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EVALUATION OF SOME WHEAT GENOTYPES UNDER TWO N-FERTILIZATION AND IRRIGATION LEVELS IN SANDY SOIL

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ABSTRACT

In two field trials conducted during the 1996/97 and 1997/98 seasons, eleven new bread wheat genotypes were subjected to a lower N application (168 kg/ha) and to a higher dose (240 kg N/ha) under two irrigation levels (3000 and 5000m^3/ha) to study their performance and water-use efficiency in the newly reclaimed land at El-Bustan region. The results revealed that both irrigation and nitrogen fertilizer treatments had significant positive effects on wheat grain yield and its contributing characters. Significant differences among the studied genotypes for grain yield were obtained. Entries No 6, 8, 7, 5, 4and 3 were statistically at par and outyielded the other genotypes irrespective of the other treatments. Substantial difference among the genotypes in their response to increasing N fertilizer rate was observed. Grain yield response index (GYRI) of the different genotypes was improved with increasing the irrigation level. Significant genotypic variation for water-use efficiency (WUE) was obtained and it was higher for the high-yielding genotypes. (WUE) of the different genotypes decreased with increasing irrigation water supply, and vice versa with increasing nitrogen application. Moreover, entry No 7 produced high grain yield with lower and / or higher levels of both irrigation and fertilization. Therefore, this line is highly recommended for the wheat national research program to be evaluated for further advanced steps.

INTRODUCTION

Increasing wheat production could be achieved through maximizing the production per unit area (vertical expansion) and /or invading deserts to expand the cultivated area (horizontal expansion). The vertical expansion would be reached via developing high yielding cultivars and simultaneously implementing proper cultural practices. The other way for narrowing the gap between our production and consumption is, growing wheat in the new reclaimed areas (horizontal expansion) as indicated by (Shehab El –Din (1993).

Adequate availability of moisture and nitrogen in the soil is an essential requirement for obtaining high yields of wheat (*Triticum aestivum L.*). Eck (1988) reported that both applied N and water were required for substantial yield increases from either variable, and for most efficient use of both of them. He also indicated that supply of one should be adjusted to that of the other. Singh *et al* (1996), Garabet *et al.* (1998) and Oweis *et al* (1998) observed increased N uptake proportional to available soil moisture, whereas Nielsen and Halvorson (1991) and Sharma *et al.* (1992) showed that sensitivity of wheat grain yield to water-uptake was higher at higher N application rates. Likewise , Ismail and Shehab El-Din (1992) reported that wheat response to applied water depends on the nitrogen fertilization level. Rao and Bhardwaj (1981) and Tomar *et al.* (1993) also noted that proper interaction of soil moisture and nitrogen fertilization boosts the grain yield than their solitary effects.

It was also found that increasing N application rate and decreasing of irrigation level are potential factors for increasing the water-use efficiency (Rao & Bhardwaj 1981, Reddy & Bhardwaj 1982, Eck 1988, Nielsen & Halvorson 1991 and Singh *et al* 1996.

In general, there is lack of information concerning the response of different wheat genotypes to nitrogen application in relation to water supply at the newly reclaimed areas. Therefore, the present study was, , undertaken to study the performance and water-use efficiency of some new wheat genotypes under two fertilization and irrigation levels in the sandy soil of the newly reclaimed area at El-behera governorate.

MATERIALS AND METHODS

The treatments of this study comprised eleven new genotypes of bread wheat Table (1), two different levels of nitrogen fertilization ((168 and 240 kg N/ha) and two levels of irrigation water (3000 and 5000m^3/ha) (300 and 500mm). Two field experiments were conducted at El-Behera Governorate, in the newly reclaimed area during the two successive wheat growing seasons 1996/97 and 1997/98.

Table 1: List of the studied wheat genotypes

Entr. No.	Entry name and pedigree
1	4777//Fkn./Gb/3/Vee"s"/4/Buc"s" Pvn"s". CM66684-b-1M-6Y-2M-2Y-1m-0Y.
2	DW15023/Snb"s"//snb"s" CM84986-H-1M-2Y-5B-0Y.
3	Nd/Ug 9144//Kal/Bb/3/Yaco "s"/4/Vee #5 "s" CM 85839 –1Y-0M –0Y –4M –0Y .
4	Trap*1/Bow"s" CM88137-21M-0SY-0H-3Y-0M
5	Nac/Vee"S" CM64224-2Ap-2Ap-1Ap-3Ap-5Ap-0Ap.
6	Buc"s"/Fik"s"//Maya"s"/Vul "s" CM91575-28Y-0M-0Y-4M-0Y.
7	Kea "s"/Vee#5"s" CM91381-11Y-0M-16SH-0SH
8	Vee"s"SWM6525 CGM 4017-1GM-7GM-3GM-0GM
9	HD 2172 /Pavon "S" // 1158.57 /Mdya 74 "s" SD 46-4sd –2sd –1sd –0sd .
10	NS 732 / Pima //Vee"s" SD 735- 4sd –1sd – 1sd –1sd –0sd .
11	(Au /Up 301 // G 11 /3/Sx /Pew "s"/4/Mai "s" /May "s"//Pew "s". CM 67245-C-1M-2Y-1M –7Y –1M –0Y)

The treatments were arranged in three replicates of a split –split block design in which water treatments were assigned to the main blocks and the fertility rates to sub-plots while, the wheat genotypes occupied the sub-sub plots. Plot size was 4.2 m^2 (3.5 x 1.2m), and consisted of six rows, spacing 20 cm. apart . The soil of the experimental site was sandy and poor in organic matter (Table-2).

Table 2: Chemical and mechanical analyses of the soil of the experimental site

Season	Ec Mmhos/cm	pH	N ppm	P Pmm	K pmm	Sand %	Silt %	Clay %	Texture
1996 /97	0.20	7.4	10.0	10.0	55.0	92	3	5	Sandy
1997 /98	0.18	8.2	13.0	11.0	60.0	91	1.1	7.8	Sandy

The preceding crop was maize in both seasons. During land preparation, phosphorus fertilizer was applied in a rate of 72 kg P_2O_5/ha in the form of mono-ammonium phosphate. Likewise, potassium fertilizer was added in two equal doses (57 kg K_2O/ha) applied as potassium sulphate 48 % during land preparation and at booting stage. Nitrogen fertilizer as ammonium nitrate (33% N) was applied at two rates i.e., 168 and 240 kg N/ha as a low and high nitrogen rates, respectively. It was splitted in both cases into six equal doses applied right before irrigation starting from plant emergence to the end of booting stage. Seeding rates was 400 seeds/m^2. Sowing was taken place during the third week of November in both seasons. Fixed sprinkler irrigation system was used. Irrigation was applied for three days (2 hrs /day) after sowing to ensure good emergence and even plant-stand, and then every week. Afterwards, irrigation treatments were imposed and a measured amount of water was applied at each of subsequent irrigations. The total water received during the crop season was (3000 and 5000m^3/ha) for the first and second treatments, respectively, including the common irrigation. The crop was harvested on May 11th and 1st in 96/1997 and 97/1998 seasons, respectively. Yield attributing characters viz., number of spikes/m^2, number of kernels/spike and 1000 kernel weight which were randomly taken for each plot were recorded along with the grain yield. Water-use efficiency (WUE) was worked out as a ratio of grain yield produced (GY) to total water applied, (Ehdaie and Waines, 1993). Grain yield response index (GYRI) was calculated as outlined by Fageria and Barbosa Filho (1981).:

$$GYRI = \frac{\text{Yield under high N} - \text{Yield under low N}}{\text{High N} - \text{Low N}}$$

The studied wheat genotypes were accordingly, classified into four groups as follows:
a- Efficient & responsive (ER).
b- ,, & non-responsive (ENR).
c- Non-efficient & responsive (NER).
d- ,, & non-responsive (NENR).

Data of each character were subjected to analysis of variance for each season and to a combined analysis for the two seasons as well, and treatment means were statistically compared using the test of least significant difference (LSD), according to Gomez, and Gomez, (1983).

RESULTS AND DISCUSSION

Genotype Effects:

Table (1) indicates that wheat genotypes are significantly different in their grain yield and the other studied traits ,irrespective of the irrigation and/or N .fertilization in the two seasons. However, entry No 6 gave the highest yield of 5.22 t/ha, followed by No 8, 7, 5, 4 and 3 with a non-significant difference between them, irrespective of the other treatments (Table 3-a). Those genotypes gave also higher yields at either low or high nitrogen level, irrespective of water treatment. This might be attributed to higher values of their productive tillers, kernels/spike and 1000 kernel weight (Tables 3-b,c,d). The rest of genotypes were similar to each other as they produced lower yields ranged from 4.46 to 4.70 t/ha with a non-significant difference between them. This result was substantiated with those obtained by Rao and Bhardwaj (1981), Tomar *et al* (1993), El-Naggar (1997) and Singh *et al* (1998).

Table 3-a : Means of grain yield (t/ha) for 11 wheat genotypes as affected by two irrigation levels under two rates of N fertilization during 1996/97 and 1997/98 seasons.

Irrig. Treat. (mm)	Genot Entr. NO.	1996/97			1997/98			Pooled		
		N Level*								
		Low	**Hi**	**Mean**	**Low**	**Hi**	**Mean**	**Low**	**Hi**	**Mean**
	1	2.88	4.81	3.84	2.92	4.23	3.57	2.90	4.52	3.71
	2	3.92	4.52	4.22	4.37	4.83	4.60	4.14	4.68	4.41
	3	4.17	5.23	4.70	4.36	4.60	4.48	4.26	4.92	4.59
	4	4.10	5.54	4.82	4.01	4.73	4.37	4.06	5.14	4.60
	5	4.13	5.42	4.77	3.93	5.38	4.65	4.03	5.40	4.71
300	6	4.73	5.42	5.07	3.94	5.35	4.64	4.34	5.38	4.86
	7	4.58	4.83	4.71	4.72	4.83	4.78	4.65	4.83	4.74
	8	4.42	4.58	4.50	4.83	5.22	5.03	4.63	4.90	4.76
	9	3.77	4.42	4.09	3.82	4.33	4.08	3.80	4.38	4.09
	10	4.06	4.69	4.38	4.12	4.34	4.23	4.09	4.52	4.30
	11	3.23	4.19	3.71	3.62	4.17	3.89	3.42	4.18	3.80
	Mean	3.99	4.88	4.44	4.06	4.73	4.39	4.03	4.80	4.42
	1	4.04	5.92	4.98	4.89	5.98	5.43	4.47	5.95	5.21
	2	4.38	5.69	5.03	4.38	5.37	4.87	4.38	5.53	4.95
	3	5.13	5.77	5.45	4.70	5.69	5.20	4.92	5.73	5.32
	4	5.63	6.56	6.09	4.53	4.65	4.59	5.08	5.60	5.34
	5	5.08	6.38	5.73	4.30	5.60	4.95	4.69	5.99	5.34
500	6	5.48	5.94	5.71	5.28	5.64	5.46	5.38	5.79	5.58
	7	5.10	6.17	5.64	5.03	5.91	5.47	5.07	6.04	5.55
	8	5.15	6.08	5.62	5.46	5.56	5.51	5.30	5.82	5.56
	9	4.77	5.60	5.19	4.55	5.45	5.00	4.66	5.53	5.09
	10	4.94	5.48	5.21	4.38	4.98	4.68	4.66	5.23	4.95
	11	5.96	6.08	6.02	4.92	5.46	5.19	5.44	5.77	5.60
	Mean	5.06	5.97	5.51	4.77	5.48	5.12	4.91	5.73	5.32
	1	3.46	5.37	4.41	3.90	5.10	4.50	3.68	5.23	4.46
	2	4.15	5.10	4.63	4.37	5.10	4.74	4.26	5.10	4.68
e	3	4.65	5.50	5.07	4.53	5.15	4.84	4.59	5.32	4.96
g	4	4.87	6.05	5.46	4.27	4.69	4.48	4.57	5.37	4.97
a	5	4.60	5.90	5.25	4.11	5.49	4.80	4.36	5.69	5.03
r	6	5.10	5.68	5.39	4.61	5.49	5.05	4.86	5.59	5.22
e	7	4.84	5.50	5.17	4.87	5.37	5.12	4.86	5.44	5.15
v	8	4.78	5.33	5.06	5.15	5.39	5.27	4.96	5.36	5.16
A	9	4.27	5.01	4.64	4.18	4.89	4.54	4.23	4.95	4.59
	10	4.50	5.08	4.79	4.25	4.66	4.46	4.38	4.87	4.62
	11	4.59	5.14	4.87	4.27	4.81	4.54	4.43	4.97	4.70
	Mean	4.53	5.42	4.98	4.41	5.10	4.76	4.47	5.26	4.87
	C.V.%			11.70			11.04			11.40
	LSD.05									
	S			-						
	W			0.30			0.08			0.10
	N			0.31			0.17			0.19
	WN			n.s			n.s			n.s
	V			0.47			0.43			0.31
	WV			n.s			0.60			0.44
	NV			n.s			n.s			0.44
	WNV			n.s			n.s			n.s

Table 3-b : Means of no of spikes / m2 for 11 wheat genotypes as affected by two irrigation levels under two rates of N fertilization during 1996/97 and 1997/98 seasons.

Irrig. Treat. (mm)	Genot Entr. NO.	1996/97			1997/98			Pooled		
		N Level*								
		Low	Hi	Mean	Low	Hi	Mean	Low	Hi	Mean
300	1	341.7	365.0	353.3	317.9	379.2	348.5	329.8	372.0	350.9
	2	345.0	391.7	368.3	367.5	422.9	395.2	356.3	407.3	381.8
	3	391.7	438.3	415.0	370.4	393.8	382.1	381.0	416.0	398.5
	4	383.3	448.3	415.8	352.9	420.0	386.5	368.1	434.2	401.1
	5	391.7	438.3	415.0	355.8	399.6	377.7	373.8	419.0	396.4
	6	393.3	430.0	411.7	361.7	423.9	392.3	377.5	426.5	402.0
	7	366.7	390.0	378.3	396.7	411.3	404.0	381.7	400.6	391.1
	8	361.7	391.7	376.7	417.1	405.4	411.3	389.4	393.5	394.0
	9	360.0	383.3	371.7	355.8	390.8	373.3	357.9	387.1	372.5
	10	370.0	395.0	382.5	382.1	382.1	382.1	376.0	388.5	382.3
	11	361.7	376.6	369.2	364.6	385.0	374.8	363.1	380.8	372.0
	Mean	369.7	404.4	387.0	367.5	401.2	384.3	368.6	402.8	385.7
500	1	390.0	420.0	405.0	417.1	449.2	433.1	403.5	434.6	419.1
	2	396.7	418.3	407.5	387.9	437.5	412.7	392.3	427.9	410.1
	3	405.0	406.7	405.8	417.1	460.8	439.0	411.0	433.8	422.4
	4	395.0	455.0	425.0	387.9	402.5	395.2	391.5	428.8	410.1
	5	391.7	458.3	425.0	396.7	431.7	414.2	394.2	445.0	419.6
	6	403.3	440.0	421.7	428.8	437.5	433.1	416.0	438.8	427.4
	7	396.7	456.7	426.7	402.5	455.0	428.8	399.6	455.8	427.7
	8	388.3	460.0	424.2	452.1	434.6	443.3	420.2	447.3	433.8
	9	385.0	423.3	404.2	401.3	425.8	417.1	396.7	424.5	410.6
	10	396.7	441.7	419.2	373.3	408.3	390.8	385.0	425.0	405.0
	11	428.3	470.0	449.2	405.4	425.8	415.6	416.9	447.9	432.4
	Mean	397.9	440.9	419.4	407.0	433.0	420.3	402.4	437.2	419.8
Average	1	365.8	392.5	379.2	367.5	414.2	390.8	366.7	403.3	385.0
	2	370.8	405.0	387.9	377.7	430.2	404.0	374.3	417.6	395.9
	3	398.3	422.5	410.4	393.8	427.3	410.0	396.0	424.9	410.4
	4	389.2	451.7	420.0	370.4	411.3	390.8	379.8	431.5	405.6
	5	391.7	448.3	420.0	376.3	415.6	395.9	383.9	432.0	408.0
	6	398.3	435.0	416.7	395.2	430.2	412.7	396.8	432.6	414.0
	7	381.7	423.3	402.5	399.6	433.1	416.4	390.6	428.3	409.4
	8	375.0	425.8	400.4	434.6	420.0	427.3	404.8	422.9	413.9
	9	372.5	403.3	387.9	382.1	408.3	395.2	377.3	405.8	391.6
	10	383.3	418.3	400.8	377.7	395.2	386.5	380.5	406.8	393.6
	11	395.0	423.3	409.2	385.0	405.4	395.2	390.0	414.4	402.2
	Mean	383.8	422.7	403.2	387.3	417.3	402.3	385.5	420.0	402.8
	C.V.%			6.0			6.9			7.0
	LSD.05									
	W			15.9			31.6			6.3
	N			12.5			13.7			6.3
	WN			n.s			n.s			n.s
	V			19.6			22.5			14.8
	WV			27.8			31.9			10.1
	NV			n.s			n.s			n.s
	WNV			n.s			n.s			n.s

Table 3-c : Means of kernels / spike for 11 wheat genotypes as affected by two irrigation levels under two rates of N fertilization during 1996/97 and 1997/98 seasons.

Irrig. Treat. (mm)	Genot Entr. NO.	1996/97			1997/98			Pooled		
		N Level*								
		Low	Hi	Mean	Low	Hi	Mean	Low	Hi	Mean
300	1	35.0	43.3	39.2	36.0	46.3	41.2	53.5	44.8	40.2
	2	38.3	44.0	41.2	41.0	40.7	40.8	39.7	42.3	41.0
	3	42.0	45.0	43.5	43.0	42.0	42.5	42.5	43.5	43.0
	4	42.7	45.7	44.2	45.0	43.7	44.3	43.8	44.7	44.3
	5	42.0	46.0	44.0	38.0	45.7	41.8	40.0	45.8	42.9
	6	40.0	46.0	43.0	40.0	45.0	42.5	40.0	45.5	42.8
	7	43.0	43.3	43.2	41.7	41.0	41.3	42.3	42.2	42.3
	8	43.0	42.0	42.5	42.0	44.3	43.2	42.5	43.2	42.8
	9	38.0	41.3	39.7	40.0	42.0	41.0	39.0	41.7	40.3
	10	42.3	44.0	43.2	40.3	42.0	41.2	41.3	43.0	42.2
	11	38.0	42.3	40.2	39.3	42.0	40.7	38.7	42.2	40.4
	Mean	40.4	43.9	42.2	40.6	43.2	41.9	40.5	43.5	42.0
500	1	42.3	52.7	47.5	41.0	51.0	46.0	41.7	51.8	46.8
	2	44.3	50.7	47.5	41.7	50.3	46.0	43.0	50.5	46.8
	3	45.3	50.3	47.8	42.3	51.3	46.8	43.8	50.8	47.3
	4	46.7	54.7	50.7	44.3	43.3	43.8	45.5	49.0	47.3
	5	46.0	53.3	49.7	43.0	49.7	46.3	44.5	51.5	48.0
	6	46.0	52.3	49.2	44.3	52.7	48.5	45.2	52.5	48.8
	7	45.7	53.3	49.5	45.3	53.3	49.3	45.5	53.3	49.4
	8	47.3	53.3	50.3	46.7	50.0	48.3	47.0	51.7	49.3
	9	42.3	46.3	44.3	46.0	48.3	47.2	44.2	47.3	45.8
	10	42.3	46.3	44.3	43.3	49.0	46.2	42.8	47.7	45.3
	11	50.7	53.7	52.2	44.3	49.7	47.0	47.5	51.7	49.6
	Mean	45.4	51.5	48.5	43.9	49.9	46.9	44.6	50.7	47.7
Average	1	38.7	48.0	43.3	38.5	48.7	43.6	38.6	48.3	43.5
	2	41.3	47.3	44.3	41.3	45.5	43.4	41.3	46.4	43.9
	3	43.7	47.7	45.7	42.7	46.7	44.7	43.2	47.2	45.2
	4	44.7	50.2	47.4	44.7	43.5	44.1	44.7	46.8	45.8
	5	44.0	49.7	46.8	40.5	47.7	44.1	42.3	48.7	45.5
	6	43.0	49.2	46.1	42.2	48.8	45.5	42.6	49.0	45.8
	7	44.3	48.3	46.3	43.5	47.2	45.3	43.9	47.8	45.8
	8	45.2	47.7	46.4	44.3	47.2	45.8	44.8	47.4	46.1
	9	40.2	43.8	42.0	43.0	45.2	44.1	41.6	44.5	43.0
	10	42.3	45.2	43.8	41.8	45.5	43.7	42.1	45.3	43.7
	11	44.3	48.0	46.2	41.8	45.8	43.8	43.1	46.9	45.0
	Mean	42.9	47.7	45.3	42.2	46.5	44.4	42.6	47.1	44.8
	C.V.%			10.4			9.8			10.0
	LSD.05									
	W			1.3			0.5			1.1
	N			1.7			2.2			1.1
	WN			2.4			n.s			1.5
	V			n.s			n.s			n.s
	WV			n.s			n.s			n.s
	NV			n.s			n.s			n.s
	WNV			n.s			n.s			n.s

Table 3-d : Means of 1000 – kernel weight for 11 wheat genotypes as affected by two irrigation levels under two rates of N fertilization during 1996/97 and 1997/98 seasons.

Irrig. Treat. (mm)	Genot Entr. NO.	1996/97			1997/98			Pooled		
		N Level *								
		Low	Hi	Mean	Low	Hi	Mean	Low	Hi	Mean
300	1	40.0	49.3	44.7	40.0	46.3	43.2	40.0	47.8	43.9
	2	41.7	49.7	45.7	48.0	49.7	48.8	44.8	49.7	47.3
	3	47.0	49.3	48.2	48.3	48.0	48.2	47.7	48.7	48.2
	4	46.7	51.7	49.2	47.0	47.7	47.3	46.8	49.7	48.3
	5	45.7	50.3	48.0	46.0	49.0	47.5	45.8	49.7	47.8
	6	45.7	51.7	48.0	46.7	49.3	48.0	46.2	50.5	48.3
	7	48.3	49.0	48.7	49.0	48.7	48.8	48.7	48.8	48.8
	8	48.7	48.3	48.5	50.3	48.7	49.5	49.5	48.5	49.0
	9	42.0	47.3	44.7	48.3	48.0	48.2	45.2	47.7	46.4
	10	45.3	46.3	45.8	46.0	48.0	47.0	45.7	47.2	46.4
	11	41.0	44.3	42.7	45.7	48.3	47.0	43.3	46.3	44.8
	Mean	44.7	48.9	46.8	46.9	48.3	47.6	45.8	48.6	47.2
500	1	43.7	51.0	47.3	47.0	50.3	48.7	45.3	50.7	48.0
	2	48.7	50.0	49.3	48.0	49.0	48.5	48.3	49.5	48.9
	3	50.7	53.3	52.0	47.3	49.0	48.2	49.0	51.2	50.1
	4	51.7	58.7	55.2	46.0	47.0	46.5	48.8	52.8	50.8
	5	50.3	52.3	51.3	46.0	49.3	47,7	48.2	50.8	49.5
	6	51.7	56.3	54.0	48.7	54.0	51.3	50.2	55.2	52.7
	7	50.3	53.0	51.7	49.7	53.0	51.3	50.0	53.0	51.5
	8	54.3	51.7	53.0	49.7	51.3	50.5	52.0	51.5	51.8
	9	50.3	52.7	51.5	48.3	52.0	50.2	49.3	52.3	50.8
	10	49.7	50.0	49.8	49.0	48.7	48.8	49.3	49.3	49.3
	11	51.3	51.0	51.2	48.0	50.7	49.3	49.7	50.8	50.3
	Mean	50.2	52.7	51.5	48.0	50.4	49.2	49.1	51.6	50.3
Average	1	41.8	50.2	46.0	43.5	48.3	45.9	42.7	49.3	46.0
	2	45.2	49.8	47.5	48.0	49.3	48.7	46.6	49.6	48.1
	3	48.8	51.3	50.1	47.8	48.5	48.2	48.3	49.9	49.1
	4	49.2	55.2	52.2	46.5	47.3	46.9	47.8	51.3	49.5
	5	48.0	51.3	49.7	46.0	49.2	47.6	47.0	50.3	48.6
	6	48.7	54.0	51.3	47.7	51.7	49.7	48.2	52.8	50.5
	7	49.3	51.0	50.2	49.3	50.8	50.1	49.3	50.9	50.1
	8	51.5	50.0	50.8	50.0	50.0	50.0	50.8	50.0	50.4
	9	46.2	50.0	48.1	48.3	50.0	49.2	47.3	50.0	48.6
	10	47.5	48.2	47.8	47.5	48.3	47.9	47.5	48.3	47.9
	11	46.2	47.7	46.9	46.8	49.5	48.2	46.5	48.6	47.5
	Mean	47.5	50.8	49.1	47.4	49.4	48.4	47.5	50.1	48.8
	C.V.%			9.4			9.3			9.5
	LSD.05									
	W			2.4			n.s			1.1
	N			3.2			n.s			1.1
	WN			4.2			n.s			n.s
	V			3.8			n.s			2.6
	WV			n.s			n.s			n.s
	NV			n.s			n.s			n.s
	WNV			n.s			n.s			n.s

Table 4 : Means of water – use efficiency (kg / ha / mm) for 11 wheat genotypes as affected by two irrigation water levels under two rates of N fertilization during 1996/97 and 1997/98 seasons.

Irrig. Treat. (mm)	Genot Entr. NO.	1996/97			1997/98			Pooled		
		N Level *								
		Low	Hi	Mean	Low	Hi	Mean	Low	Hi	Mean
300	1	9.6	16	12.8	9.7	14.1	11.9	9.7	15.1	12.4
	2	13.1	15.1	14.1	14.6	16.1	15.3	13.8	15.6	14.7
	3	13.9	17.4	15.7	14.5	15.3	14.9	14.2	16.4	15.3
	4	13.7	18.5	16.1	13.4	15.8	14.6	13.5	17.1	15.3
	5	13.8	18.1	15.9	13.1	17.9	15.5	13.4	18	15.7
	6	15.8	18.1	16.9	13.1	17.8	15.5	14.5	17.9	16.2
	7	15.3	16.1	15.7	15.7	16.2	15.9	15.5	16.1	15.8
	8	14.7	15.3	15	16.1	17.4	16.8	15.4	16.3	15.9
	9	12.6	14.7	13.6	12.7	14.4	13.6	12.7	14.6	13.6
	10	13.5	15.6	14.6	13.7	14.5	14.1	13.6	15	14.3
	11	10.8	14	12.4	12.1	13.9	13	11.4	13.9	12.7
	Mean	13.3	16.3	14.8	13.5	15.8	14.6	13.4	16	14.7
500	1	8.1	11.8	10	9.8	12	10.9	8.9	11.9	10.4
	2	8.8	11.4	10.1	8.8	10.7	9.7	8.8	11.1	9.9
	3	10.3	11.5	10.9	9.4	11.4	10.4	9.8	11.5	10.6
	4	11.3	13.1	12.2	9	9.3	9.1	10.1	11.2	10.7
	5	10,2	12.7	11.4	8.6	11.2	9.9	9.4	12	10.7
	6	11	11.9	11.4	10.6	11.3	10.9	10.8	11.6	11.2
	7	10.2	12.3	11.3	10.1	11.8	10.9	10.1	12.1	11.1
	8	10.3	12.2	11.2	10.9	11.1	11	10.6	11.6	11.1
	9	9.5	11.2	10.4	9.1	10.9	10	9.3	11.1	10.2
	10	9.9	11	10.4	8.8	10	9.4	9.3	10.5	9.9
	11	11.9	12.2	12	9.8	10.9	10.4	10.9	11.5	11.2
	Mean	10.1	11.9	11	9.5	11	10.2	9.8	11.4	10.6
	1	8.8	13.9	11.4	9.8	13	11.4	9.3	13.5	11.4
	2	10.9	13.2	12.1	11.7	13.4	12.5	11.3	13.3	12.3
	3	12.1	14.5	13.3	12	14.4	12.7	12	13.9	13
	4	12.5	15.8	14.1	11.2	12.5	11.9	11.8	14.2	13
	5	12	15.4	13.7	10.9	14.6	12.7	11.4	15	13.2
	6	13.4	15	14.2	11.8	14.6	13.2	12.6	14.8	13.7
	7	12.7	14.2	13.5	12.9	14	13.4	12.8	14.1	13.5
	8	12.5	13.7	13.1	13.5	14.3	13.9	13	14	13.5
	9	11.1	13	12	10.9	12.7	11.8	11	12.8	11.9
	10	11.7	13.3	12.5	11.2	12.2	11.7	11.5	12.8	12.1
	11	11.3	13.1	12.2	10.9	12.4	11.7	11.1	12.7	11.9
	Mean	11.7	14.1	12.9	11.5	13.4	12.4	11.6	13.7	12.7
	C.V.%			11.8			11.4			11.6
	LSD.05									
	W			1			0.3			0.4
	N			0.9			0.6			0.4
	WN			n.s			n.s			0.6
	V			1.2			1.1			0.8
	WV			1.7			1.6			1.2
	NV			n.s			n.s			1.2
	WNV			n.s			n.s			n.s

Remarkable difference among the tested genotypes in their response to increasing N fertilizer rate was also observed. Averaged, grain yield response index (GYRI) of the different genotypes varied from 5.55 to 21.52, irrespective of irrigation treatment (Table 5). Using GYRI, the studied genotypes were classified into four different groups (Fig 1). Entry No 4 fell under the efficient and responsive (ER) group, while entries No 3, 6, 7 and 8 were fallen under the efficient and non-responsive (ENR) group. From breeders point of view, cultivars falling under these two groups are desirable as they could produce relatively higher yields at low N levels. Singh and Srivastava (1996), Oweis *et al* (1998) and Iman Sadik and Abo-Warda (1998) obtained similar results and reported that response to N application varied with the different wheat genotypes.

Table 5 : Grain yield response index (GYRI) for 11 wheat genotypes as affected by two irrigation levels during 1996/97 and 1997/98 Seasons

Irrig. Treat.(mm)	Genot Entr.NO.	Seasons		
		1996/97	1997/98	Mean
300	1	26.80	18.19	22.50
	2	8.33	6.38	7.50
	3	14.72	3.33	9.16
	4	20.00	10.00	15.00
	5	17.91	20.13	19.02
	6	9.58	19.58	14.44
	7	3.47	1.52	2.50
	8	2.22	5.41	3.75
	9	9.02	7.08	8.05
	10	8.75	3.05	5.97
	11	13.33	7.63	10.55
	Mean	12.36	9.30	10.69
500	1	26.11	15.13	20.55
	2	18.19	13.75	15.97
	3	8.88	13.75	11.25
	4	12.91	1.66	7.22
	5	18.05	18.05	18.05
	6	6.38	5.00	5.69
	7	14.86	12.22	13.47
	8	12.91	1.38	7.22
	9	11.52	12.50	12.08
	10	7.50	8.33	7.91
	11	1.66	7.50	4.58
	Mean	12.63	9.86	11.38
Average	1	26.52	16.66	21.52
	2	13.19	10.13	11.66
	3	11.80	8.61	10.13
	4	16.38	5.83	11.11
	5	18.05	19.16	18.47
	6	8.05	12.22	10.13
	7	9.16	6.94	8.05
	8	7.63	3.33	5.55
	9	10.27	9.86	10.00
	10	8.05	5.69	6.80
	11	7.63	7.50	7.50
	Mean	12.36	9.58	10.97

Fig1

The results also showed that GYRI of the different genotypes increased with increasing the irrigation level in both seasons (Table 5). This was in agreement with the results of Eck (1988), Garabet *et al* (1998) and Oweis *et al* (1998) who found that irrigation increased crop response to nitrogen application.

On the other hand the decreased average (GYRI) for the different genotypes in the second season could be attributed to the adverse environmental condition in the second season. Singh and Srivastava (1996) also came up with the same conclusion.

Irrigation effects:

The results revealed that irrigation at 500mm of water significantly increased the yield attributing characters namely, number of spikes/m^2 and number of kernels/spike in the two seasons and 1000-kernel weight in the first season only. Based on pooled data, the average increase in number of spikes/m^2 number of kernels/spike and 1000 kernel weight at 500 mm over 300mm irrigation level were 8.8, 13.2 and 6.7%, respectively, (Tables 3-b,c,d). Therefore, there were progressive and significant increases in grain yield of the different genotypes with increasing the amount of irrigation water applied in both seasons. Combined analysis of the 2-year data indicated that irrigation at 500mm resulted in significantly higher average yield of 5.32 t/ha compared with 4.42 t/ha with 300mm, irrespective of the other treatments (Table 3-a). This increase (20.4%) could be due to the higher quantity of available soil moisture resulting in higher solubility and nitrogen uptake and hence, higher grain yields (Rathore and Singh 1978). Higher grain yield of wheat were also reported with higher moisture regimes by Rao and Bhardwaj (1981), Eck (1988), Tomar *et al* (1993), Pal *et al* (1996), Mishra *et al* (1998) and Oweis *et al* (1998).

The entry No 7 with the high water level (500 mm) and high nitrogen rate (240 kg/ha) recorded the highest grain yield over the rest of treatment combinations although the interaction between the different traits (WNV) was not significant.

Water-use efficiency (WUE):

The results of the two studied seasons revealed that there were significant differences among the tested genotypes for (WUE) .Moreover , wheat entries No 6, 7, 8, 5, 4 and 3 were statistically at par and recorded the highest WUE values ranged from 13.0 to 13.7 kg/ha/mm, (Table 4). Ehdaie (1995) and Oweis *et al* (1998) which supports our results also formed significant genotypic variation for WUE.

The results also showed that (WUE) was significantly increased at both irrigation levels for all genotypes with the increment of N fertilization rate in both seasons. Additionally, pooled average data showed that WUE values were, 11.6 and 13.7 kg/ha/mm at the two N rates (Table 4). Thus, the increase in WUE value due to nitrogen application was to an extent of 18.1%. This was probably because nitrogen fertilization increased proportionately much more leaf area and photosynthetic activity of plants. Similar results were obtained by Rao and Bhardwaj (1981), Reddy and Bhardwaj (1982), Eck (1988) and Nielsen and Halvorson (1991).

In contrast, a reverse trend was noted with water supply since, WUE progressively decreased with increasing the irrigation level at both N rates for all genotypes in both seasons, (Table 4). Moreover, WUE values were 14.7 and 10.6 kg/ha/mm with the lower and higher level of irrigation in sequence (Table 4). Although the grain yield at the low water level (300 mm) was reduced by about 17.0%, WUE was increased by 38.7%and this was the main goal of this research. These results are in harmony with the findings of. Rao and Bhardwaj (1981), Reddy and Bhardwaj (1982), Eck (1988) and Singh *et al* (1996).

In conclusion, entry No 7 produced high grain yield with lower and /or higher levels of both irrigation and fertilization, therefor, this line is highly recommended for the wheat national, research program to be evaluated for further advanced steps.

REFERENCES

Eck,H.V. (1988). Winter wheat response to nitrogen and irrigation Agron. J, 80:902-908.

Ehdaie, B. (1995). Variation in water-use efficiency and its components in wheat : II. Pot and field experiments Crop Sci., 35: 1617-1626.

---------- ., Shakiba, M.R. and Waines, J.G. (1999). Path analysis of genotype x environment interactions of wheat to nitrogen. Agronomie, 19 : 45-56.

--------- .and Waines, J.G. (1993).Well-watered pot experiment. Crop Sci., 33: 294-299.

El-Naggar, H.M.M. (1997). Varietal response of yield components and Chemical composition of wheat grains to nitrogen sources. Annals of Agric. Sci., Moshtohor, 35 : 731-744.

Fageria, N.K. and Barbosa Filho . (1981). Screening rice cultivars for higher efficiency of Phosphorus absorption. Pesq. Agropec. Bras. Brasilia, 16 : 777-782. (C.F. Egypt J. Plant Breed 3:89- 99, 1999)

Garabet, S., Ryan, J. and Wood, M. (1998). Nitrogen and water effects on wheat yield in a Mediterranean-type climate. II. Fertilizer-use efficiency with labelled nitrogen .Field Crops Res., 58:213-221.

Gomez , K.A. and A.A. Gomez, (1983) .Statistical procedures for agricultural research .A Wiley interscience publication , John Wiley & Son, 2nd ed.

Iman M.Sadek and Abo-Warda ,A.M.A. (1998) .Response of different wheat varieties to varying levels of nitrogen in the new reclaimed areas . Egypt. J.Appl. Sci.,13: 71-79.

Ismail ,S.M and Shehab El –Din,T.M. (1992) .Wheat yield respons to water and nitrogen under sprinkler irrigation Misr J.Ag.Eng., 9 :617 - 623 .

Mishra, R.K., Pandey, N., Pandey, V.k., Chaudhary, S.K and Paliwal, A.K. (1998). Effect of nitrogen and irrigation scheduling on biomass accumulation and net primary productivity in wheat. Adv. Pl. Sci., 11:99-103.

Nielsen, D.C. and Halvorson, A.D. (1991). Nitrogen fertility influence on water stress and yield of winter wheat Agron. J., 83: 1065-1070.

Oweis, T., Mustafa Pala and Ryan, J. (1998). Stabilizing rainfed wheat yields with supplemental irrigation and nitrogen in a Mediterranean climate. Agron. J., 90: 672-681.

Pal, S.K., Kaur, J., Thakur, R., Verma, U.N. and Singh, M.K. (1996). Effect of irrigation, seeding date and fertilizer on growth and yield of wheat (*Triticum aestivum.* L).Indian J. Agron., 41:386-389.

Rao, Y.G. and Bhardwaj, R.B.L . (1981). Consumptive use of water, growth and yield of Aestivum and Durum wheat varieties at varying levels of nitrogen under limited and adequate irrigation situation .Indian J.Agron., 26 : 243-250 .

Rathore, S.S. and Singh, R.M. (1978). Uptake of N and P by wheat as influenced by soil moisture regimes, N and P fertilization. Indian J. Agron., 23:326-330.

Reddy, A.S. and Bhardwaj, R.B.L. (1982). Water use studies in wheat as influenced by levels of nitrogen and phosphorus under limited and adequate irrigation.Indian J. Agron., 27:22-27.

Sharma, B.D., Jalota, S.K., Kar, S. and Singh, C.B. (1992).Effect of nitrogen and water uptake on yield of wheat. Fert. Res. 31:5-8.

Shehab El-Din ,T.M. (1993) .Effects of twenty nitrogen fertilization levels on spring wheat (*T. aestivum* , L. em. Thell.) in sandy soil . J.Agric. Sci. Mansoura Univ., 18 : 2241 - 2245

Singh, O.P. and Srivastava, R.D.L. (1996). Utilization and response to fertilizer N and productive efficiency of wheat grown under varying levels of nitrogen.Indian J.Pl. Phys., 1: 210 –211

Singh, P.N., Singh, G. and Dey, P. (1996). Effect of supplemental irrigation and nitrogen applications to wheat on water use, yield and uptake of major nutrients.J. Indian Soc. Soil Sci. ,44: 198- 201.

Singh, R., Sannigrahi, A.K. and Kumar, N. (1998). Evaluation of wheat genotypes in upper Brahmaputra valley of Assam. Environ. & Ecology, 16: 353-354.

Tomar, R.K S., Raghu, J.S., Yadav, L.N. and Ghurayya, R.S. (1993). Response of wheat (T. aestivum) varieties to irrigations under different fertility levels. Indian J. Agron., 38: 291-293.

تقييم بعض التراكيب الوراثية لقمح الخبز تحت مستويين للتسميد و الرى فى الأراضى الرملية

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أجرى هذا البحث فى الأراضى الجديدة الرملية بمنطقة البستان لمدة موسميين متتالين 1997/96 ,1998/97 على أحد عشر من تراكيب وراثية جديدة تحت معدلى نتروجين (168, 240 كجم / هكتار) ومعدلين لكميات المياه (300, 500 مم) وذلك لتقييم كفاءة استخدام المياه لهذه السلالات الجديدة فى هذه المنطقة .

وقد أوضحت نتائج التحليل التجميعى لكل من معاملتى الرى و النيتروجين تأثيرات معنوية ايجابية على محصول الحبوب و مكوناته و أيضا كانت هناك أختلافات معنوية فيما بين التراكيب الوراثية المختبرة لمحصول الحبوب الناتج و قد حققت السلالات 3,4,5,7,8,6 أعلى محصول للحبوب بصفه عامة رغم عدم معنوية الفروق بينها .و قد ظهرت اختلافات جوهرية بين محصول السلالات فى الاستجابة للتسميد النتروجينى كما وجد أيضا أن معدل الاستجابة للنتروجين للسلالات يزداد بزيادة كميات مياه الرى .و أوضحت النتائج وجود اختلافات جوهرية لكفاءة استخدام السلالات لمياه الرى حيث تؤدى زيادة كميات مياه الرى إلى تناقص كفاءت تلك السلالات لاستخدام المياه. وقد حققت السلالة رقم 7 محصولاً عالياً تحت كلا المعدلين (168, 240 كجم / هكتار) لكل من الرى و التسميد ولذي نوصى البرنامج القومي لبحوث القمح بتقيمها فىالمراحل المتقدمة من الاختبارات .