdSTAT Production quantity of wheat. Available at: (http://faostat.fao.org/site/567/default.aspx) 18.10.2007: at 22:00

Fernandez, G.C.J. 1992. Effective selection criteria for assessing plant stress tolerance. Proceedings of a Symposium, Taiwan, 13-18 Aug. pp. 257-270

Fischer, R.A. and R. Maurer. 1978. Drought resistance in spring wheat cultivars. Part 1: grain yield response. Aust. J. Agric. Res. 29: 897–912.

Fonseca, C.R., Overton, J.M., Collins, B. and Westoby, M. (2000) Shifts in trait-combinations along rainfall and phosphorus gradients. Journal of Ecology 88: 964–977.

Gavuzzi, P., Rizza, F., Palumbo, M., Campaline, R.G., Ricciardi, G.L., and B. Borghi. 1997. Evaluation of field and laboratory predictors of drought and heat tolerance in winter cereals. Can. J. Plant Sci. 77: 523–531.

Giunta, F., R. Motzo, and M. Deidda. 1993. Effect of drought on yield and yield components of durum wheat and triticale in a Mediterranean environment. Field Crops Res. 33:399–409.

Guarda, G., S. Padovan and G. Delogu. 2004. Grain yield, nitrogen-use efficiency and baking quality of old and modern Italian bread-wheat cultivars grown at different nitrogen levels, Eur. J. Agron. **21** : 181–192.

Hamam, K.A. 2004. Improving Crop Varieties of Spring Barley for Drought and Heat Tolerance with AB-QTL-analysis. Ph.D. Thesis, Fac of Agric., Bonn Uni., Germany.pp. 55-58.

Hamam, K.A. and A.M.A. Salman. 2007. Evaluation of Spring Barley Genotypes Tolerance to Drought Stress and Aphid Infestation. Annals Agric. Sci. 52 (2): 327-340.

Hohls, T. 2001. Conditions under which selection for mean productivity, tolerance to environmental stress, or stability should be used to improve yield across a range of contrasting environments. Euphytica 120: 235– 245.

Hossain, A.B.S., Sears, A.G., Cox, T.S., Paulsen, G.M. 1990. Desiccation tolerance and its relationship to assimilate partitioning in winter wheat. Crop Sci. 30: 622–627.

Hsiao, T. C. 1973. Plant responses to water stress. Annual Review of Plant Physiology 24: 519-570.

Ismail, A. A. 1995. The performance and stability of some wheat genotypes under different environments. Assiut J. of Agric. Sci. 26: 15 - 37.

Jatimliansky JR, and F .J . Babinec. 1984 Relationships between photosynthesis and canopy traits in flint type maize. Maize Genetics Cooperation Newsletter 58: 117-118.

Kheiralla, K.A. and A.A.Ismail. 1995. Stability analysis for grain yield and some traits related to drought resistance in spring wheat. Assiut J. of Agric. Sci. 26 (1): 253 - 266.

Kheiralla, K.A.; B.R.Bakhit and R. A. Dawood. 1989. Response of wheat to drought conditions at different growth stages. Assiut J. of Agric. Sci. 20 (1): 161 - 175.

Maggio, A., De Pascale, S., Ruggiero, C., and G. Barbieri. 2005. Physiological response of field-grown cabbage to salinity and drought stress. Europ. J. Agronomy 23 : 57–67.

Martin, J. M., T.K. Blake and E. A. Hockett. 1991. Diversity among North American spring barley cultivares based on coefficients of parentage. Crop Sci. 31:1131- 1137.

Menshawy, A.M.M. 2004. Genetical analysis of grain yield and some related traits im bread wheat. Egypt. J.Agric. Res. 82 (1):203 – 214.

Menshawy, A.M.M. 2007. Evaluation of some early bread wheat genotypes under different sowing dates: agronomy characters. (May 27 Giza) Egypt. J. Plant Breed 11 (1) :41 - 54.

Miralles, D.J., R.A. Richards., and G.A. Slafer. 2000. Duration of the stem elongation period influences the number of fertile florets in wheat and barley. Aust. J. Plant Physiol. 27:931–940.

Monneveux, P., and E. Belhassen. 1996. The diversity of drought adaptation in the wide. Plant Growth Regul. 20:85–92.

Morgan J.M. 1984 Osmoregulation and water stress in higher plants. Ann.

Rev. Plant. Physiol 35: 299-319.

Nasir Ud-Din, Carver, B.F., and A.C. Clutte. 1992. Genetic analysis and selection for wheat yield in drought-stressed and irrigated environments. Euphytica 62: 89–96.

Ortiz-Monasterio, J.I.R., Sayre, K.D., Rajaram, S., and M. McMahon. 1997. Genetic progress in wheat yield and nitrogen use efficiency under four nitrogen rates. Crop Sci. 37: 898–904.

Panthuwan, G., Fokai, S., Cooper, M., Rajatasereekul, S., and J. C. O'Toole. 2002. Yield response of rice genotypes to different types of drought under rainfed lowlands. Part 1: grain yield and yield components. Field Crop Res. 41: 45–54.

Pedretti, R.R., and M. M. Kohli. 1991. Wheat production in Paraguay: Trends, major constraints, and potential. In: D.A. Saunders (ed.).Wheat for Nontraditional, Warm Areas. Mexico, D.F.: CIMMYT.

Pillen, K.; A. Zacharias and J. Léon. 2003. Advanced backcross QTL analysis in barley (Hordeum vulgare L.). Theor. Appl. Genet. 107: 340-352.

Pimentel, C., H. Roy-Macauley, A.C. de S Abboud, O. Diouf, and B. Sarr. 1999. Effects of irrigation regimes on the water status of cowpea cultivated in the field. Physiol. Mol. Biol. Plants 5:153–159.

Rajaram, S., and M. Van Ginkle. 2001. Mexico, 50 years of international wheat breeding. In: Bonjean, A.P., Angus, W.J. (Eds.), The World Wheat Book: A History of Wheat Breeding. Lavoisier Publishing, Paris, France, pp. 579–604.

Rathjen, A.J. 1994. The biological basis of genotype environment interaction: its definition and management. In: Proceedings of the Seventh Assembly of the Wheat Breeding Society of Australia, Adelaide, Australia.

Richards, R.A. 1996. Defining selection criteria to improve yield under drought. Plant Growth Regul. 20: 157–166.

Rizza, F., Badeckb, F.W., Cattivellia, L., Lidestric, O., Di Fonzoc, N. and A.M. Stancaa. 2004. Use of a water stress index to identify barley genotypes adapted to rainfed and irrigated conditions. Crop Sci. 44: 2127–2137.

Rosielle, A.A. and J. Hamblin. 1981. Theoretical aspects of selection for yield in stress and non-stress environment. Crop Sci. 21: 943–946.

Royo, C., M. Abaza, R. Blanco, and L.F. García del Moral. 2000. Triticale grain growth and morphometry as affected by drought stress, late sowing and simulated drought stress. Aust. J. Plant Physiol. 27:1051–1059.

Ryan, J., M. Pala, S. Masri, M. Singh and H. Harris. 2008. Rainfed wheat-based rotations under Mediterranean conditions: Crop sequences, nitrogen fertilization, and stubble grazing in relation to grain and straw quality. European Journal of Agronomy, 28 (2): 112-118.

SAS. 1999. SAS Institute Inc., Cary, NC, USA

Sharma, P.K., P.K.Gupta and H.S.Balyan. 1998. Genetic diversity in large collection of wheat (*Triticum Spp.*). Indian J.of Genet. 58 (3):271 – 278.

Shivani, U. V.; S. K.Pal.; R. Thakur and S. Kumar. 2001. Production potential and water use efficieny of wheat (*Triticum aestivem*) cultivars under different date of seeding and irrigation levels. Indian J. of Agronomy, 46 (4) : 659 – 664.

Sio-Se Mardeh, A; A. Ahmadi; K. Poustini; and V. Mohammadi. 2006. Evaluation of drought resistance indices under various environmental conditions. Field Crops Res. 98: 222–229.

SPPS .1995. Computer user's guide SPPS In, USA.

Turner, N.C. 1979. Drought resistance and adaption to water deficits in crop plants. Mussel, H. & stables, R.C.(eds.) wiley & sons, N.Y.pp.343 – 372.

Turner, N.C. 1986. Adaptation to water deficits: A changing perspective. Asut. J. Plant Physiology. 13: 175-190.

Van Ginkel, M., Calhoun, D.S., Gebeyehu, G., Miranda, A., Tian-you, C., Pargas Lara, R., Trethowan, R.M., Sayre, K., Crossa, L. and S. Rajaram. 1998. Plant traits related to yield of wheat in early, late, or continuous drought conditions. Euphytica 100: 109–121.

Waller, R. A. and D.B. Duncan 1969. A bayes rule for the symmetric multiple comparison problem. J.Ame. Stat. Asocy. 64:1485 – 1503.

Winter, S.R., Musick, J.T., and K.B. Porter. 1988. Evaluation of screening techniques for breeding drought-resistance winter wheat. Crop Sci. 28: 512–516

Zhong-hu, H., and S. Rajaram. 1994. Differential responses of bread wheat characters to high temperature. Euphytica 72:197 –203.

أداء بعض التراكيب الوراثية فى قمح الخبز تحت إجهادات الرى المختلفه والتسميد النيتروجينى

خلف على همام

قسم المحاصيل – كلية الزراعة – جامعة سوهاج – سوهاج – مصر

أجريت هذة الدراسة لتقييم أداء اربعة وعشرون تراكيب وراثى من قمح الخبز مختلفة فى الاداء المحصولى زرعت فى قطاعات كاملة العشوائية فى ثلاث مكررات فى موسمين 2005/2004- 2006/2005 بمزرعة كلية الزراعة – جامعة سوهاج.

تم زراعة التراكيب الوراثية تحت ثلاث مستويات من الاجهاد المائى (الرى العادى، الحرمان من الرى فى طور التفريع وطور طرد السنابل، الحرمان من الرى فى طور التفريع وطور طرد السنابل وطور امتلاء الحبوب) ومستويين من التسميد الأزوتى (70 كجم ازوت و100كجم ازوت). أظهرت الدراسة ان تحليل التباين كان معنوى لكل الصفات المدروسة مستويات الاحهاد المائى ، مستويين التسميد الازوتى وبين التراكيب الوراثية.

وجدت الدراسة أنه تحت مستوى التسميد الأزوتى 70 كجم و بدون اجهاد مائى (معاملة الكنترول) خلال الموسمين كانت أفضل خمس تراكيب وراثية هى جيزة 168 ، 9 ، 12، 18 و 21 بينما تحت70 كجم أزوت و المستوى الثانى من الاجهاد المائى وجد أن افضل خمس تراكيب وراثية هى 5 ، 8 ، 18 ، 21 و 22، ومن ناحية أخرى فقد وجد أن تحت معاملة70 كجم أزوت و المستوى الثالث من الاجهاد المائى كانت أفضل خمس تراكيب وراثية هى 14 ، 16 ، 18 ، 19 و 22.

ووجدت الدراسة انه تحت مستوى التسميد الازوتى 100 كجم و بدون اجهاد مائى(معاملة الكنترول) خلال الموسمين افضل خمس تراكيب وراثية هى جيزة 168 ، 9 ، 12، 18 و 21 بينما تحت100 كجم أزوت و المستوى الثانى من الاجهاد المائى وجد افضل خمس تراكيب وراثية هى 5 ، 8 ، 16 18 و21، ومن ناحية اخرى تحت معاملة100 كجم أزوت و المستوى الثالث من الاجهاد المائى وجد افضل خمس تراكيب وراثية هى 14 ، 16 ، 18 ، 19 و 22.

النتائج اظهرت ان متوسط الانتاجية ، وصفة متوسط الانتاج و معامل تحمل الاجهاد أدت إلى تاثير عالى لتحديد محصول التراكيب الوراثية تحت كل من معاملات الجفاف والرى العادى. اظهرت النتائج انه من المفضل تمييز التراكيب الوراثية المتحملة للجفاف بمساعدة معامل حساسية الاجهاد. والخلاصة وجد انه من المؤثر التميز والانتخاب بين التراكيب الوراثية تحت اجهادات شديدة و مختلفة. وقد اظهرت النتائج ارتباط قوى موجب بين محصول الحبوب وكل من الرى العادى والجفاف والجفاف الشديد (** 0.84 ، **0.86 و**0.84) خلال الموسمين على التوالى.