# EVALUATION OF SOME NEW BREAD WHEAT GENOTYPES UNDER DIFFERENT IRRIGATION INTERVALS AND N-FERTILIZATION LEVELS IN SANDY SOILS.

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# ABSTRACT

Two field experiments were conducted at El-Bustan region (EL-Behaira Governorate) in 1998/1999 and 1999/2000 seasons to evaluate three new wheat genotypes of bread wheat (*Triticum aestivum*, L.) namely; Gemmeiza 5,Sakha 93 and Giza 168 compared to the two commercial cultivars Sakha 69 and Sids 1 in the sandy soils at three different nitrogen rates (72, 144 and 216 kg N/ha) with four sprinkler irrigation treatments viz., irrigation at 7-day intervals throughout the growing season + increasing the intervals from 7 to 14 days only at either of the three stages of crop growth i.e., from planting to booting, from booting to milk stage and from milk stage to maturity.

Obtained results indicated that irrigation every seven days through the season resulted in the highest grain yield from all tested genotypes. Elongating the interval of irrigation from 7 to 14 days at any of the three growth stages resulted in significant reductions estimated by 19.6, 13.4 and 9.8%, respectively, indicating that the first stage from planting to booting was the most sensitive period for water stress. Yield components; number of spikes/m<sup>2</sup>, number of kernels/spike and 1000-kernel weight were also depressed by elongating the irrigation intervals with reductions being more at the first stage.

Grain yield and yield components of the different genotypes were significantly increased with each successive level of nitrogen application. In addition, differences in grain yield among the tested genotypes were significant. Gemmeiza 5 gave the highest grain yield (5.81 t/ha) but was not significantly different from that produced by Sakha 93. Giza 168 and Sids1 were next to follow whereas, Sakha 69 gave the lowest grain yield (4.61 t/ha).The interactions between the different treatments were significant and the highest yields were produced from cultivars Gemmeiza 5 and Sids 1 irrigated every 7 days throughout the season and fertilized with 216 kgN/ha.

In addition, substantial difference among the genotypes in their response to increasing N fertilizer level was observed. Grain yield response index (GYRI) was highest for cultivar Gemmeiza 5 and lowest for Sakha69. Furthermore, GYRI and water-use efficiency(WUE) were highest when the shortest irrigation interval of 7 days was followed at both the first and the second growth stages and were declined with elongating the intervals at either one of them, particularly in the first stage. Likewise, WUE significantly increased with increasing N application.

Moreover, significant genotypic variation for WUE was obtained and the highest values were achieved from the high-yielding genotypes.

In conclusion, the new cultivars; Gemmeiza 5 followed by Sakha 93 and Giza168 along with the commercial cultivar Sids 1 are highly recommended to be grown in the sandy soil of new reclaimed area of EI-Bustan region (EI-Behaira Governorate) and for maximum yield, irrigation should be practiced every 7 days and N fertilizer should be applied at a rate of 216 kgN/ha.

# INTRODUCTION

Extensive studies on fertilizing and irrigating wheat (*Triticum aestivum*, L.) revealed that both applied N and water are required for substantial yield increases from either variable .For the most efficient use of both of them, the supply of one should be adjusted to that of the other. Mishra *et al.* (1998)reported that plant biomass increased with increasing N rate and irrigation frequency. Also, Singh and Srivastava (1996),Oweis *et al.* (1998) and Ehdaie *et al.* (1999) reported that wheat yield increased by nitrogen application and that the response to N varied with the different genotypes. Meanwhile, Eck (1988), Singh *et al.* (1996), Garabet *et al.* (1998) and Oweis *et al.* (1998) observed increases in yield response to applied N proportional to available soil moisture, whereas Nielsen and Halvorson (1991), Sharma *et al.* (1992) and Sharma and Acharya (1996) showed that sensitivity of wheat grain yield to water uptake was higher at higher N application rates. Also, Ismail and Shehab-El-Din (1992) reported that wheat response to applied water depends on the nitrogen fertilization level..

Nevertheless, there are periods of wheat life cycle during which more frequent irrigation is required (Slatyer, 1969). Rajki (1982) reported that spring wheat plants were extremely sensitive to water stress during tillering and ear formation stages. While, Sharma et al. (1992) found that the sensitivity factor for water uptake was higher at the reproductive stage than at the vegetative and maturation stages. Farah (1986) showed that wheat grain yield was highest when irrigation intervals were shortened in all the three growth stages, while increasing the intervals during the second stage (from booting to milk stage) had a more adverse effect on vield. Ravichandran and Mungse (1997), also showed that flowering was the most sensitive growth stage to moisture stress. Whereas, Hassan et al. (1987) reported that regular irrigation at 10- days interval produced the highest grain yield as well as number of spikes/m<sup>2</sup>, while moisture stress during crown root initiation and jointing stages reduced the wheat grain yield and was also detrimental to spike number and number of kernels/spike . Eck (1988) also showed that under limited irrigation, preventing stress during tillering and jointing is the best strategy for yield sustainability. It was also indicated that number of seeds/m<sup>2</sup> was reduced by water stress with reduction being greater at tillering and jointing than at heading and grain filling stages. Mosaad et al. (1995) found that number of spikes/plant was decreased significantly with increasing water stress during the pre-heading stages. However, Ahmed (1993) and Ibrahim (1995) reported that wheat could tolerate long irrigation intervals up to 28 days during the vegetative growth stage, and that reasonable grain yields could be obtained if moisture stress is avoided by shorter intervals during the reproductive stages.

In Egypt, there is lack of information about the most efficient combination of irrigation water and fertilizer on growth stages of wheat in the new reclaimed areas. Therefore, this study was undertaken to find out the optimum schedule of watering in relation to N levels for obtaining higher grain yield of wheat in sandy soil.

# MATERIALS AND METHODS

A field experiment was conducted in 1998/1999 and repeated in 1999/2000 wheat growing seasons in the new reclaimed area at El-Bustan region, Behaira Governorate to study the response of the following bread wheat genotypes; the two commercial cultivars Sakha 69 and Sids1 and the three newly released cultivars Gemmeiza 5, Sakha 93 and Giza 168 to three different levels of N fertilization with four irrigation intervals. The N levels used were 72, 144 and 216 kg /ha and the four irrigation treatments are listed below as follows:

	Irrigation inter		
Irrigation	planting to	booting to	milking
treatments	booting stage	milking stage	to maturity
I-1	7	7	7
I-2	14	7	7
I-3	7	14	7
I-4	7	7	14

The split-split block design with four replications was used. In this design irrigation treatments were assigned to the main blocks and nitrogen levels to the sub-plot, while the wheat genotypes occupied the sub-sub-plot. The plot size was 4.5 m<sup>2</sup>. The soil of the experimental site is classified as sandy in texture, having low available nitrogen as well as phosphorus and organic matters with pH of 8.2 (Table 1).

The preceding crop was maize in both seasons. During land preparation, 72 kg  $P_2O_5$ /ha in the form of mono-ammonium phosphate (15%  $P_2O_5$ ) and 57 kg  $K_2O$  as potassium sulphate (48%  $K_2O$ ) were broadcasted. Additional dose of 57 kg  $K_2O$ /ha was applied at booting stage. Nitrogen fertilizer in the form of ammonium nitrate (33% N) was used. Planting dates were 20 Nov. 1998, and 22 Nov. 1999 in rows spacing 15 cm using 400 seeds/m<sup>2</sup>.

Fixed sprinkler irrigation system was used. After sowing, irrigation was taken place for 2 hrs/day in the first three days to ensure good emergence and plant stand. Afterwards, irrigation treatments were practiced and a measured amount of water was applied at each of subsequent irrigation. The wheat crop was harvested on May 1<sup>st</sup>, in each season. Yield attributing characters viz., number of spikes/m<sup>2</sup>, number of kernels/spike and 1000 kernel weight, were also investigated along with the grain yield. In addition, water use efficiency (WUE) was worked out as a ratio of produced grain yield (GY) to the total water applied according to Ehdaie and Waines, (1993). Grain yield response index (GYRI) was also calculated as outlined by Fageria and Barbosa Filho (1981):

Yield under high N – yield under low N

# GYRI =

#### High N – low N

All obtained data were subjected to statistical analyses of variance for each season and to combined analysis for the two seasons according to Steel and Torrie (1980), and treatment means were statistically compared using the test of least significant difference (LSD).

	Season						
Analysis							
	1998/1999	1999/2000					
EC mmhos/cm	0.14	0.14					
pН	8.2	8.0					
ESP	2.52	2.50					
CaCO3 %	5.6	5.4					
OM %	0.5	0.5					
N (ppm)	16.3	16.0					
P (ppm)	15.0	16.0					
K (ppm)	87.7	89.0					
Sand %	89.4	89.0					
Silt %	1.1	1.2					
Clay %	9.5	9.8					
Texture	Sandv	Sandv					

Table 1: Soil analyses of the experimental sites.

# **RESULTS AND DISCUSSION**

The combined analysis for the collected data in the two seasons showed no significant effect for season on all studied traits except number of kernels/spike. Therefore, the average of the two seasons for all studied characters will be discussed.

### Irrigation intervals

The results revealed that grain yield of the different genotypes were significantly affected by irrigation treatments in both seasons. Combined analysis showed that irrigation at 7-days interval treatment (I-1) throughout the growing season gave significantly the highest average yield (6.12t/ha), while increasing the intervals of irrigation up to 14 days during the first stage; from planting to booting (I-2) caused the greatest grain yield reduction (19.6%) compared with treatment (I-1), indicating that this stage of crop growth was the most sensitive period for water stress (Tables 2 & 3). This could be expected since that period of growth coincides with the time of initiation of reproductive tillers and spikelet development.

Moreover, Increasing the intervals during the second stage from booting to milk stage (I-3) had a more adverse effect on yield than during the third stage from milk stage to maturity (I-4). However, the differences between the two treatments were not significant in both seasons and combined analysis as well. Based on pooled data, the reductions were 13.4 and 9.8% for the two treatments, respectively as compared with treatment(I-1). This result was in agreement with the findings of Slatyer (1969), Rajki (1982), Farah (1986), Hassan *et al.* (1987) and Mishra *et al.* (1998).

fertilization levels at El-Bustan region combined over 1998/1999 and 1999/2000 growing seasons .											
Treat.	Grain yield (t/ha)	Spikes no./m <sup>2</sup>	Kernels no./spike	1000-kernel weight (gm)	WUE (kg/ha/mm)						
Irrigation (I)*											
Ĭ-1	6.12	470	49.2	50.9	13.0						
I-2	4.92	387	44.1	47.0	12.0						
I-3	5.30	432	46.2	48.7	12.3						
I-4	5.52	442	46.3	48.0	13.1						
LSD at 0.05 level	0.28	26.7	1.8	1.6	0.7						
Nitrogen (N)											
72 kg N/ha	4.85	388	42.4	45.6	11.2						
144 kg N/ha	5.50	435	46.5	48.8	12.7						
216 kg N/ha	6.04	475	50.5	51.6	14.0						
LSD at 0.05 level	0.08	7.7	1.0	0.7	0.2						
Cultivras (C)											
Sids 1	5.58	437	48.2	49.2	12.9						
Sakha 69	4.61	384	43.7	45.7	10.7						
Sakha 93	5.70	454	44.4	50.9	13.2						
Gemmeiza 5	5.81	449	48.5	49.8	13.4						
Giza 168	5.62	439	47.5	47.7	13.0						
LSD at 0.05 level	0.14	13.9	1.2	1.1	0.3						
Interactions											
season	NS	NS	*	NS	NS						
I x N	*	*	NS	*	*						
IxC	*	*	*	*	*						
NxC	NS	NS	*	NS	NS						
IxNxC	*	NS	*	NS	*						

Table (2): Grain yield and other agronomic traits of five wheat cultivars as affected by variation in the irrigation intervals and N

The direct depressive effects of increasing the intervals of irrigation at the different growth stages on the yield components could explain the effect of this treatment on grain yield. For instance, number of spikes/m<sup>2</sup> was markedly reduced with increasing irrigation intervals from 7 to 14 days at the three growth stages; (I-2), (I-3) and (I-4), although, the difference between the two treatments (I-3) and (I-4) was not significant. These reductions were

$\begin{array}{c c c c c c c c c c c c c c c c c c c $	Irri. N level	Sids	Sakha S	akhaG	Gemm.	Giza	Average	Sids 3	Sakhas	Sakha	Gemr	n.Giza	Average
$ \begin{bmatrix} 1 & 72 & 572 & 506 & 538 & 501 & 544 & 564 & 528 & 439 & 533 & 532 & 578 & 521 \\ 144 & 596 & 578 & 672 & 725 & 627 & 640 & 572 & 478 & 544 & 670 & 641 & 5.82 \\ 216 & 618 & 64.6 & 637 & 706 & 626 & 6.33 & 614 & 477 & 576 & 644 & 647 & 5.9 \\ 127 & 21 & 15 & 476 & 451 & 434 & 4.10 & 4.37 & 346 & 361 & 457 & 5.09 & 4.74 & 4.37 \\ 144 & 512 & 467 & 500 & 467 & 5.33 & 4.96 & 4.71 & 4.00 & 578 & 600 & 4.93 & 5.08 \\ 216 & 564 & 431 & 560 & 574 & 528 & 4.98 & 4.73 & 307 & 433 & 555 & 4.45 & 5.46 \\ 144 & 517 & 272 & 543 & 427 & 512 & 4.76 & 529 & 4.98 & 4.73 & 307 & 433 & 555 & 4.45 & 5.45 \\ 144 & 597 & 4.77 & 571 & 2.47 & 526 & 5.48 & 5.43 & 5.64 & 3.09 & 4.12 & 5.63 & 5.18 \\ 216 & 620 & 526 & 6.92 & 5.76 & 4.62 & 5.48 & 5.43 & 5.64 & 3.09 & 4.02 & 5.63 & 5.18 \\ 216 & 620 & 526 & 6.92 & 5.76 & 4.62 & 5.73 & 5.64 & 4.50 & 5.67 & 4.32 & 5.09 & 4.62 & 5.38 \\ 4.47 & 22 & 5.56 & 4.47 & 5.57 & 4.82 & 4.97 & 5.62 & 3.54 & 5.69 & 5.26 & 5.18 \\ 216 & 6.20 & 5.26 & 5.18 & 5.49 & 5.22 & 5.73 & 5.64 & 4.54 & 6.99 & 4.02 & 5.38 & 5.49 \\ 144 & 5.76 & 5.31 & 6.40 & 5.44 & 5.24 & 5.14 & 4.89 & 5.16 & 5.46 & 5.19 \\ 144 & 5.76 & 5.31 & 6.40 & 5.44 & 5.24 & 5.14 & 4.89 & 5.16 & 5.46 & 5.36 \\ 216 & 6.11 & 5.94 & 6.21 & 5.64 & 5.40 & 5.65 & 5.57 & 4.32 & 5.70 & 5.36 & 6.03 & 5.39 \\ 172 & 5.21 & 4.63 & 5.18 & 5.42 & 5.11 & 5.44 & 5.49 & 5.17 & 5.96 & 5.36 \\ 216 & 6.21 & 5.54 & 6.29 & 6.65 & 5.65 & 5.57 & 5.44 & 4.12 & 5.28 & 5.91 & 5.75 & 5.36 \\ 144 & 5.76 & 5.22 & 5.73 & 5.58 & 5.63 & 5.40 & 4.14 & 5.8 & 6.03 & 5.39 \\ 1 \times N & NS & 0.177 \\ Cultivars (C) & 0.14 & 0.05 & 0.08 & 6.21 & 4.58 & 6.26 & 6.65 & 6.01 \\ 1 \times 4 & 5.27 & 5.20 & 5.67 & 5.81 & 5.43 & 5.43 & 5.44 & 5.41 & 5.41 & 5.44 & 5.44 & 5.44 & 5.45 & 6.01 \\ 1 \times 2 & 7.2 & 4.00 & 4.19 & 5.45 & 5.75 & 5.31 & 5.44 & 4.12 & 5.28 & 5.91 & 5.75 & 5.36 \\ 1 \times 1 & 2 & 6 & 6.37 & 5.67 & 5.81 & 5.43 & 5.43 & 5.44 & 5.41 & 5.45 & 5.44 & 4.12 & 5.28 & 5.91 & 5.75 & 5.36 & 6.01 \\ 1 \times 2 & 7.2 & 4.00 & 4.19 & 4.54 & 4.72 & 4.24 & 4.37 & 1.44 & 5.85 & 6.66 & 5.55 & 5.31 & 1.17 & 7.5 & 8.4 & 13.1 & $	I reat. Kg/ha	1	69	93	5	168		1	69	93	5	168	
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	I-1 72	5 72	5.06	5 58	9 6 0 1	5 84	5 64	5 25	4 39	1999/ 5 33	5 32	5 78	5 21
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	144	5.96	5.78	6.72	7.25	6.27	6.40	5.72	4.75	5.44	6.80	6.41	5.82
Average 6.19 5.76 6.37 7.06 6.26 6.33 6.14 4.77 5.76 6.44 6.42 5.91 12 72 4.15 4.76 4.51 4.37 3.86 3.61 4.57 5.09 4.74 4.37 144 5.12 4.67 5.00 4.67 5.33 4.96 4.71 4.00 5.76 6.00 4.93 5.08 216 5.64 4.51 5.60 5.74 5.14 5.33 5.09 4.14 5.88 6.33 5.52 5.39 Average 4.97 4.64 5.04 4.92 4.86 4.89 4.56 3.92 5.40 4.95 13 72 5.43 4.27 5.12 4.76 5.29 4.98 4.89 4.56 3.92 5.40 4.95 144 5.97 4.77 5.69 5.24 5.48 5.43 5.64 3.27 5.21 6.19 5.62 5.19 216 6.20 5.26 6.32 5.76 5.46 5.80 6.14 4.11 6.29 6.31 6.41 5.88 Average 5.87 4.77 5.71 5.26 5.41 5.40 5.51 3.48 5.48 6.01 5.49 5.19 144 5.76 5.31 6.40 5.94 5.22 5.73 5.54 4.54 5.60 5.33 4.72 216 6.21 5.26 6.34 5.76 5.46 5.65 5.57 4.32 5.07 5.96 5.36 216 6.11 5.94 6.41 6.42 6.31 6.24 6.14 6.24 6.31 6.24 6.93 6.30 5.99 72 5.21 4.63 5.18 4.92 5.01 4.99 4.71 3.65 4.98 5.15 5.07 4.71 144 5.70 5.13 5.95 5.78 5.58 5.63 5.57 4.32 5.70 5.36 6.03 5.39 72 5.21 4.63 5.18 4.92 5.01 4.99 4.71 3.65 4.98 5.15 5.07 4.71 144 5.70 5.13 5.95 5.78 5.58 5.63 5.63 5.40 4.14 5.53 6.02 5.73 5.36 Average 5.71 5.10 5.81 5.72 5.50 5.67 5.44 4.12 5.85 5.91 5.77 4.71 144 5.70 5.13 5.95 5.78 5.58 5.63 5.63 5.40 4.14 5.53 6.02 5.73 5.36 20% 7.12 10.5	216	6.88	6.44	6.81	7.91	6.68	6.95	7.46	5.18	6.51	7.19	7.07	6.68
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	Average	6.19	5.76	6.37	7.06	6.26	6.33	 6.14	4.77	5.76	6.44	6.42	5.91
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	I-2 72	4.15	4.76	4.51	4.34	4.10	4.37	3.86	3.61	4.57	5.09	4.74	4.37
Average 4.97 4.64 5.04 4.92 4.86 4.89 4.56 3.92 5.40 5.81 5.06 4.95 1.3 72 5.43 4.27 5.12 4.78 5.29 4.98 4.73 3.07 4.93 5.56 4.45 4.56 144 5.97 4.77 5.69 5.24 5.48 5.43 5.64 3.27 5.21 6.19 5.62 5.19 216 6.20 5.26 6.32 5.76 5.46 5.80 6.14 4.11 6.29 6.31 6.41 5.88 Average 5.87 4.77 5.71 5.26 5.41 5.40 5.51 3.48 5.48 6.21 5.49 5.19 144 5.76 5.31 6.40 5.94 5.22 5.73 5.54 4.54 5.80 5.74 4.32 5.70 5.76 5.36 216 6.11 5.94 6.41 6.42 6.31 6.24 6.14 4.89 6.31 6.40 6.79 6.11 Average 5.81 5.22 6.11 5.64 5.45 5.56 5.57 4.32 5.70 5.36 6.03 5.39 72 5.21 6.31 5.94 5.41 6.42 5.90 6.08 6.21 4.89 6.31 6.40 6.79 6.11 Average 5.81 5.22 6.11 5.84 5.45 5.65 5.57 4.32 5.70 5.36 6.02 5.73 5.36 216 6.21 5.54 6.29 6.48 5.90 6.08 6.21 4.58 6.25 6.56 6.45 6.01 Average 5.71 5.10 5.81 5.72 5.50 5.57 5.44 4.12 5.58 5.91 5.75 5.36 CV% 7.12 LSD at 0.05 level for Irrigation (I) 0.35 0.17 7 Cultivars (C) 0.16 0.22 0.44 5.04 0.17 Combined 0.17 Cultivars (C) 0.16 0.35 0.95 7.58 1.54 0.22 0.71 0.55 1.1 7 2.58 4.73 5.45 5.67 5.81 5.43 1.44 5.84 5.26 6.08 7.02 6.34 6.11 2.17 2.58 4.73 5.45 5.67 5.81 5.43 1.44 5.84 5.26 6.08 7.02 6.34 6.11 1.72 5.84 1.73 5.45 5.67 5.81 5.43 1.44 5.84 5.26 6.08 7.02 6.34 6.11 1.72 5.84 1.73 5.45 5.67 5.81 5.43 1.44 5.84 5.26 6.08 7.02 6.34 6.11 2.17 2.58 4.73 5.45 5.67 5.81 5.43 1.44 5.84 5.26 6.08 7.02 6.34 6.11 2.16 6.17 5.27 6.06 6.75 6.34 6.12 11.7 7.5 8.4 13.1 7.4 9.6 1.2 72 4.00 4.19 4.54 3.54 5.51 5.33 2.16 6.17 5.27 6.06 6.75 6.34 6.12 11.7 7.5 8.4 13.1 7.4 9.6 1.2 72 5.08 3.67 5.05 5.74 5.85 5.34 5.33 2.46 6.37 4.32 5.74 6.48 3.13 5.02 2.46 6.37 4.32 5.74 6.48 3.13 5.02 2.46 6.47 4.59 5.05 5.74 5.55 2.47 4.96 6.74 4.28 5.22 5.36 4.96 4.92 9.5 0.9 8.3 9.1 6.3 6.9 1.44 5.81 4.02 5.45 5.71 5.55 5.31 2.16 6.17 5.20 5.07 4.84 2.16 6.17 5.20 5.07 4.84 2.16 6.13 5.42 6.34 6.41 6.55 6.17 2.496 6.14 5.75 5.50 5.74 5.52 5.8 10.1 7.2 1.2.6 10.3 9.2 2.4 4.96 4.46 5.74 5.90 5.65 5.50 2.16 6.21 5.06 6.27 6.51 6.17 6.04 2.16 6.21 5.06 6.27 6.51 6.17 6.04 2.16 6.21 5.06 6.27 6.51 6.	216	5.12	4.67	5.00	4.67	5.33	4.90	4.71	4.00	5.76	6.00	4.93	5.08
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	Average	4.97	4.64	5.04	4.92	4.86	4.89	4.56	3.92	5.40	5.81	5.06	4.95
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	1-3 72	5.43	4.27	5.12	4.78	5.29	4.98	 4.73	3.07	4.93	5.55	4.45	4.55
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	144	5.97	4.77	5.69	5.24	5.48	5.43	5.64	3.27	5.21	6.19	5.62	5.19
Average 5.87 4.77 5.71 5.26 5.41 5.72 5.57 5.44 15 5.26 5.47 4.22 5.73 5.54 4.54 5.09 5.07 5.96 5.36 5.36 5.36 6.11 5.24 5.41 5.52 5.41 5.52 5.73 5.54 4.54 5.69 5.07 5.96 5.36 72 5.96 5.36 5.37 72 5.21 4.63 5.18 4.92 5.01 4.99 4.71 3.65 4.98 5.15 5.07 4.71 4.4 5.70 5.13 5.95 5.78 5.58 5.65 5.57 4.32 5.70 5.36 6.03 5.39 72 5.21 4.63 5.18 4.92 5.01 4.99 4.71 3.65 4.98 5.15 5.07 4.71 4.4 5.70 5.13 5.95 5.78 5.58 5.65 5.57 4.32 5.70 5.36 6.03 5.39 72 5.21 4.63 5.18 4.92 5.01 4.99 4.71 3.65 4.98 5.15 5.07 4.71 4.71 4.573 6.02 5.73 5.36 6.03 5.39 72 5.21 4.53 5.25 5.78 5.54 4.14 5.53 6.02 5.73 5.36 72 5.36 7.25 5.36 5.01 4.14 5.53 6.02 5.73 5.36 72 5.36 72 5.36 72 5.36 72 5.36 72 5.36 72 5.36 5.01 5.36 5.27 5.54 4.12 5.58 5.91 5.75 5.36 5.01 5.36 5.20 5.76 5.36 5.27 5.34 4.12 5.58 5.91 5.75 5.36 5.20 5.76 5.36 5.27 5.34 4.12 5.58 5.91 5.75 5.36 5.27 5.34 4.12 5.58 5.91 5.75 5.36 5.20 5.76 5.36 5.20 5.20 5.20 5.20 5.20 5.20 5.20 5.20	216	6.20	5.26	6.32	5.76	5.46	5.80	6.14	4.11	6.29	6.31	6.41	5.85
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	Average	5.87	4.//	5.71	5.26	5.41	5.40	 5.51	3.48	5.48	6.01	5.49	5.19
17t  5.10  5.31  6.34  6.24  6.33  6.24  6.34  6.34  6.35  6.30  5.33  5.36  6.01  7.71  7.71  5.36  6.01  7.72  5.36  6.01  7.72  5.36  6.01  7.72  5.36  6.01  7.71  7.10  8.13	1-4 72	5.55	4.41	5.52	4.57	4.82	4.97	5.02	3.54	5.09	4.62	5.33	4.72
Average  5.81  5.22  6.11  5.64  5.65  5.57  4.32  5.70  5.36  6.03  5.39    72  5.21  4.63  5.18  4.99  4.71  3.66  4.98  5.15  5.07  4.71    144  5.70  5.13  5.95  5.58  5.63  5.40  4.14  5.53  6.02  5.73  5.36    216  6.21  5.54  6.29  6.46  5.90  6.08  6.21  4.58  6.25  5.66  6.45  6.01    Average  5.71  5.10  5.81  5.72  5.57  5.44  4.12  5.58  5.91  5.75  5.36    CV%  7.12  10.5  0.48  0.09  1.1  1.03  0.09  1.1	216	6 1 1	5.94	6 4 1	6 42	6.31	6 24	6 14	4.34	6.31	6 40	6 79	6 11
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	Average	5.81	5.22	6.11	5.64	5.45	5.65	5.57	4.32	5.70	5.36	6.03	5.39
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	72	5.21	4.63	5.18	4.92	5.01	4.99	 4.71	3.65	4.98	5.15	5.07	4.71
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	144	5.70	5.13	5.95	5.78	5.58	5.63	5.40	4.14	5.53	6.02	5.73	5.36
Average  5.71  5.10  5.81  5.72  5.50  5.57  5.44  4.12  5.58  5.91  5.75  5.36    CV%  7.12  ID  0.35  0.48  0.05  0.48  0.09  10.5    LSD at 0.05 level for  0.11  0.35  0.48  0.09  1.7  0.09  1.7    Cultivars (C)  0.16  0.22  1.7  0.45  NS  1.7  0.445  NS  1.7  1.44  5.84  5.67  5.81  5.43  1.44  5.48  5.67  5.81  5.43  1.44  5.48  5.67  5.81  5.43  1.7  7.8  8.4  13.1  7.4  9.6  1.2  7.2  4.00  4.19  4.54  4.72  4.33  11.7  7.5  8.4  13.1  7.4  9.6  1.2  72  4.00  4.19  4.54  4.72  4.33  11.7  7.5  8.4  13.1  7.4  9.6  1.2  72  4.00  4.19  5.55  5.31  2.16  6.3  5.92  5.64  6.12  11	216	6.21	5.54	6.29	6.46	5.90	6.08	6.21	4.58	6.25	6.56	6.45	6.01
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	Average	5.71	5.10	5.81	5.72	5.50	5.57	 5.44	4.12	5.58	5.91	5.75	5.36
$ \begin{array}{  c    c   c   c  } \hline Call 0.03   even 101 \\ \hline Irrigation (1) & 0.35 & 0.48 \\ \hline Nitrogen (N) & 0.14 & 0.09 \\ \hline I \times N & NS & 0.17 \\ \hline Cultivars (C) & 0.16 & 0.22 \\ \hline I \times C & 0.32 & 0.45 \\ \hline N \times C & 0.27 & NS \\ \hline I \times C \times N & 0.55 & NS \\ \hline \hline C & Combined & GYR \\ \hline 1 & 72 & 5.48 & 5.26 & 6.08 & 7.02 & 6.34 & 6.11 \\ \hline 2 & 72 & 4.00 & 4.19 & 4.54 & 4.72 & 4.24 & 4.37 \\ \hline 144 & 5.84 & 5.26 & 6.08 & 7.02 & 6.34 & 6.12 & 11.7 & 7.5 & 8.4 & 13.1 & 7.4 & 9.6 \\ \hline I & 7.17 & 5.81 & 6.66 & 7.55 & 6.88 & 6.81 \\ \hline Average & 6.17 & 5.27 & 6.06 & 6.75 & 6.34 & 6.12 & 11.7 & 7.5 & 8.4 & 13.1 & 7.4 & 9.6 \\ \hline I & 7 & 72 & 4.00 & 4.19 & 4.54 & 4.72 & 4.42 & 4.37 \\ \hline 144 & 4.92 & 4.33 & 5.38 & 5.34 & 5.13 & 5.02 \\ \hline 2 & 72 & 4.00 & 4.19 & 4.54 & 4.72 & 4.42 & 4.37 \\ \hline 144 & 4.92 & 4.33 & 5.38 & 5.34 & 5.13 & 5.02 \\ \hline 2 & 16 & 5.37 & 4.22 & 5.74 & 6.03 & 5.33 & 5.36 \\ \hline Average & 4.76 & 4.28 & 5.22 & 5.36 & 4.96 & 4.92 & 9.5 & 0.9 & 8.3 & 9.1 & 6.3 & 6.9 \\ \hline I & 72 & 5.08 & 3.67 & 5.02 & 5.16 & 4.87 & 4.76 \\ \hline 144 & 5.81 & 4.02 & 5.45 & 5.71 & 5.55 & 5.31 \\ \hline 2 & 16 & 6.17 & 4.86 & 6.30 & 6.03 & 5.93 & 5.83 \\ \hline Average & 5.69 & 4.13 & 5.59 & 5.64 & 5.45 & 5.30 & 7.6 & 7.0 & 8.9 & 6.0 & 7.4 & 7.4 \\ \hline I & 4 & 72 & 5.29 & 3.97 & 5.31 & 4.59 & 5.07 & 4.84 \\ \hline 144 & 5.65 & 4.92 & 6.04 & 5.01 & 5.59 & 5.54 \\ \hline 2 & 16 & 6.13 & 5.42 & 6.34 & 6.41 & 6.56 & 6.17 \\ \hline Average & 5.69 & 4.77 & 5.90 & 5.50 & 5.74 & 5.52 & 5.8 & 10.1 & 7.2 & 12.6 & 10.3 & 9.2 \\ \hline \hline 72 & 4.96 & 4.14 & 5.08 & 5.03 & 5.04 & 4.85 \\ \hline 144 & 5.55 & 6.44 & 5.74 & 5.90 & 5.65 & 5.50 \\ \hline 2 & 16 & 6.21 & 5.06 & 6.27 & 6.51 & 6.17 & 6.04 \\ \hline Average & 5.58 & 4.61 & 5.70 & 5.81 & 5.62 & 5.46 & 8.7 & 6.4 & 8.3 & 10.3 & 7.8 & 8.3 \\ \hline CV & Season (S) & NS \\ \hline Irrigation (h) & 0.28 \\ \hline Nitrogen (N) & 0.08 \\ \hline I \times N & 0.17 \\ \hline Cultivars (C) & 0.14 \\ \hline \end{array}$	CV%	7.12						10.5					
Nitrogen (N)  0.14  0.09    IxN  NS  0.17    Cultivars (C)  0.16  0.22    IxC  0.32  0.45    NxC  0.27  NS    IxCxN  0.55  NS    Combined  GYRI    I-1  72  5.48  4.73  5.45  5.67  5.81  5.43    144  5.26  6.08  7.02  6.34  6.11  2  7.7  5.84  13.1  7.4  9.6    I-2  72  4.00  4.19  4.54  4.72  4.42  4.37  5.45  5.67  5.81  5.02  5.09  8.3  9.1  6.3  6.9    I-2  72  4.00  4.94  4.54  4.72  4.42  4.37  5.45  5.31  5.02  2.16  5.37  4.32  5.74  6.03  5.33  5.36  Average  4.76  4.44  5.65  5.31  2.16  4.87  4.76  4.44  5.65  5.31  2.16  5.93  5.64  5.45  5.30	Irrigation (I)		0.35							0	48		
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	Nitrogen (N	)	0.14							0.	09		
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	I x N	<i>,</i>	NS							Ó.	17		
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	Cultivars (C	)	0.16							0.	22		
$\begin{array}{ c c c c c c c c c c c c c c c c c c c$	IXC		0.32							0.	45		
Combined    GYRI      11    72    5.48    4.73    5.45    5.67    5.81    5.43      144    5.84    5.26    6.08    7.02    6.34    6.11      216    7.17    5.81    6.66    7.55    6.88    6.81      Average    6.17    5.27    6.06    6.75    6.34    6.12    11.7    7.5    8.4    13.1    7.4    9.6      I-2    72    4.00    4.19    4.54    4.72    4.42    4.37      144    4.92    4.33    5.38    5.34    5.13    5.02      216    5.37    4.32    5.74    6.03    5.33    5.36      Average    5.69    4.13    5.59    5.64    5.45    5.30    7.6    7.0    8.9    6.0    7.4    7.4      1-4    72    5.29    3.97    5.31    4.59    5.07    4.84      144    5.65    4.92    6.04 <td< td=""><td></td><td></td><td>0.27</td><td></td><td></td><td></td><td></td><td></td><td></td><td>N</td><td>IS</td><td></td><td></td></td<>			0.27							N	IS		
I-1 72 5.48 4.73 5.45 5.67 5.81 5.43 144 5.84 5.26 6.08 7.02 6.34 6.11 216 7.17 5.81 6.66 7.55 6.88 6.81 Average 6.17 5.27 6.06 6.75 6.34 6.12 11.7 7.5 8.4 13.1 7.4 9.6 I-2 72 4.00 4.19 4.54 4.72 4.42 4.37 144 4.92 4.33 5.38 5.34 5.13 5.02 216 5.37 4.32 5.74 6.03 5.33 5.36 Average 4.76 4.28 5.22 5.36 4.96 4.92 9.5 0.9 8.3 9.1 6.3 6.9 I-3 72 5.08 3.67 5.02 5.16 4.87 4.76 144 5.81 4.02 5.45 5.71 5.55 5.31 216 6.17 4.68 6.30 6.03 5.93 5.83 Average 5.69 4.13 5.59 5.64 5.45 5.30 7.6 7.0 8.9 6.0 7.4 7.4 I-4 72 5.29 3.97 5.31 4.59 5.07 4.84 144 5.65 4.92 6.04 5.01 5.59 5.54 216 6.13 5.42 6.34 6.41 6.55 6.17 Average 5.69 4.77 5.90 5.50 5.74 5.52 5.8 10.1 7.2 12.6 10.3 9.2 72 4.96 4.14 5.08 5.03 5.04 4.85 144 5.55 4.64 5.74 5.90 5.65 5.50 216 6.21 5.06 6.27 6.51 6.17 6.04 Average 5.58 4.61 5.70 5.81 5.62 5.46 8.7 6.4 8.3 10.3 7.8 8.3 CV% 8.9 LSD at 0.05 level for Season (S) NS Irrigation (I) 0.28 Nitrogen (N) 0.08 I x N 0.17 Cultivars (C) 0.14			Cor	nbine	d					GY	RI		
144  5.84  5.26  6.08  7.02  6.34  6.11    216  7.17  5.81  6.66  7.55  6.88  6.81    Average  6.17  5.27  6.06  6.75  6.34  6.12  11.7  7.5  8.4  13.1  7.4  9.6    I-2  72  4.00  4.19  4.54  4.72  4.42  4.37    144  4.92  4.33  5.38  5.34  5.13  5.02    216  5.37  4.32  5.74  6.03  5.35  5.36    Average  4.76  4.28  5.22  5.36  4.96  4.92  9.5  0.9  8.3  9.1  6.3  6.9    I-3  72  5.08  3.67  5.02  5.16  4.87  4.76  4.44  5.81  4.02  5.45  5.31    216  6.13  5.49  5.01  5.55  5.31  5.54  5.44  5.55  5.54    216  6.13  5.42  5.03  5.04  4.85  6.07  7.8  8	I-1 72	5.48	4.73	5.45	5.67	5.81	5.43						
216  7.17  5.81  6.66  7.55  6.88  6.81    Average  6.17  5.27  6.06  6.75  6.34  6.12  11.7  7.5  8.4  13.1  7.4  9.6    I-2  72  4.00  4.19  4.54  4.72  4.42  4.37    144  4.92  4.33  5.38  5.34  5.13  5.02    216  5.37  4.32  5.74  6.03  5.33  5.36    Average  4.76  4.28  5.22  5.36  4.96  4.92  9.5  0.9  8.3  9.1  6.3  6.9    I-3  72  5.08  3.67  5.02  5.16  4.87  4.76    144  5.81  4.02  5.45  5.71  5.55  5.31    216  6.17  4.88  6.30  6.03  5.93  5.83    Average  5.69  4.13  5.59  5.64  5.45  5.30  7.6  7.0  8.9  6.0  7.4  7.4    I-4  72  5.90 </td <td>144</td> <td>5.84</td> <td>5.26</td> <td>6.08</td> <td>7.02</td> <td>6.34</td> <td>6.11</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td>	144	5.84	5.26	6.08	7.02	6.34	6.11						
Average  0.11  5.27  0.00  0.73  0.54  0.12  11.7  7.3  0.4  13.1  7.4  9.0    1-2  72  4.00  4.19  4.54  4.72  4.42  4.37  144  4.92  4.33  5.38  5.34  5.13  5.02  216  5.37  4.32  5.74  6.03  5.33  5.36  Ayer  9.5  0.9  8.3  9.1  6.3  6.9    1-3  72  5.08  3.67  5.02  5.16  4.87  4.76    144  5.81  4.02  5.45  5.71  5.55  5.31  216  6.17  4.88  6.00  7.4  7.4    144  5.69  4.13  5.59  5.64  5.45  5.30  7.6  7.0  8.9  6.0  7.4  7.4    1-4  72  5.29  3.97  5.31  4.59  5.07  4.84  4.34  4.34  5.4  6.4  6.4  5.55  5.54    216  6.13  5.42  6.34  6.41  6.55	216	6.17	5.81	6.66	7.55	6.88	6.81	117	75	01	12.1	74	0.6
112  1.00  4.13  4.17  4.12  4.12  4.13  5.14  4.13  5.12  4.14  5.13  5.13  5.02  216  5.37  4.32  5.74  6.03  5.33  5.36    Average  4.76  4.28  5.22  5.36  4.96  4.92  9.5  0.9  8.3  9.1  6.3  6.9    13  72  5.08  3.67  5.02  5.16  4.87  4.76  4.14  5.81  4.02  5.45  5.71  5.55  5.31    216  6.17  4.68  6.30  6.03  5.93  5.83  7.6  7.0  8.9  6.0  7.4  7.4    144  5.65  4.92  6.04  5.01  5.59  5.54  216  6.13  5.42  6.34  6.41  6.55  6.17    Average  5.69  4.77  5.90  5.50  5.74  5.52  5.8  10.1  7.2  12.6  10.3  9.2    72  4.96  4.14  5.08  5.03  5.04  4.85  4		4 00	1 10	4.54	4 72	1 12	4 27	 11.7	7.5	0.4	13.1	1.4	9.0
116  5.37  4.32  5.74  6.03  5.33  5.36    Average  4.76  4.28  5.22  5.36  4.96  4.92  9.5  0.9  8.3  9.1  6.3  6.9    I-3  72  5.08  3.67  5.02  5.16  4.87  4.76    144  5.81  4.02  5.45  5.71  5.55  5.31    216  6.17  4.68  6.30  6.03  5.93  5.83    Average  5.69  4.13  5.59  5.64  5.45  5.30  7.6  7.0  8.9  6.0  7.4  7.4    I-4  72  5.29  3.97  5.31  4.59  5.07  4.84    144  5.65  4.92  6.04  5.01  5.54  216  6.13  5.42  6.34  6.41  6.55  6.17    Average  5.69  4.77  5.90  5.50  5.74  5.52  5.8  10.1  7.2  12.6  10.3  9.2    72  4.96  4.14  5.08  5.0	144	4.00	4.19	5.38	5.34	5 13	5.02						
Average  4.76  4.28  5.22  5.36  4.96  4.92  9.5  0.9  8.3  9.1  6.3  6.9    I-3  72  5.08  3.67  5.02  5.16  4.87  4.76    144  5.81  4.02  5.45  5.71  5.55  5.31    216  6.17  4.68  6.30  6.03  5.93  5.83    Average  5.69  4.13  5.59  5.64  5.45  5.30  7.6  7.0  8.9  6.0  7.4  7.4    I-4  72  5.29  3.97  5.31  4.59  5.07  4.84    144  5.65  4.92  6.04  5.01  5.54  5.21  5.8  10.1  7.2  12.6  10.3  9.2    72  4.96  4.14  5.08  5.03  5.04  4.85  144  5.55  4.64  5.70  5.50  5.74  5.52  5.8  10.1  7.2  12.6  10.3  9.2    72  4.96  4.14  5.08  5.03  5.04	216	5.37	4.32	5.74	6.03	5.33	5.36						
I-3 72 5.08 3.67 5.02 5.16 4.87 4.76 144 5.81 4.02 5.45 5.71 5.55 5.31 216 6.17 4.68 6.30 6.03 5.93 5.83 Average 5.69 4.13 5.59 5.64 5.45 5.30 7.6 7.0 8.9 6.0 7.4 7.4 I-4 72 5.29 3.97 5.31 4.59 5.07 4.84 144 5.65 4.92 6.04 5.01 5.59 5.54 216 6.13 5.42 6.34 6.41 6.55 6.17 Average 5.69 4.77 5.90 5.50 5.74 5.52 5.8 10.1 7.2 12.6 10.3 9.2 72 4.96 4.14 5.08 5.03 5.04 4.85 144 5.55 4.64 5.74 5.90 5.65 5.50 216 6.21 5.06 6.27 6.51 6.17 6.04 Average 5.58 4.61 5.70 5.81 5.62 5.46 8.7 6.4 8.3 10.3 7.8 8.3 CV% 8.9 LSD at 0.05 level for Season (S) NS Irrigation (I) 0.28 Nitrogen (N) 0.08 I x N 0.17 Cultivars (C) 0.14	Average	4.76	4.28	5.22	5.36	4.96	4.92	9.5	0.9	8.3	9.1	6.3	6.9
144  5.81  4.02  5.45  5.71  5.55  5.31    216  6.17  4.68  6.30  6.03  5.93  5.83    Average  5.69  4.13  5.59  5.64  5.45  5.30  7.6  7.0  8.9  6.0  7.4  7.4    I-4  72  5.29  3.97  5.31  4.59  5.07  4.84    144  5.65  6.49  6.04  5.01  5.59  5.54    216  6.13  5.42  6.34  6.41  6.55  6.17    Average  5.69  4.77  5.90  5.50  5.74  5.52  5.8  10.1  7.2  12.6  10.3  9.2    72  4.96  4.14  5.08  5.03  5.04  4.85  4.85  4.46  5.50  216  6.27  6.51  6.17  6.04  Average  5.58  4.61  5.70  5.81  5.62  5.46  8.7  6.4  8.3  10.3  7.8  8.3    CV%  8.9  LSD at 0.05 level for  Sea	1-3 72	5.08	3.67	5.02	5.16	4.87	4.76	 					
216  6.17  4.68  6.30  6.03  5.93  5.83    Average  5.69  4.13  5.59  5.64  5.45  5.30  7.6  7.0  8.9  6.0  7.4  7.4    1-4  72  5.29  3.97  5.31  4.59  5.07  4.84    144  5.65  4.92  6.04  5.01  5.59  5.54    216  6.13  5.42  6.34  6.41  6.55  6.17    Average  5.69  4.77  5.90  5.50  5.74  5.52  5.8  10.1  7.2  12.6  10.3  9.2    72  4.96  4.14  5.08  5.03  5.04  4.85    144  5.55  4.64  5.74  5.90  5.65  5.50    216  6.21  5.06  6.27  6.51  6.17  6.04    Average  5.58  4.61  5.70  5.81  5.62  5.46  8.7  6.4  8.3  10.3  7.8  8.3    CV%  8.9  LSD  N </td <td>144</td> <td>5.81</td> <td>4.02</td> <td>5.45</td> <td>5.71</td> <td>5.55</td> <td>5.31</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td>	144	5.81	4.02	5.45	5.71	5.55	5.31						
Average  5.09  4.13  5.39  5.04  5.43  5.30  7.6  7.0  5.9  6.0  7.4  7.4    I-4  7.2  5.29  3.97  5.31  4.59  5.07  4.84    144  5.65  4.92  6.04  5.01  5.59  5.54    216  6.13  5.42  6.34  6.41  6.55  6.17    Average  5.69  4.77  5.90  5.50  5.74  5.52  5.8  10.1  7.2  12.6  10.3  9.2    72  4.96  4.14  5.08  5.03  5.04  4.85  144  5.55  4.64  5.75  5.0    216  6.21  5.06  6.27  6.51  6.17  6.04  Average  5.8  4.61  5.70  5.81  5.62  5.46  8.7  6.4  8.3  10.3  7.8  8.3    CV%  8.9  ESD at 0.05 level for  Season (S)  NS  Irrigation (I)  0.28  Nitrogen (N)  0.08  Ix N  0.17  Cultivars (C)  0.14	216	6.17	4.68	6.30	6.03	5.93	5.83	76	7.0	0 0	60	74	74
144  5.65  4.92  6.04  5.01  4.04    144  5.65  4.92  6.04  5.01  5.54    216  6.13  5.42  6.04  5.01  5.52  5.8  10.1  7.2  12.6  10.3  9.2    72  4.96  4.14  5.08  5.03  5.04  4.85    144  5.55  4.64  5.74  5.50  5.50    216  6.21  5.06  6.27  6.51  6.17  6.04    Average  5.58  4.61  5.70  5.65  5.50  216  6.21  5.06  6.27  6.51  6.17  6.04    Average  5.58  4.61  5.70  5.81  5.62  5.46  8.7  6.4  8.3  10.3  7.8  8.3    CV%  8.9  ESD at 0.05 level for  Season (S)  NS  Irrigation (I)  0.28    Nitrogen (N)  0.08  Ix N  0.17  Cultivars (C)  0.14		5.09	2.07	5.39	1 50	5.45	1 9/	 7.0	7.0	0.9	0.0	1.4	7.4
216  6.13  5.42  6.34  6.41  6.55  6.17    Average  5.69  4.77  5.90  5.50  5.74  5.52  5.8  10.1  7.2  12.6  10.3  9.2    72  4.96  4.14  5.08  5.03  5.04  4.85    144  5.55  4.64  5.74  5.90  5.50    216  6.21  5.06  6.27  6.51  6.17  6.04    Average  5.58  4.61  5.70  5.81  5.62  5.46  8.7  6.4  8.3  10.3  7.8  8.3    CV%  8.9  ESD at 0.05 level for  Season (S)  NS  Irrigation (I)  0.28  1  10.08  1	14 12	5.29	4 92	6.04	5.01	5.59	5 54						
Average    5.69    4.77    5.90    5.50    5.74    5.52    5.8    10.1    7.2    12.6    10.3    9.2      72    4.96    4.14    5.08    5.03    5.04    4.85      144    5.55    4.64    5.74    5.90    5.65    5.50      216    6.21    5.06    6.27    6.51    6.17    6.04      Average    5.58    4.61    5.70    5.81    5.62    5.46    8.7    6.4    8.3    10.3    7.8    8.3      CV%    8.9    Issaeson (S)    NS    Irrigation (I)    0.28    Irrigation (I)    0.28    Issaeson (S)    NS    Issaeson (S)    Issaeson (S)    Issaeson (S)    Issaeson (	216	6.13	5.42	6.34	6.41	6.55	6.17						
72  4.96  4.14  5.08  5.03  5.04  4.85    144  5.55  4.64  5.74  5.90  5.65  5.50    216  6.21  5.06  6.27  6.16  6.7  6.04    Average  5.58  4.61  5.70  5.81  5.62  5.46  8.7  6.4  8.3  10.3  7.8  8.3    CV%  8.9	Average	5.69	4.77	5.90	5.50	5.74	5.52	5.8	10.1	7.2	12.6	10.3	9.2
144  5.55  4.64  5.74  5.90  5.65  5.50    216  6.21  5.06  6.27  6.51  6.17  6.04    Average  5.58  4.61  5.70  5.81  5.62  5.46  8.7  6.4  8.3  10.3  7.8  8.3    CV%  8.9    5.62  5.46  8.7  6.4  8.3  10.3  7.8  8.3    CV%  8.9    5.62  5.46  8.7  6.4  8.3  10.3  7.8  8.3    LSD at 0.05 level for  Season (S)  NS  Irrigation (I)  0.28    Nitrogen (N)  0.08    I x N  0.17   Cultivars (C)  0.14 <td>72</td> <td>4.96</td> <td>4.14</td> <td>5.08</td> <td>5.03</td> <td>5.04</td> <td>4.85</td> <td> </td> <td></td> <td></td> <td></td> <td></td> <td></td>	72	4.96	4.14	5.08	5.03	5.04	4.85	 					
216  6.21  5.06  6.27  6.51  6.17  6.04    Average  5.58  4.61  5.70  5.81  5.62  5.46  8.7  6.4  8.3  10.3  7.8  8.3    CV%  8.9  Iso	144	5.55	4.64	5.74	5.90	5.65	5.50						
Average    5.58    4.61    5.70    5.81    5.62    5.46    8.7    6.4    8.3    10.3    7.8    8.3      CV%    8.9    Iso    Iso <t< td=""><td>216</td><td>6.21</td><td>5.06</td><td>6.27</td><td>6.51</td><td>6.17</td><td>6.04</td><td>07</td><td>~ 4</td><td></td><td></td><td>7.0</td><td></td></t<>	216	6.21	5.06	6.27	6.51	6.17	6.04	07	~ 4			7.0	
CV%    8.9      LSD at 0.05 level for    Season (S)      Nitrogen (N)    0.28      Nitrogen (N)    0.08      I x N    0.17      Cultivars (C)    0.14	Average	5.58	4.61	5.70	5.81	5.62	5.46	 8.7		8.3	10.3	7.8	8.3
Lab a (0.05 level for      Season (S)    NS      Irrigation (I)    0.28      Nitrogen (N)    0.08      I x N    0.17      Cultivars (C)    0.14	LSD at 0.05 lov	8.9											
Irrigation    0    0.28      Nitrogen (N)    0.08      I x N    0.17      Cultivars (C)    0.14	Season (S)		NS										
Nitrogen (Ň)    0.08      I x N    0.17      Cultivars (C)    0.14	Irrigation (I)		0.28										
I x N 0.17 Cultivars (C) 0.14	Nitrogen (N	)	0.08										
Cuntvars (C) 0.14	IXN		0.17										
	Cultivars (C	)	0.14										
N X C NS	NxC		N.S										
I x C x N 0.48	İXČXN		0.48										

Table 3: Grain yield of five wheat cultivars (t/ha) as affected by variation in the irrigation intervals and N fertilization levels at El-Bustan region .

estimated by 17.7, 8.1 and 6.0% for the three stages, respectively, comparing to that obtained at 7-day intervals (I-1) which had significantly the highest average number of spikes/m<sup>2</sup> (Tables 2 & 3a). Logically, treatment (I-2) would have the reduced number of spikes due to plants being stressed during tillering, while treatments (I-3) and (I-4) had statistically similar spike numbers since irrigation intervals being the same during that period. This result was in harmony with the findings obtained by Hassan *et al.* (1987) and Mosaad *et al.* (1995).

The same trend was observed with respect to number of kernels/spike. Increasing the intervals of irrigation at the different growth stages reduced kernel numbers in both years. Averaged over the two years data, treatments (I-3) and (I-4) resulted in producing statistically similar numbers of kernels/spike with reductions being less than that from treatment (I-2) as compared to treatment (I-1)where the highest number of kernels was obtained (Tables 2 & 3b). These results are confirmed by those obtained by Hassan *et al.* (1987) and Eck (1988).

Significant differences among the different irrigation treatments with respect to 1000-kernel weight were also indicated in both seasons. Regular irrigation at 7-day intervals throughout the season gave significantly the heaviest 1000-kernel weight. Elongation of irrigation intervals, at the first stage resulted in remarkable reduction in kernel weight comparing to the reduction caused by the water stress in the second or the third growth stage (Tables 2 & 3c). Similar results were obtained by Hassan *et al.* (1987).

#### Nitrogen levels

The mean grain yield of the different genotypes significantly increased with each successive level of N applied, as it was 4.85, 5.50 and 6.04 t/ha for the three N levels (72, 144 and 216 kg/ha), respectively. The grain yield increment was estimated by 13.4 and 9.8% for the two high nitrogen levels, respectively, (Tables 2 & 3). This might be attributed to increased values of yield components; number of spikes/m<sup>2</sup>, number of kernels/spike and 1000-kernel weight as indicated from Tables (2, 3-a, b and c.)

The respective average increase for those characters due to the increased N levels were 12.1 & 9.2%; 9.7 & 8.6 % and 7.0 & 5.7%, respectively. These findings are supported by the results of Eck (1988), Nielsen and Halvorson (1991), Shehab El-Din (1993), Mishra *et al.* (1998), Oweis *et al.* (1998) and Ehdaie *et al.* (1999).

Substantial difference among the tested genotypes in their response to increasing N fertilizer levels was also observed. Gemmeiza 5 recorded the highest grain yield response index value (10.3), while Sakha 69 gave the lowest value (6.4) with increasing nitrogen level from 72 to 216 kg /ha, (Table 3). Singh and Srivastava (1996), Oweis *et al.* (1998)and Ehdaie *et al.*.(1999) came to the same conclusion.

Ireat. Kg/na1699351681699351681998/19991999/2000I-172419379508428431433443398434430425428144462422504509500479493435479479443466216495430522563523507529452533520493505Average459410511500485473488429482479454466I-272367331349345375353316283407398353351144375385396367403385390305428416426393216462391406394399410431308449486471429Average4013693833693923833792994284384114163731-3723743674034114333983392604384114163731-372374367403415476448342542574493480Average444428458433436440395305
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$
Average  439  410  511  500  485  473  486  429  482  479  454  466    I-2  72  367  331  349  345  375  353  316  283  407  398  353  351    144  375  385  396  367  403  385  390  305  428  416  426  393    216  462  391  406  394  399  410  431  308  486  471  429    Average  401  369  383  369  392  383  379  299  428  433  417  391    I-3  72  374  367  403  411  433  398  339  260  438  411  416  373    144  481  416  471  402  461  446  398  314  475  470  438  411    216  478  503  500  487  446  398
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$
$\begin{array}{cccccccccccccccccccccccccccccccccccc$
Average    401    369    383    369    392    383    379    299    428    433    417    391      I-3    72    374    367    403    411    433    398    339    260    438    411    416    373      144    481    416    471    402    461    446    398    314    475    470    438    411      216    478    503    500    487    415    476    448    342    524    574    493    480      Average    444    428    458    433    436    440    395    305    485    485    490    424      I-4    72    383    366    369    349    407    375    416    345    384    448    362    391      144    495    465    469    354    442    445    461    388    429    511
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$
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216    478    503    500    487    415    476    448    342    542    574    493    480      Average    444    428    458    433    436    440    395    305    485    485    449    424      I-4    72    383    366    369    349    407    375    416    345    384    448    362    391      144    495    465    469    354    442    445    461    398    429    511    438    448      216    512    499    522    470    478    496    524    421    488    533    515    496      Average    463    443    453    391    442    439    467    388    434    497    438    445      72    386    361    407    384    411    390    378    321    416    424    389
Average    444    420    436    435    436    440    595    505    465    465    442      I-4    72    383    366    369    349    407    375    416    345    384    448    362    391      144    495    465    469    354    442    445    461    398    429    511    438    448      216    512    499    522    470    478    496    524    421    488    533    515    496      Average    463    443    453    391    442    439    467    388    434    497    438    445      72    386    361    407    384    411    390    378    321    416    424    389    386      72    386    361    407    384    411    390    378    321    416    424    389    386
144  495  505  505  545  407  575  416  536  506  406  354    144  495  565  466  354  442  445  461  398  429  511  438  448    216  512  499  522  470  478  496  524  421  488  533  515  496    Average  463  443  453  391  442  439  467  388  434  497  438  445    72  386  361  407  384  411  390  378  321  416  424  389  386
216    512    499    522    470    478    496    524    421    488    533    515    496      Average    463    443    453    391    442    439    467    388    434    497    438    445      72    386    361    407    384    411    390    378    321    416    424    389    386
Average    463    443    453    391    442    439    467    388    434    497    438    445      72    386    361    407    384    411    390    378    321    416    424    389    386
72 386 361 407 384 411 390 378 321 416 424 389 386
144 453 422 460 408 452 439 436 363 453 469 437 431
216 487 456 487 478 454 472 483 381 503 528 493 478
Average 442 413 451 423 439 434 433 355 457 474 439 432
CV% 8.5 13.7
LSD at 0.05 level for
Nitrogen (N) 10.8 111
IxN 21.8 NS
Cultivars (C) 14.7 23.6
LxC 29.4 47.3
N XG 25.4 NS
Combined
I-1 72 431 389 471 433 428 430
144 477 429 491 494 472 473
216 512 441 527 541 509 506
Average 473 420 430 490 403 470
1-2 12 341 307 378 378 304 332 144 383 345 412 391 415 389
216 446 349 427 440 435 420
Average 390 334 406 401 405 387
I-3 72 357 314 421 411 424 385
144 439 365 473 436 450 433
216 463 422 521 530 454 478
Average 420 307 472 439 443 432
1-4 72 399 355 376 396 364 365 1/4 778 732 776 733 776 786 364
216 518 460 505 502 496 496
Average 465 416 444 444 440 442
72 382 341 411 404 400 388
144 444 392 456 438 444 435
216 485 418 495 503 474 475
Average 437 384 454 449 439 433
CV% 11.0
Irriantion (I) 26.7
Nitrogen (Ň) 7.7
LxN 15.3
Cultivars (C) 13.9
IXCXN NS

Table 3a: Means of number of spikes/m² of five wheat cultivars asaffected by variation in the irrigation intervals and Nfertilization levels at El-Bustan region.

Table	3b.	Means	of	nur	nbei	' of	kerne	ls/sp	ike o	f five	wl	heat	culti	vars	asa	affeo	cted
	by	variati	ion	in	the	irrig	gation	inte	rvals	and	Ν	ferti	lizati	on l	level	s at	EI-
	Bu	istan re	gio	n.													

Irri N	lovol	Side	Sakha	Sakha	Comm	Giza	Avorago	Side	Sakhr	Sakh	Gom	m Giza	Avorago
Treat k	(a/ha	1	69	93	5	168	Average	1	69	93	30em 5	168	Average
fical.i	(g/nu		10	008/10	<u>aa</u>	100			05	1000	/2000	100	
I-1 7	72	46 8	48 0	49 2	42.3	37.8	44 8	44 8	48.0	41.5	42.8	47 0	44 8
14	44	45.0	47.1	49.5	48.3	48.6	47.7	48.0	49.3	46.0	47.8	55.3	49.3
2	16	55.5	48.0	51.9	59.1	54.6	53.8	53.5	52.5	50.3	55.8	61.0	53.6
Avera	ge	49.1	47.7	50.2	49.9	47.0	48.8	48.8	49.9	45.9	48.8	54.4	50.0
I-2	72	45.0	39.0	43.5	44.4	45.0	43.4	41.5	30.0	39.0	39.0	40.0	37.9
14	44	52.2	39.6	49.5	51.6	45.0	47.6	46.5	30.8	42.5	41.3	46.8	41.6
. 2'	16	52.2	41.1	48.0	53.1	46.8	48.2	51.0	34.3	48.8	45.3	55.0	46.9
Avera	ge	49.8	39.9	47.0	49.7	45.6	46.4	46.3	31.8	43.4	41.8	47.3	42.1
1-3	(2	46.5	45.6	39.6	48.0	43.8	44.7	42.3	38.5	38.8	44.8	39.5	40.8
14	44	48.9	45.6	42.0	54.6	43.8	47.0	49.0	43.8	41.5	49.0	49.3	46.1
		40.0 /7 8	49.5	43.0 /1 8	51.8	43.5	47.5	53.3 /8.2	40.5	13.8	23.3	20.2 45.8	50.9 45 9
Avera	ye 70	47.0	40.9	41.0	45.0	43.7	40.4	40.2	42.9	43.0	49.0	40.0	40.9
1-4 1	1 Z ·	41.4	42.0	42.0	45.0	41.4	42.0	44.0	40.5	33.5	39.0 47.5	43.0	40.2
2	16	42.0 60.6	49.3	40.0	55.2	54.3	52.9	43.3 52.0	44.3	43.5	47.5	53.0	43.2
Avera	ne	48.2	46.8	45.2	51.4	47.5	47.8	47.2	43.5	38.2	45.6	49.1	44 7
	70	11 0	12 0	42.7	44.0	42.0		12.1	20.2	20 2	11 6	42.4	40.0
14	44	44.5	45.0	43.7	52 1	42.0	43.9	43.1	42.0	<u>41</u> 9	41.0	42.4 50.1	40.9
2	16	54 1	46.7	47.5	55.1	49.8	50.6	52.4	44.8	48.4	50.9	54.9	50.3
Avera	ae	48.7	45.3	46.1	50.7	46.0	47.4	47.6	42.0	42.8	46.3	49.1	45.6
CV%		9.0						9.4					
I SD at	0.05 leve	al for						0.4					
Irric	pation (I)		NS	5						:	3.2		
Niti	rogen (N)	)	1.1	ī						(	5.7		
lх	Nँ `́		2.2	2						1	٧S		
Cu	Itivars (C)	)	1.3	3							1.7		
Iх	C		2.6	6							3.4		
N :	хC		3.0	0							٧S		
	∩ NI			0							10		
IX	C x N		5.8	8 amhin	<b>.</b>						NS		
X	C x N	15.8	5.8 <b>C</b>	B ombin	ed	12 1	11.8				VS		
I-1 1	C x N 72 44	45.8	5.8 <b>C</b> 48.0 48.2	8 ombin 45.4 47.8	ed 42.5 48.0	42.4	44.8 48 5				NS		
I-1 14	C x N 72 44 16	45.8 46.5 54.5	5.8 48.0 48.2 50.3	8 ombin 45.4 47.8 51.1	ed 42.5 48.0 57.4	42.4 51.2 57.8	44.8 48.5 54.2				NS		
I-1	C x N 72 44 16 ge	45.8 46.5 54.5 48.9	5.8 48.0 48.2 50.3 48.8	8 <b>ombin</b> 45.4 47.8 51.1 48.1	ed 42.5 48.0 57.4 49.3	42.4 51.2 57.8 50.7	44.8 48.5 54.2 49.2			ļ	NS		
I-1 14 2' Averaç I-2	C x N 72 44 16 ge 72	45.8 46.5 54.5 48.9 43.3	5.8 <b>C</b> 48.0 48.2 50.3 48.8 34.5	8 <b>ombin</b> 45.4 47.8 51.1 48.1 41.3	ed 42.5 48.0 57.4 49.3 41.7	42.4 51.2 57.8 50.7 42.5	44.8 48.5 54.2 49.2 40.6				NS		
I-1 14 22 Averag	C x N 72 44 16 ge 72 44	45.8 46.5 54.5 48.9 43.3 49.4	5.8 48.0 48.2 50.3 48.8 34.5 35.2	8 <b>ombin</b> 45.4 47.8 51.1 48.1 41.3 46.0	ed 42.5 48.0 57.4 49.3 41.7 46.4	42.4 51.2 57.8 50.7 42.5 45.9	44.8 48.5 54.2 49.2 40.6 44.6				NS		
I-1 14 22 Averag I-2 14 22	C x N 72 44 16 ge 72 44 16	45.8 46.5 54.5 48.9 43.3 49.4 51.6	5.8 48.0 48.2 50.3 48.8 34.5 35.2 37.7	8 45.4 47.8 51.1 48.1 41.3 46.0 48.4	ed 42.5 48.0 57.4 49.3 41.7 46.4 49.2	42.4 51.2 57.8 50.7 42.5 45.9 50.9	44.8 48.5 54.2 49.2 40.6 44.6 47.5				<u>NS</u>		
I-1 Averag	C x N 72 44 16 ge 72 44 16 ge	45.8 46.5 54.5 48.9 43.3 49.4 51.6 48.1	5.8 48.0 48.2 50.3 48.8 34.5 35.2 37.7 35.8	8 45.4 47.8 51.1 48.1 41.3 46.0 48.4 45.2	ed 42.5 48.0 57.4 49.3 41.7 46.4 49.2 45.8	42.4 51.2 57.8 50.7 42.5 45.9 50.9 46.4	44.8 48.5 54.2 49.2 40.6 44.6 47.5 44.1				NS		
I-1 14 22 Averag I-2 14 22 Averag I-3	C x N 72 44 16 ge 72 44 16 ge 72	45.8 46.5 54.5 48.9 43.3 49.4 51.6 48.1 44.4	5.8 48.0 48.2 50.3 48.8 34.5 35.2 37.7 35.8 42.1	B 45.4 47.8 51.1 48.1 41.3 46.0 48.4 45.2 39.2	ed 42.5 48.0 57.4 49.3 41.7 46.4 49.2 45.8 46.4	42.4 51.2 57.8 50.7 42.5 45.9 50.9 46.4 41.7	44.8 48.5 54.2 49.2 40.6 44.6 47.5 44.1 42.7				NS		
I-1 14 2' Average I-2 14 2' Average I-3 14	C x N 72 44 16 ge 72 44 16 ge 72 72 44	45.8 46.5 54.5 48.9 43.3 49.4 51.6 48.1 44.4 49.0	5.8 48.0 48.2 50.3 48.8 34.5 35.2 37.7 35.8 42.1 44.7	B <b>ombin</b> 45.4 47.8 51.1 48.1 41.3 46.0 48.4 45.2 39.2 41.8	ed 42.5 48.0 57.4 49.3 41.7 46.4 49.2 45.8 46.4 51.8	42.4 51.2 57.8 50.7 42.5 45.9 50.9 46.4 41.7 45.5	44.8 48.5 54.2 49.2 40.6 44.6 47.5 44.1 42.7 46.5				NS		
I-1 14 2' Averac 1-2 14 2' Averac 1-3 14 2'	C x N 72 44 16 ge 72 44 16 ge 72 44 16	45.8 46.5 54.5 48.9 43.3 49.4 51.6 48.1 44.4 49.0 50.6	5.8 48.0 48.2 50.3 48.8 34.5 35.2 37.7 35.8 42.1 44.7 48.0	B 45.4 47.8 51.1 48.1 41.3 46.0 48.4 45.2 39.2 41.8 47.4	ed 42.5 48.0 57.4 49.3 41.7 46.4 49.2 45.8 46.4 51.8 53.0	42.4 51.2 57.8 50.7 42.5 45.9 50.9 46.4 41.7 45.5 47.0	44.8 48.5 54.2 49.2 40.6 44.6 47.5 44.1 42.7 46.5 49.2				<u>NS</u>		
I-1 1-2 Averag I-2 1-2 1-2 1-3 1-3 1-3 1-3 1-3 1-3 1-3 1-3	C x N 72 44 16 ge 72 44 16 ge 72 44 16 ge	45.8 46.5 54.5 48.9 43.3 49.4 51.6 48.1 44.4 49.0 50.6 48.0	5.8 48.0 48.2 50.3 48.8 34.5 35.2 37.7 35.8 42.1 44.7 48.0 44.9	B 45.4 47.8 51.1 48.1 41.3 46.0 48.4 45.2 39.2 41.8 47.4 42.8	ed 42.5 48.0 57.4 49.3 41.7 46.4 49.2 45.8 46.4 51.8 53.0 50.4	42.4 51.2 57.8 50.7 42.5 45.9 50.9 46.4 41.7 45.5 47.0 44.7	44.8 48.5 54.2 49.2 40.6 44.6 47.5 44.1 42.7 46.5 49.2 46.2				<u>NS</u>		
I-1 1-2 Average I-2 1-2 1-2 1-3 1-3 1-3 1-3 1-3 1-3 1-4 1-4	C × N 72 44 16 ge 72 44 16 ge 72 44 16 ge 72	45.8 46.5 54.5 48.9 43.3 49.4 51.6 48.1 44.4 49.0 50.6 48.0 42.7	5.8 48.0 48.2 50.3 48.8 34.5 35.2 37.7 35.8 42.1 44.7 48.0 44.9 41.6	B 45.4 47.8 51.1 48.1 41.3 46.4 45.2 39.2 41.8 47.4 42.8 38.1	ed 42.5 48.0 57.4 49.3 41.7 46.4 49.2 45.8 46.4 51.8 53.0 50.4 42.4	42.4 51.2 57.8 50.7 42.5 45.9 50.9 46.4 41.7 45.5 47.0 44.7 42.2	44.8 48.5 54.2 49.2 40.6 44.6 47.5 44.1 42.7 46.5 49.2 46.2 41.4				<u>NS</u>		
I-1 14 2' Averag I-2 1-2 1-2 1-2 1-2 1-2 1-2 1-2 1	C x N 72 44 16 ge 72 44 16 ge 72 44 16 ge 72 72 44	45.8 46.5 54.5 48.9 43.3 49.4 51.6 48.1 44.4 49.0 50.6 48.0 42.7 44.1 56.2	5.8 48.0 48.2 50.3 48.8 34.5 35.2 37.7 35.8 42.1 44.7 48.0 44.9 41.6 46.9 47.0	B 45.4 47.8 51.1 48.1 41.3 46.4 45.2 39.2 41.8 47.4 42.8 38.1 42.2	ed 42.5 48.0 57.4 49.3 41.7 46.4 45.8 46.4 51.8 53.0 50.4 42.4 50.8	42.4 51.2 57.8 50.7 42.5 45.9 50.9 46.4 41.7 45.5 47.0 44.7 42.2 49.0 50.7	44.8 48.5 54.2 49.2 40.6 44.6 47.5 44.1 42.7 46.5 49.2 46.2 41.4 46.6 500				<u>NS</u>		
I-1 14 2' Averag I-2 Averag I-3 14 2' Averag I-3 14 2' Averag I-3 14 2' Averag I-3 14 2' Averag I-2 14 14 14 14 14 14 14 14 14 14	C x N 72 44 16 ge 72 44 16 ge 72 44 46 16 ge 72 44 41 16 20	45.8 46.5 54.5 48.9 43.3 49.4 51.6 48.1 44.4 49.0 50.6 48.0 42.7 44.1 56.3	5.8 48.0 48.2 50.3 34.5 35.2 37.7 35.8 42.1 44.7 48.0 44.9 41.6 46.9 47.0 45.2	B 45.4 47.8 51.1 48.1 41.3 46.0 48.4 45.2 39.2 41.8 47.4 42.8 38.1 42.2 44.4 38.1	ed 42.5 48.0 57.4 49.3 41.7 46.4 45.8 46.4 51.8 53.0 50.4 42.4 50.8 52.4 50.8 52.4	42.4 51.2 57.8 50.7 42.5 45.9 50.9 46.4 41.7 45.5 47.0 44.7 42.2 49.0 53.7 48.2	44.8 48.5 54.2 49.2 40.6 44.6 47.5 44.1 42.7 46.5 49.2 46.2 41.4 46.6 50.8 46.2				<u>NS</u>		
I-1 14 2' Averac I-2 1-2 1-2 1-3 1-3 1-3 1-3 1-3 1-3 1-4 1-4 2' Averac Averac	C x N 72 44 16 ge 72 44 16 ge 72 44 16 ge 72 44 16 ge	45.8 46.5 54.5 48.9 43.3 49.4 51.6 48.1 44.4 49.0 50.6 48.0 42.7 44.1 56.3 47.7	5.8 48.0 48.2 50.3 34.5 35.2 37.7 35.8 42.1 44.7 48.0 44.9 41.6 46.9 47.0 45.2	B 45.4 47.8 51.1 48.1 41.3 46.0 48.4 45.2 39.2 41.8 47.4 42.8 38.1 42.2 44.9 41.3 38.1 42.2 44.9 41.3	ed 42.5 48.0 57.4 49.3 41.7 46.4 49.2 45.8 46.4 51.8 53.0 50.4 42.4 50.8 52.4 48.5	42.4 51.2 57.8 50.7 42.5 45.9 46.4 41.7 45.5 47.0 44.7 42.2 49.0 53.7 48.3 7	44.8 48.5 54.2 49.2 40.6 44.6 47.5 44.1 42.7 46.5 49.2 46.2 41.4 46.6 50.8 46.3				<u>NS</u>		
I-1 1-2 Average I-2 Average I-3 1-4 2- Average I-3 1-4 2- Average I-3 1-2 4- 2- Average I-2 1- 2- 4- 2- 1- 1- 2- 1- 2- 1- 2- 1- 2- 1- 2- 1- 2- 1- 2- 1- 2- 1- 1- 1- 1- 1- 1- 1- 1- 1- 1	C x N 72 44 16 59 72 44 16 59 72 44 16 59 99 72 44	45.8 46.5 54.5 48.9 43.3 49.4 51.6 48.1 44.4 49.0 50.6 48.0 42.7 44.1 56.3 47.7 44.0	5.8 48.0 48.2 50.3 48.8 34.5 35.2 37.7 35.8 42.1 44.7 48.0 44.9 41.6 46.9 47.0 45.2 41.5	B 45.4 47.8 51.1 48.1 41.3 46.0 48.4 45.2 39.2 41.8 47.4 42.8 38.1 42.2 44.9 41.7 41.0	ed 42.5 48.0 57.4 49.3 41.7 46.4 49.2 45.8 46.4 51.8 53.0 50.4 42.8 50.4 42.8 52.4 48.5 48.5	42.4 51.2 57.8 50.7 42.5 50.9 46.4 41.7 45.5 44.7 45.5 47.0 44.7 42.2 49.0 53.7 48.3 42.2	44.8 48.5 54.2 49.2 40.6 44.6 47.5 44.1 42.7 46.5 49.2 46.2 41.4 46.6 50.8 46.3 46.3 46.3				<u>NS</u>		
I-1 1-2 Average I-2 Average I-3 I-4 1-4 1-4 1-4 1-4 1-4 1-4 1-4 1	C x N 72 44 16 59 72 44 16 59 72 72 44 16 59 72 72 44 16 72 72 44 16	45.8 46.5 54.5 43.3 49.4 51.6 48.1 44.4 49.0 50.6 50.6 42.7 44.1 56.3 47.7 44.0 47.2 53.3	5.8 48.0 48.2 50.3 48.8 34.5 35.2 37.7 35.8 42.1 44.7 48.0 44.9 41.6 46.9 47.0 45.2 41.5 43.7 45.7	B 45.4 47.8 51.1 48.1 41.3 46.0 48.4 45.2 41.8 47.4 42.8 38.1 42.8 38.1 42.8 38.1 42.9 41.7 41.0 44.4 47.9	ed 42.5 48.0 57.4 49.3 41.7 46.4 49.2 45.8 53.0 50.4 45.4 53.0 50.4 42.4 50.4 45.4 52.4 48.5 43.2 49.3 53.0	42.4 51.2 57.8 50.7 42.5 50.9 46.4 41.7 45.5 45.9 46.4 41.7 45.7 44.7 42.2 49.0 53.7 48.3 42.2 48.3	44.8 48.5 54.2 49.2 40.6 44.6 47.5 44.1 42.7 46.5 49.2 46.2 41.4 46.6 50.8 46.3 42.4 46.5 50.5				<u>NS</u>		
I-1 1-2 Averag I-2 1-2 1-2 1-3 1-3 1-3 1-4 1-4 1-4 1-4 1-4 1-4 1-4 1-4	C x N 72 44 16 ge 72 44 16 ge 72 44 16 ge 72 72 44 16 16 ge 72 44 16 ge	45.8 46.5 54.5 48.9 43.3 49.4 51.6 48.1 44.4 49.0 50.6 48.0 42.7 44.0 47.2 53.3 47.7 53.3 47.2	5.8 48.0 48.2 50.3 48.8 34.5 35.2 37.7 35.8 42.1 44.7 48.0 44.9 41.6 46.9 44.9 41.6 46.9 47.0 45.2 41.5 43.7 45.7	B      45.4      45.8      51.1      48.1      41.3      46.4      45.2      39.2      41.8      47.8      39.2      41.8      47.4      42.8      38.1      42.2      41.7      41.0      44.4      47.4	ed 42.5 48.0 57.4 49.3 41.7 46.4 49.2 45.8 46.4 51.8 53.0 50.4 42.4 50.8 52.4 42.5 43.2 49.3 53.0 48.5	42.4 51.2 57.8 50.7 42.5 45.9 50.9 46.4 41.7 45.5 47.0 44.7 45.5 47.0 44.7 49.0 53.7 48.3 42.2 48.1 52.3	44.8 48.5 54.2 49.2 40.6 44.6 47.5 44.1 42.7 46.5 49.2 46.2 41.4 46.6 50.8 46.3 42.4 46.5 50.5 50.5 46.4				<u>NS</u>		
I-1 1-2 Averag I-2 1-2 1-2 1-2 1-2 1-2 1-2 1-2 1	C x N 72 44 16 59 72 44 16 59 59 72 44 16 59 59 72 72 72 72 44 16 59 59 72 72 44 16 59 59 72 72 44 16 59 59 72 72 44 16 59 72 72 72 72 72 72 72 72 72 72 72 72 72	45.8 46.5 54.5 48.9 43.3 49.4 51.6 48.1 44.4 44.4 44.0 50.6 48.0 42.7 44.1 44.2 50.6 48.0 42.7 44.1 47.2 53.3 47.2 53.3 48.2	5.8 48.0 48.2 50.3 48.8 34.5 35.2 37.7 35.8 42.1 44.7 48.0 44.9 41.6 46.9 47.0 45.7 43.7 43.7	B      45.4      47.8      51.1      48.4      45.2      39.2      41.8      47.4      42.8      44.1      42.2      44.9      41.7      44.9      41.7      44.4      47.9      44.4	ed 42.5 48.0 57.4 49.3 41.7 46.4 49.2 45.8 46.4 51.8 53.0 42.4 50.8 50.4 42.4 50.8 50.4 42.5 43.2 49.3 53.0 48.5	42.4 51.2 57.8 50.7 42.5 45.9 50.9 46.4 41.7 45.5 47.0 44.7 42.2 49.0 53.7 48.1 52.3 47.5	$\begin{array}{r} 44.8\\ 48.5\\ 54.2\\ 49.2\\ 40.6\\ 44.6\\ 47.5\\ 44.1\\ 42.7\\ 46.5\\ 49.2\\ 46.2\\ 41.4\\ 46.6\\ 50.8\\ 46.3\\ 42.4\\ 46.5\\ 50.5\\ 50.5\\ 46.4\\ \end{array}$				<u>NS</u>		
I-1 14 22 Averag I-2 14 22 Averag I-3 14 22 Averag I-4 14 22 Averag I-4 14 22 Averag I-4 14 22 Averag	C x N 72 44 16 59 72 44 16 59 72 44 16 59 72 44 16 59 72 44 16 59 99 72 72 44 16 59 72 72 44 16 59 72 72 72 72 72 72 72 72 72 72 72 72 72	45.8 46.5 54.5 48.9 43.3 49.4 51.6 48.1 44.4 44.4 44.0 50.6 48.0 42.7 44.1 56.3 44.2 54.5 54.5 54.5 54.5 54.5 54.5 54.5	5.8 48.0 48.2 50.3 48.8 34.5 35.2 37.7 35.8 42.1 44.7 48.0 44.9 41.6 44.9 47.0 45.2 41.5 43.7 43.7	B      45.4      47.8      51.1      48.1      44.3      46.0      48.4      45.2      39.2      41.8      47.4      42.8      38.1      44.9      41.7      41.9      41.7      44.4	ed 42.5 48.0 57.4 49.3 41.7 46.4 49.2 45.8 46.4 51.8 53.0 50.4 42.4 50.4 42.4 50.4 48.5 43.2 49.3 53.0 48.5	42.4 51.2 57.8 50.7 42.5 45.9 50.9 50.9 46.4 41.7 45.5 47.0 44.7 42.0 43.7 48.3 42.2 48.3 42.2 48.3 47.5	44.8 48.5 54.2 49.2 40.6 44.6 47.5 44.1 42.7 46.5 49.2 46.2 41.4 46.6 50.8 46.3 42.4 46.5 50.5 46.4				NS		
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I.1 I-1 14 22 Averag I-2 1-2 1-2 1-2 1-2 1-2 1-2 1-2 1	C x N 72 44 16 ge 72 44 16 ge 72 44 16 16 16 16 16 16 16 16 16 16	45.8 46.5 54.5 48.9 43.3 49.4 51.6 48.1 44.4 49.0 50.6 48.0 42.7 44.0 55.6 3 47.7 44.0 47.2 47.2 47.2 47.2 47.2 9.2 9.2 9.2 9.2 9.2 9.2 9.2	5.8 48.0 48.2 50.3 48.8 34.5 35.2 37.7 35.8 42.1 44.7 48.0 44.9 41.6 46.9 47.0 45.2 41.5 43.7 45.7 45.7 45.7 40.7 40.7 40.7 40.7 40.0 40.0 40.0 40	3 <b>ombin</b> 45.4 45.8 51.1 445.4 46.0 48.4 45.2 39.2 39.2 38.1 42.2 44.9 41.3 38.1 42.4 44.9 41.4 44.4 47.9 44.4 45.4 46.0 41.4 45.2 45.4 45.2 45.4	ed 42.5 48.0 57.4 49.3 41.7 46.4 49.2 45.8 53.0 50.4 46.4 51.8 53.0 50.4 42.4 50.8 52.4 48.5 53.0 48.5	42.4 51.2 57.8 50.7 42.5 45.9 50.9 46.4 41.7 45.5 47.0 44.7 42.2 49.0 53.7 48.3 42.2 48.1 52.3 47.5	44.8 48.5 54.2 49.2 40.6 44.6 47.5 44.1 42.7 46.5 49.2 46.2 41.4 46.6 50.8 46.3 42.4 46.5 50.5 50.5 50.5 46.4				NS		
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I-1 I-1 14 22 Averag I-2 I-2 I-2 I-2 I-2 I-2 I-2 I-2	C x N 72 44 16 59 72 72 44 16 59 72 72 72 72 72 72 72 72 72 72	45.8 446.5 54.5 443.3 443.4 51.6 48.1 556.3 47.7 553.3 44.7 553.3 44.7 553.3 48.2 9.2 9.2 9.2 9.1 9.2	5.8 48.0 48.2 50.3 48.8 34.5 35.2 37.7 35.8 42.1 44.7 48.0 41.6 46.9 41.6 46.9 47.0 45.2 41.5 43.7 45.7 43.7 0.0 1.8 NS NS NS NS NS NS NS NS NS NS	B      ombin      45.4      45.7      45.4      45.4      45.4      44.1      48.1      44.1      46.0      48.4      45.2      39.2      41.8      45.2      39.2      41.8      45.2      38.1      42.2      38.1      42.8      38.1      42.8      38.1      44.9      41.7      41.0      44.4      66      50	ed 42.5 48.0 57.4 49.3 41.7 46.4 49.2 45.8 46.4 53.0 53.0 53.0 42.4 52.4 49.3 53.0 48.5 53.0 48.5 53.0 48.5	42.4 51.2 57.8 50.7 42.5 45.9 50.9 50.9 46.4 41.7 45.5 47.0 44.7 42.2 49.0 53.7 48.3 42.2 48.3 42.2 48.3 47.5	44.8 48.5 54.2 49.2 40.6 44.6 47.5 44.1 42.7 46.5 49.2 46.2 41.4 46.6 50.8 46.3 42.4 46.5 50.5 46.4				NS		
I-1 I-1 I-2 Averag I-2 I-2 I-2 I-2 I-2 I-2 I-2 I-2	C x N 72 44 16 59 59 72 44 16 59 59 72 44 16 59 59 50 50 50 50 50 50 50 50 50 50	45.8 46.5 54.5 48.9 43.3 51.6 48.1 50.6 48.0 50.6 48.0 50.6 48.0 50.6 48.0 50.6 48.0 50.6 48.0 50.6 48.1 55.3 47.7 53.3 48.2 9.2 el for	5.8 48.0 48.2 50.3 48.8 34.5 35.2 37.7 35.8 42.1 44.7 48.0 44.9 41.6 46.9 47.0 45.2 41.5 43.7 45.7 45.7 45.7 45.7 45.7 45.7 45.7 1.1 0.0 1.8 1.2 1.1 1.0	B      ombin      45.4      45.4      45.4      45.4      445.4      48.1      44.3      46.0      48.4      41.3      39.2      41.8      39.2      41.8      44.4      42.8      38.1      42.2      44.9      41.7      41.0      44.4      44.4      66      8      0      52	ed 42.5 48.0 57.4 49.3 41.7 46.4 49.2 45.8 53.0 50.4 42.4 50.8 52.4 43.3 52.4 49.3 53.0 53.0 48.5	42.4 51.2 57.8 50.7 42.5 45.9 50.9 50.9 46.4 41.7 45.5 47.0 53.7 42.2 48.3 42.2 48.3 42.2 48.1 52.3 47.5	44.8 48.5 54.2 49.2 40.6 44.6 47.5 44.1 42.7 46.5 49.2 46.2 41.4 46.6 50.8 46.3 42.4 46.5 50.5 46.4				NS		
IX I-1 14 22 Averag I-2 1-2 1-2 1-2 1-2 1-2 1-2 1-2 1	C x N 72 44 16 52 72 44 16 52 72 44 16 52 72 44 16 52 72 44 16 52 72 44 16 52 72 44 16 52 72 44 10 50 72 44 10 50 72 44 10 50 72 44 10 50 72 44 10 50 72 44 10 50 72 44 10 50 72 44 10 50 72 44 10 50 72 44 10 50 72 44 10 72 72 44 10 72 72 72 74 72 72 72 72 72 72 72 72 72 72	45.8 446.5 54.5 48.9 49.4 51.6 48.1 49.0 50.6 48.1 44.1 49.0 50.6 48.1 44.2 44.1 45.3 44.1 47.2 53.3 44.2 47.7 44.0 47.2 53.3 47.7 44.0 9.2 53.3 49.2 9.1 6 1 6 1 6 1 6 1 6 1 6 1 6 1 6 1 6 1 6	5.8 48.0 48.2 50.3 48.8 34.5 35.2 37.7 35.8 42.1 44.7 48.0 42.1 44.7 48.0 42.1 44.9 41.6 46.9 47.0 45.2 41.5 43.7 45.7 45.7 45.7 45.7 45.7 45.7 45.7 45	B ombin 45.4 45.4 45.1 45.2 41.3 46.0 48.4 45.2 39.2 41.8 47.4 42.8 38.1 42.2 44.9 42.8 38.1 42.2 44.9 42.4 45.4 45.4 45.4 45.4 45.4 45.4 45.4 45.4 45.4 45.4 45.4 45.4 45.4 45.4 45.4 45.4 45.4 45.4 45.2 45.4 45.4 45.2 45.4 45.2 45.4 45.2 45.4 45.2 45.2 45.2 45.2 45.4 45.2 45	ed 42.5 48.0 57.4 49.3 41.7 46.4 49.2 45.8 53.0 46.4 51.8 53.0 46.4 50.4 42.4 48.5 53.0 48.5	42.4 51.2 57.8 50.7 42.5 45.9 50.9 46.4 41.7 45.5 47.0 53.7 42.2 49.0 53.7 48.3 42.2 48.1 52.3 47.5	44.8 48.5 54.2 49.2 40.6 44.6 47.5 44.1 42.7 46.5 49.2 46.2 41.4 46.6 50.8 46.3 42.4 46.5 50.5 50.5 46.4				NS		
IX I-1 14 22 Average I-2 1-2 1-2 1-2 1-2 1-2 1-2 1-2 1	C x N 72 44 16 59 72 72 44 16 59 72 72 72 72 72 72 72 72 72 72	45.8 446.5 54.5 48.9 43.3 449.4 451.6 48.0 450.6 48.0 44.4 44.0 450.6 48.0 44.1 44.4 44.0 47.7 44.1 47.7 44.0 47.2 53.3 44.0 47.2 53.3 9.2 el for	5.8 48.0 48.2 50.3 48.8 34.5 35.8 42.1 44.7 44.7 44.7 44.9 41.6 46.9 47.0 45.2 41.5 43.7 43.7 0.0 1.8 1.2 2.2 2.2	B ombin 45.4 47.8 51.1 41.3 46.0 48.4 44.1 44.2 39.2 41.8 38.1 42.2 39.2 41.4 42.8 38.1 42.4 44.9 44	ed 42.5 48.0 57.4 49.3 41.7 46.4 49.2 45.8 46.4 53.0 50.4 42.4 55.2 4 42.5 43.2 43.2 43.2 43.2 48.5 48.5	42.4 51.2 57.8 50.7 42.5 45.9 50.9 50.9 46.4 41.7 45.5 47.0 44.7 42.2 49.0 44.7 42.2 48.3 42.2 48.3 47.5	44.8 48.5 54.2 49.2 40.6 44.6 47.5 44.1 42.7 46.5 49.2 46.2 41.4 46.6 50.8 46.3 42.4 46.5 50.5 46.4				NS		

	Bust	an re	gion.								
Irri. N level	Sids	Sakha	Sakha	Gemn	n. Giza	Average	Sids	Sakha	aSakhaGemr	n.Giza	Average
i reat. Kg/ha	1	69	93	5	168		1	69	93 5	168	
I_1 72	10 0	51 5	51 3	50 5	50.8	50.6	46.5	177	1999/2000	17 1	47.0
144	48.3	51.5	53.0	52.5	51.0	51.3	51.0	48.3	48.3 51.9	49.2	50.0
216	51.3	53.3	56.0	53.0	50.8	52.9	53.7	50.4	56.4 53.1	55.2	53.8
Average	49.5	52.1	53.4	52.0	50.8	51.6	50.4	48.8	49.9 51.1	50.6	50.2
1-2 72	45.3	48.3	48.5	47.5	43.0	46.5	44.1	33.9	43.5 44.7	39.0	41.0
144	47.3	51.8	52.0	49.3	44.5	49.0	50.1	37.8	46.2 49.2	43.8	45.4
216	50.3	52.0	55.0	48.3	54.3	52.0	53.4	39.3	50.4 51.9	46.8	48.4
Average	47.6	50.7	51.8	48.3	47.3	49.1	49.2	37.0	46.7 48.6	43.2	44.9
I-3 72	47.0	45.5	50.0	48.5	45.5	47.3	41.1	36.0	43.8 44.7	41.1	41.3
144	58.5	46.5	54.3	51.0	46.5	51.4	49.5	42.3	49.8 50.4	45.6	47.5
	57.5	54.0 48.7	54.3 52.8	47.3	47.3	52.1	54.3	47.1	50.8 51.0	52.5 46.4	52.9 47.2
	44.5	40.7	JZ.0	40.3	46.2	46.4	40.3	20.0	47 4 45 2	40.4	47.2
1-4 72	44.0 51.3	44.5	47.5	49.3	40.3	40.4	44.7	39.0	47.4 45.5	45.0	44.4
216	44.3	48.5	55.0	54.0	49.3	50.2	50.4	45.3	52.2 53.4	52.5	50.8
Average	46.7	46.0	51.8	51.3	48.0	48.8	47.9	40.8	49.6 49.3	48.6	47.2
72	46.4	47.4	49.3	48.9	46.4	47.7	44.1	39.2	44.9 45.8	43.3	43.4
144	51.3	48.7	53.1	50.8	47.6	50.3	49.8	41.6	48.4 50.2	46.6	47.3
216	50.8	51.9	55.1	50.6	50.4	51.8	53.0	45.5	54.5 52.5	51.8	51.4
Average	49.5	49.4	52.5	50.1	48.1	50.0	49.0	42.1	49.3 49.5	47.2	47.4
CV%	7.2						9.4				
LSD at 0.05 le	evel for										
Irrigation	(1)	0.9	9						3.3		
Nitrogen (	N)	1.4	4						1.1		
LX IN Cultivore	$(\mathbf{C})$	2.0	0						2.2		
	(0)	NS NS	Ś						3.6		
NXC		NS	ŝ						NS		
IxCxN		5.0	0						NS		
		С	ombin	ed							
I-1 72	47.8	49.6	48.1	49.4	49.1	48.8					
144	49.6	49.9	50.7	52.2	50.1	50.5					
216	52.5	51.8	56.2	53.1	53.0	53.3					
	44.7	11 1	46.0	46.1	41.0	42.0					
144	44.7	41.1	40.0	40.1	41.0	43.0					
216	51.8	45.7	52.7	50.1	50.5	50.2					
Average	48.4	43.8	49.3	48.5	45.2	47.0					
1-3 72	44.1	40.8	46.9	46.6	43.3	44.3					
144	54.0	44.4	52.0	50.7	46.1	49.4					
216	55.9	50.6	56.5	49.4	49.9	52.5					
Average	51.3	45.2	51.8	48.9	46.4	48.7					
I-4 72	44.6	41.8	47.5	47.3	45.9	45.4					
144	49.9	41.6	51.1	49.9	48.1	48.1					
210	47.3	40.9	53.0	50.7	20.9 49.2	50.5					
- TVEI aye	47.5	43.0	47 4	47 0	+0.5	40.0					
12	40.3 50.6	43.3 15.2	47.1 50.7	47.3	44.ŏ ∕17 1	40.0 /8.8					
216	51.9	48.7	54.8	51.6	51 1	51.6					
Average	49.2	45.7	50.9	49.8	47.7	48.7					
CV%	8.3										
LSD at 0.05 le	evel for										
Season (S	S)	NS	S								
Irrigation	(I)	1.0	6								
Nitrogen (	N)	0.	7								
I X N	$(\mathbf{C})$	1.4	4								
	(U)	1.	ו כ								
NXC		2., NS	š								
İxCxN		NS	S								

Table 3c: Means of 1000-kernel weight (gm) of five wheat cultivars as affected by variation in the irrigation intervals and N fertilization levels at El-Bustan region.

#### Genotypes

Significant differences in grain yield among the tested wheat genotypes were also observed. Gemmeiza 5 produced the highest grain yield (5.81 t/ha), being at par with Sakha 93 (5.70 t/ha) and was significantly more than the other genotypes, (Tables 2 & 3). This might be attributed to their higher values of number of spikes/m<sup>2</sup>, kernels/spike and 1000-kernel weight. Giza 168 and Sids 1 ranked the third and fourth with a non-significant difference between their grain yields being 5.62 and 5.58 t/ha receptively. While, Sakha 69 produced the lowest grain yield, (4.61t/ha)which might be due to its lowest yield attributing characters; number of spikes/m<sup>2</sup>, number of kernels/spike and 1000-kernel weight as compared with the other genotypes Tables 2, 3-a, b and c.

Concerning the significance of the interaction among the studied treatments (INC), the highest yields were achieved from cultivars Gemmeiza 5 and Sids 1 by irrigation at 7-day intervals and fertilized with 216 kg N/ha. This result was in agreement with those obtained by Ahmed (1993), El-Naggar (1997), Singh and Sharma (1997) and Singh *et al.* (1998).

Regarding the grain yield response index (GYRI), the results showed that the highest value (9.6) was obtained with the regular irrigation at 7-day intervals (I-1), whereas the lowest value of (6.9) was obtained with increasing the irrigation intervals during the first stage of crop growth (I-2). Treatments (I-1 and I-4) had almost equal values of GYRI as they were 9.6 and 9.2 for the two treatments, respectively, while that of treatment (I-3), was 7.4 (Table 3). Garabet *et al.* (1998) found that nitrogen fertilizer use efficiency (NFUE) was highest before anthesis, and it was increased by higher rainfall and irrigation. This might explain the obtained results regarding the decline in GYRI values with increasing the irrigation intervals either at the first stage (I-2) or at the second one(I-3), while the higher values were obtained with the treatments where the shortest intervals of 7 days were followed at both stages (I-1 and I-4).

### Water use efficiency

The results revealed that water use efficiency (WUE) was influenced by the different treatments of irrigation intervals although the differences were not significant in the second season of the study. The highest WUE values were obtained when the shortest intervals was followed at the first two stages, while a significant reduction occurred with increasing the irrigation intervals at either one of them, more so at the first stage than at the second one (Table 4). The lowest WUE value was obtained from the treatment (I-2), which also resulted in the lowest grain yield. Similar results were also reported by Eck (1988) and Ahmed (1993).

Irri. N level	Sids	Sakha	Sakha	Gemm	. Giza	Average	Sids	Sakha	Sakha	Gemm.Giz	a Average
Treat.Kg/ha	1	69	93	5	168		1	69	93	5 168	
I-1 72	122	10.8	11 9	<b>12</b> 8	12 4	12.0	11 2	93	1999/	13 123	11 1
144	12.7	12.3	14.3	15.4	13.3	13.6	12.2	10.1	11.6 1	4.5 13.6	12.4
216	14.6	13.7	14.5	16.8	14.2	14.8	15.9	11.0	13.8 1	5.3 15.0	14.2
Average	13.2	12.3	13.5	15.0	13.3	13.5	 13.1	10.2	12.3 1	3.7 13.7	12.6
1-2 72	10.1	11.6	11.0	10.6	10.0	10.7	9.4	8.8	11.2 1	2.4 11.6	10.7
216	13.8	11.4	13.7	14.0	12.5	13.0	12.4	9.0	14.1	5.4 13.5	13.2
Average	12.1	11.3	12.3	12.0	11.8	11.9	11.1	9.6	13.2 1	4.2 12.3	12.1
1-3 72	12.6	9.9	11.9	11.1	12.3	11.6	 11.0	7.1	11.5 1	2.9 10.3	10.6
144	13.9	11.1	13.2	12.2	12.7	12.6	13.1	7.6	12.1 1	4.4 13.1	12.1
	14.4	12.2	14.7	13.4	12.7	13.5	14.3	9.6	14.6 1	4.7 14.9	13.6
I-4 72	13.2	10.5	13.2	10.9	11.5	11.8	 12.0	8.4	12.7	10 12.0	11.2
144	13.7	12.6	15.2	14.1	12.4	13.6	13.2	10.8	13.5 1	2.1 14.2	12.8
216	14.5	14.1	15.3	15.3	15.0	14.9	14.6	11.7	15.0 1	5.2 16.2	14.5
Average	13.8	12.4	14.5	13.4	13.0	13.4	 13.3	10.3	13.6 1	2.8 14.3	12.8
72	12.0	10.7	12.0	11.3	11.5	11.5	10.9	8.4	11.5 1	1.9 11.7	10.9
216	14.3	12.8	14.5	13.3	12.9	13.0	12.5	9.6	14.5 1	5.9 13.2	12.4
Average	13.2	11.8	13.4	13.2	12.7	12.8	12.6	9.5	12.9 1	3.7 13.3	12.4
CV%	7.2						 10.7				
LSD at 0.05 lev	el for									_	
Irrigation (I)		0.9	3						N	S	
Nitrogen (N	)	0.0	3						0.4	20	
Cultivars (C	;)	0.4	1						0.5	53	
IxC	,	0.7	7						1.0	56	
NXC		NS	5						N	S	
TXCXN		1.3	3						N	S	
I-1 72	11 7	10.1	11 6	12 1	12 4	11.5					
144	12.4	11.2	12.9	14.9	13.4	13.0					
216	15.3	12.4	12.2	16.1	14.6	14.5					
Average	13.1	11.2	12.9	14.4	13.5	13.0	 				
1-2 72	9.8	10.2	11.1	11.5	10.8	10.7					
216	13.1	10.0	14.0	14.7	12.5	13.1					
Average	11.6	10.4	12.7	13.1	12.1	12.0					
1-3 72	11.8	8.5	11.7	12.0	11.3	11.1					
144	13.5	9.4	12.7	13.3	12.9	12.3					
216	14.4	10.9	14.7	14.0	13.8	13.5					
Average	13.2	9.0	13.0	10.1	12.7	12.3	 				
1-4 72	13.5	9.5	14.4	13.1	13.3	13.2					
216	14.6	12.9	15.1	15.3	15.6	14.7					
Average	13.5	11.4	14.1	13.1	13.7	13.1	 				
72	11.5	9.6	11.8	11.6	11.6	11.2	 				
144	12.8	10.7	13.3	13.6	13.1	12.7					
	14.3	11.7	14.5	15.0	14.3	14.0					
CV%	9.1			10.4			 				
LSD at 0.05 lev	el for										
Season (S)		NS	5								
Irrigation (I)		0.7	7								
Nitrogen (N	)	0.2	<u>/</u>								
LX IN Cultivars (C	:)	0.4	+ 3								
IxC	.,	0.6	5								
NXC		NS	6								
IxCxN		1.1	1								

Table 4: Water-use efficiency (kg/ha/mm) of five wheat cultivars as<br/>affected by variation in the irrigation intervals and N<br/>fertilization levels at El-Bustan region.

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Water-use efficiency of the different genotypes was significantly increased with increments of N-level in all irrigation treatments (Table 4). WUE was 11.2 and 14.0 kg/ha/mm for the lowest and highest N-levels, respectively. The increase in WUE due to nitrogen application was probably because nitrogen fertilization increase proportionately much more leaf area, and photosynthetic activity of plants than water loss. Similar results were obtained by Eck (1988), Nielsen and Halvorson (1991) and Singh *et al.* (1996). The results also showed that there was significant difference among the tested genotypes for WUE. Gemmeiza 5 recorded the highest WUE value, which was not significantly different from that obtained for Sakha 93. Moreover, Giza 168 and Sids 1 were statistically at par and were next to follow, whereas Sakha 69 gave the lowest WUE value (Table 4). Significant genotypic variation for WUE was also reported by Ahmed (1993), Ehdaie (1995) and Oweis *et al.* (1998).

Based on these results, the new cultivars, Gemmeiza 5 followed by Sakha 93 and Giza 168 along with the commercial cultivar Sids 1 are highly recommended to be grown in the sandy soil of new reclaimed area of El-Bustan region (El-Behaira Governorate) and for maximum, yield irrigation should be practiced every 7 days and N fertilizer should be applied at a rate of 216 kg N/ha.

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تقييم بعض التراكيب الوراثية الجديدة لقمح الخبز تحت فترات مختلفة من الرى ومعدلات التسميد النتروجيين فى الأراضى الرملية .

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أقيمت تجربتان فى الأراضى الرملية بمنطقة البستان بمحافظة البحيرة خلال موسمى ١٩٩٩/١٩٩٨ و بالمقارنة مع الحديثية ثلاثة تراكيب وراثية جديده من قمح الخبز وهى جميزة ٥ وسخا ٩٣ وجيزة ١٦٨ بالمقارنة مع الصنفين التجاريين سخا ٦٩ وسدس ١ تحت ثلاثة مستويات من التسميد النيتروجينى (٧٢, ١٤٤, ٢١٦ كجم/ن/هكتار) وأربع معاملات لفترات الرى وذلك بالرى كل ٧ أيام طوال موسم النمو فى احداها وزيادة فترات الرى الى ١٤ يوماً خلال أيّ من مراحل النمو التالية على الترتيب وهى من الزراعة الى طور الحمل، ومن الحمل الى الطور اللبنى، ومن الطور اللبنى حتى النضج .

ولقد أشارت نتائج الدراسة الى وجود تأثير معنوى لمعاملات الرّى على محصول الحبوب ومكوناته , كما تبين بالتحليل التجميعى للبيانات أن الرى كل ٧ أيام خلال موسم النمو قد أعطى أعلى محصول لجميع التراكيب الوراثية المختبرة وأن إطالة فترات الرى من ٧ الى ١٤ يوماً فى أىّ من مراحل النمو الثلاث المذكورة قد نتج عنه نقص معنوى فى محصول الحبوب وذلك بنسبة ١٩,٦ , ١٣,٤ م ٩,٨ % لتلك المراحل على الترتيب بما يشير الى أن المرحلة الأولى من مراحل نمو النبات ( من الزراعة حتى طور الحمل) هى الأكثر تأثراً بإطالة فترات الرى. كما تبين أيضا تناقص مكونات المحصول ( عدد السنابل /م٢ , مه ٩ مل الحموب / سنبلة ووزن الألف حبه ) بإطالة فترات الرى وبنسبة أكبر فى المرحلة الأولى .

كذلك أوضحت النتائج زيادة معنوية فى محصول الحبوب ومكوناته الثلاثة للأصناف المختبرة بزيادة معدلات التسميد النيتروجينى. كما كانت الفروق معنويه بين تلك الأصناف المختبره بالنسبة لكمية المحصول حيث أعطى الصنف جميزة ٥ أعلى محصول ( ٨٩.٥ طن/هكتار) وذلك بفرق معنوى عن بقية الأصناف بأستثناء سخا ٩٣ حيث لم يكن الفرق بينهما معنوياً, يليهما جيزة ١٦٨ وسدس ١ فى حين أعطى سخا ٦٩ أقل محصول ( ٢١.٦ طن/هكتار) وذلك بفرق معنوى عن بقية الأصناف, كما كان التفاعل بين المعاملات المختلفة معنوياً وقد حقق الصنف جميزة ٥ وسدس ١ أعلى محصول وذلك بالرى كل ٧ أيام خريس المعاملات مع التسميد بمعدل ( ٢١٦ كجم /ن/هكتار)

كما أشارت الدراسة الى وجود فروق جوهرية بين التراكيب الوراثية المختبرة فى استجابتها لزيادة معدلات التسميد النيتروجينى، وقد حقق الصنف جميزة ٥ أعلى معامل استجابة (GYRI) بينما كان الصنف سخا ٢٩ أقلها فى ذلك . كما تبين إرتفاع كل من معامل الإستجابة للتسميد(GYRI) , وكفاءة استخدام المياه(WUE) باتباع فترة الرى القصيرة ( ٧ أيام) خلال المرحلتين الأولى والثانية من مراحل نموالنبات المذكورة وأنخفاضهما بإطالة فترة الرى خلال إى من تلك المرحلتين وعلى الأحص خلال المرحلة الأولى . وكذاك اشارت النتائج أيضاً الى إرتفاع كفاءة استخدام مياه الروطى والثانية من مراحل نموالنبات المذكورة ومود فروق معنوية بين التراكيب الوراثية المختبرة بالنسبة لكفاءة استخدام المياه (WUE) الوراثية ذات أعلى محصول.

وبذلك يوصى للأراضى الرملية فى المناطق المستصلحة بمنطقة البستان فى محافظة البحيرة بزراعة الأصناف الجديدة جميزة ٥ وسخا ٩٣ وجيزة ١٦٨ وكذا الصنف التجارى سدس ١ مع الرى كل ٧ أيام طوال موسم النمو وبمعدل تسميد ٢١٦ كجم ن/هكتار للحصول على أعلى محصول منها.