Effect of Surface Water Irrigation Intervals and N-Fertilization on Productivity of Two Egyptian Wheat Cultivars Under Newly Reclaimed Land Conditions

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ABSTRACT

Two field experiments were conducted in EL- Bustan experimental farm, Faculty of Agriculture, Damanhour Branch, Alexandria University, Beheira Governorate, during two successive winter seasons (2000/ 2001 – 2001/ 2002) to study the effect of two surface water irrigation intervals (15 days and 30 days/ irrigation) on productivity of two Egyptian wheat cultivars (Sakha 8 and Sakha 69) under five levels of N fertilizer (0- 71.5- 143.0- 214.5 and 286 kg N/ ha).

A split-split-plot design in four replications was used. The two surface water irrigation intervals were randomly arranged in the main plots, while the two wheat cultivars were assigned to the sub-plots and the sub-sub plots were occupied by the five levels of nitrogen fertilizer

Results indicated the superiority of irrigation with 15-day intervals compared to 30-day intervals in most of the studied traits in both seasons, i.e., biological yield, grain yield, no. of spikes/ m^2, 100 kernel weight, spike weight, grain weight/ spike, no. of spikelets/ spike, plant height and heading date. On the otherhand, the crude grain protein % decreased, in both seasons.

Data also revealed that all studied traits, in both seasons, except for the number of spikelets/ spike and spike length in the second season, were insignificantly affected between the two wheat cultivars, where, Sakha 8 had higher grain/ spike compared to Sakha 69, while, Sakha 69 had higher number of spikelets/ spike and spike length compared to Sakha 8.

Significant interactions were noted among water irrigation intervals and wheat cultivars for both no. of spikes/ m^2 and spike length in the first season.

Regarding the nitrogen fertilization effects, data indicated highly significant differences, for all studied traits in both seasons, except harvest index in the first season, due to N fertilization. Generally, increase of N level up to 214.5 kg/ ha was followed by significant increase in most studied traits.

A significant interaction occurred between irrigation intervals and nitrogen fertilizer level for biological yield and grain yield in both seasons, while the interaction was significant for no. of grains/ spike, no. of spikelets/ spike, grain weight/ spike and plant height in the first season.

A significant interaction was detected between wheat cultivars and nitrogen fertilizer levels, in the second season, for both no. of spikelets/ spike and spike length.

Therefore, the study recommends wheat fertilization using 214.5 kg N/ ha and irrigation plants at 15-day intervals for either Sakha 8 or Sakha 69 Egyptian wheat cultivars under newly reclaimed land conditions.

INTRODUCTION

Wheat (*Triticum aestivum*, L.) is considered as one of the most strategic cereal crops in the world, as well as in Egypt, since it is a staple food for human.

However, the gap between the local production and consumption continuously increase with the fast growth in human population and limited cultivated area. So, increasing wheat production, either horizontal or vertical, through scientific basis is a national target.

Many other winter crops compete with wheat for the limited cropped area within the Nile Valley and Delta. Consequently growing wheat in newly reclaimed areas is a necessity. However, these newly reclaimed areas have a marginal nature. Therefore, sowing wheat might face many environmental stress conditions. Among the major stresses are the shortage of irrigation water and low soil fertility.

Irrigation intervals, cultivars and N fertilization levels are three essential production inputs. However, these factors are costly and are less available under the conditions of the newly reclaimed lands, such as El-Bustan Region in El-Beheira Governorate. Information conceming these three production inputs is very important to improve the productivity of wheat production under El-Bustan region conditions. Many researchers recorded significant increase of number irrigations **(Shalaby *et. al.* 1992; Khater *et. al*, 1997 and Moussa and Abdel- Maksoud, 2004)**.

Several authors recorded significant increase in yield of wheat due to the increase of N level up to 216 kg/ ha **(Moselhy, 1995 and Abdul Galil *et. al.*, 2003)**. However, others got similar response when they added 240 kg N/ ha **(El- Bana and Aly, 1993; Attia and Aly, 1998 Hassan and Gaballah, (2000). Moreover, Abdul Galil *et. al.*, (2003)** concluded that grain yield of wheat responded to N application up to 288 kg N/ ha. Furthermore, Fayed **(1992) and Soliman (2000)** got similar response, but to N applications of 288 and 432 kg N/ ha., respectively.

Several workers reported significant varietal differences in grain yield and yield components among different Egyptian wheat cultivars **(Hassanien *et. al*, 1997; Mowafy, 1999; Abdul Galil *et. al*, 2000 and Abdul Galil *et. al.*, 2003)**. On the other hand, other researchers indicated insignificant differences between cultivars in grain yield and its components **(Adb El-Gawad *et. al.*, 1986; El- Genbeehy, 1994; El-Eryani, 1995; Abo-Wadra, 2002 and Hassaan, 2003)**.

MATERIALS AND METHODS

Two field experiments were conducted at El- Bustan experimental farm, Faculty of Agriculture, Damanhour Branch, Alexandria University, Egypt, during two successive winter seasons of 2000/2001 and 2001/2002, respectively. The objectives were to study the productivity of two Egyptian wheat (*Triticum aestivum*, L) cultivars in response to five nitrogen fertilization levels under two surface water irrigation intervals. Soil samples were taken from the experimental site in the two seasons. The main physical and chemical properties of the soil are presented in **Table (1)**.

The treatments were arranged in a spilt-spilt plot design in four replications. The main plots were occupied with surface water irrigation intervals treatments, i.e., fifteen and thirty-day intervals, the total number of irrigation/ season was eight and four, respectively. The sub-plots Regarding the response of wheat to N-fertilization under newly reclaimed soil conditions,

The present investigation, therefore, aimed to study the effect of two irrigation intervals on the response of two Egyptian wheat cultivars to five levels of N fertilization under reclaimed soil conditions.

The nitrogen levels were assigned to the tested two wheat cultivars which were considered to be the most widely sown in Behira Governorate namely Sakha 8 (is known to be highly tolerant to salt and harsh environments) and Sakha 69 (has a highly yielding capacity under optimum conditions).

The sub-sub-plots were occupied with five levels of nitrogen fertilizer i.e., 0, 71.5, 143.0, 214.5 and 286.0 kg N/ ha as ammonium sulphate (20.5% N). Fifth of each N level was given at sowing. The remaining amounts (4/5) were given in two equal splits within thirty days from sowing. The area of sub-sub-plot was 20 m^2 (4 m long × 5 m width) and included 25 rows spaced 20 cm apart. Wheat cultivars grain were drilled on November 23rd and 29th, in the first and second seasons, respectively.

Phsophorus fertilizer, in the form of calcium superphosphate (15.5% P_2O_5) and potassium fertilizer in the form of potassium sulphate (48% K_2O) were applied before sowing at the rate of 73 kg P_2O_5 and 58 K_2O/ ha., respectively.

All other agricultural practices, were applied as recommended for the experimentation site. Heading date was recorded as the number of days from seeding to 50% of spikes completely emerged from flage leaf sheath. Plant height (cm) was recorded as the mean of three

measurements random of the distance from soil surface to the tip of spikes for each sub-sub-plot.

At harvest, ten plants were taken randomly from each sub-sub-plot to calculate the following characters, number grains/ spike, number of spikelets/ spike and spike length (cm). In addition one random guarded square matter was harvested from each sub-sub-plot in order to determine biological yield (total aboveground biomass at maturity), grain yield (t/ ha) and then harvest index (H.I%) was calculated as follows:

H.I = (Grain yield/ biological yield) * 100

The number of spikes/ m^2 was measured as the number of spike within five one- meter row for each sub-sub-plot and expressed as number of spikes/ m^2.

One-hundred kernel weight (g) was calculated as an average of two samples. The crude grain protein (%) was determined according to Kjeldohl method as described in **A.O.A.C (1985)**. The data were statistically analyzed, according to **Steel and Torrie (1980)**.

Table (1): Some physical and chemical properties of the experimental field site of E Jstan farm:

Soil properties	Seasons	
	2000/ 2001	2001/ 2002
Sand %	92.13	91.96
Clay %	3.94	4.19
Silt %	3.93	3.85
Soil texture	Sand	Sand
pH (1:1)	8.30	8.00
EC (1: 2) dSm^{-1}	1.37	1.39
Total CO_3^-	3.58	3.96
Organic – C%	0.67	0.58
Available – N (mg/ kg soil)	48.40	50.30
Available – K (mg/ kg soil)	96.00	106.00
Available – P (mg/ kg soil)	4.20	5.70

RESULTS AND DISCUSSION

A- Irrigation intervals effect:

Data in **Table (2)** revealed that most of the studied traits in both studied seasons i.e., biological yield, grain yield, no. of spikes/ m^2, 100-kernel weight, spike weight, grain weight/ spike, no. of spikelets/ spike, plant height, heading date and crude grain protein significantly responded

to the irrigation intervals. Irrigation of wheat plants at 15-day intervals resulted in higher means for the above mentioned traits except crude grain protein compared with those irrigated at 30-day intervals **(Tables 4, 5, 6 and 7)**. The increase percentages for irrigation of plants at 15-day intervals compared to 30-day intervals were 39.71, 38.97, 32.07, 15.32, 26.57, 25.78, 17.69, 9.63, and 1.48%, averaged over both seasons, for the above mentioned traits, respectively but crude grain protein was decreased by 3.53%, averaged for both seasons.

These results may be due to the water functions in plant growth, especially under conditions of the experiment where the soil texture was sandy **(Table 1)**, since water is a major constituent of physiologically active tissue and a solvent in which salts, sugars and other solutes move from cell to cell and organ to organ and essential for the maintenance of the turgidity necessary for cell enlargement and growth, consequently dry matter and growth characters **(Salem *et. al.* 2003)**.

On the other hand, **Abd El-Gawad *et. al.*, (1993)** stated that when the wheat plant is exposed to a prolonged period of water deficit, grain yield is seriously decreased through decreasing its reproductive organs number of fertile tillers/ plant and number of grains/ spike. In this concern, **Singh and Bhana (1998)** indicated that the increase in wheat yield attributes was due to more water supply which led to increase in cell turgidity, better opening of stomata and finally increasing the partitioning of photosynthesis to sink.

Our sreults were in agreement with those of **Halvorson *et. al.*, (1999), Guttieri *et. al.*, (2000) and Hassaan (2003)**.

On the other hand, harvest index, was insignificantly affected by irrigation intervals, in both seasons **(Table 2)**. The harvest index values were 29.19 and 29.66%, with irrigation of 15-day and 30-day intervals, in the first season, respectively. Mean while, the corresponding values were 29.96 and 28.86 %, in the second season **(Tables 4 and 5)**.

We think that result may be due to that harvest index is a ratio (grain yield/ biological yield) and logically if both demineistrator and denominator increase and/ or decease together the ratio will be little changed. Similar results were obtained by **El-Eryani (1995), Awad *et. al.*, (2000) and Heinawy and Wahba (2003)**.

B- Wheat cultivars effect:

Data of plant height, heading date, crude grain protein, biological yield, grain yield and its components as affected by the two wheat cultivars i.e., Sakha 8 and Sakha 69, in 2000/ 2001 and 2001/ 2002 seasons, are

presented in **Tables (2, 3, 4 and 5)**. Data indicated that all studied traits, except the number of spikes/ m^2 in the first season, number of grains/ spike, number of spikelets/ spike and spike length in the second season, were insignificantly affected by the two wheat cultivars in both studied seasons **(Table 2)**.

In this concern, many researchers reported insignificant wheat cultivars differences regarding biological yield, grain yield and harvest index **(El- Eryani, 1995)**, 100- kernel weight **(Abd El-Gawad *et. al.*, 1986; El-Genbeehy, 1994 and El- Eryani, 1995)**, number of spikelets/ spike **(Shalaby *et. al.*, 1992)**, spike length **(Shalaby, 1986)**, number of spikes/ m^2 **(El- Genbeehy, 1994 and Hassaan, 2003)** and plant height **(Shalaby *et. al.*, 1992; El- Genbeehy, 1994 and El- Eryani, 1995)**. However, these data disagreed with those reported by several workers as they reported significant wheat cultivars differences regarding plant height, number of spikes/ m^2 **(Hassanien *et. al.*, 1997 and Abdul Galil *et. al.*, 2000)**, spike length and number of spikelets/ spike **(Shalaby, 1986)**. The confliction between our results and those of the above mentioned workers may be explained that they tested foreign wheat cultivars along with Egyptian wheat cultivars that differed in their genetic make up and their interaction to the environmental conditions prevailing during their growth.

Regarding number of spiks/ m^2, data in **Table (3)** revealed that Sakha 8 cultivar was significantly superior to Sakha 69 in the first season. No wheat varietal effect or number of spikes/ m^2 was supported by reports of **(Abd El- Gawad *et. al.*, 1986; Shalaby *et. al.*, 1992 and El- Eryani, 1995)**.

Concerning the number of grains/ spike, highly significant differences were detected between Sakha 8 and Sakha 69 in the second season, whereas, the differences did not reach the significance level in the first season **(Tables 2, 4 and 7)**. Sakha 8 produced 26.57 grains/ spike but Sakha 69 had 25.98, averaged over both seasons. The results corresponded to those reported by **(Abd El-Gawad *et. al.*, 1993; Abd El-Raouf *et. al.*, 1986; Shalaby, 1986; El Genbeehy, 1994 and Hassaan, 2003)**.

For the number of spikelets/ spike, Sakha 69 wheat cultivar had higher means; 6.86 and 6.64%, compared with Sakha 8 in the first and second seasons, respectively **(Tables 4 and 7)**. However, the differences did not reach the level of significance in the first season **(Tables 2 and 4)**, **Shalaby *et. al.*, (1992)** found similar results.

With respect to the spike length, data in **Table (7)** revealed that Sakha 69 cultivar had longer spike than Sakha 8 by 7.96% in the second

seasons, whereas, the differences were insignificant in the first season **(Table 4)**. These results were in agreement with **Shalaby *et. al.* (1992)**.

C- Irrigation intervals × wheat cultivars interaction effect:

Data in **Table (2)** showed that the interaction between the irrigation intervals and wheat cultivars was significant for both number of spikes/ m^2 and spike length in the first season only. The highest value for spikes/ m^2 (486.10) was obtained from Sakha 8 when it was irrigated at 15- day intervals. On the other hand, the lowest value of spikes/ m^2 (315.9) was obtained from Sakha 69 which was irrigated at 30- day intervals **(Table 3)**.

Regarding the spike length, data in **Table (3)** revealed that the highest mean value (9.06 cm) resulted when cultivar of Sakha 69 was irrigated at 15-day intervals, while the lowest mean (7.9 cm) was obtained when plants of Sakha 8 cultivar were irrigated at 30- day intervals. These results may be due to that Sakha 69 has a high yielding capacity under optimum conditions compared to Sakha 8. These results are in agreement with **Shalaby *et. al.* (1992)**.

D- Nitrogen fertilizer levels effect:

Data in **Table (2)** show highly significant effects for nitrogen fertilizer levels on all studied characters in both studied seasons, except harvest index in the first season. These results may be expected where the experimental farm soil is sandy (92% sand) and of poor fertility level with vegrad to organic matter, macro and micronutrients **(Table 1)**. Nitrogen fertilizer is considered the most effective element on the metabolic processes and physiological activities of the meristimatic tissues. In addition, nitrogen element is responsible for cell division and elongation, formation of plant organs, thus leading to more vigorous growth and consequently accumulation of more photosynthesis assimilates, resulting in increase of dry matter and agronomic traits. Moreover, **Boquet and Johnson (1987)** indicated that the increase percentage of grain yield of wheat due to nitrogen application resulted from increased fertile tillers/ ha. Similar results were obtained by **Singh and Bahan (1998)** who concluded that sink capacity of the plant is dependent mainly on vegetative growth of plant, where vigorous vegetative growth increased due to the application of nitrogen and supply of photosynthates for formation of tillers and spikes of wheat. In both seasons, the results presented in **Tables (4, 5, 6 and 7)** generally indicated that increase of N level up to 214.5 kg N/ ha. was, followed by a significant increase in all studied traits of the experiment i.e., biological yield, grain yield, harvest index, no of spikes/ m^2, no. of grains/ spike, 100-kernel weight, spike length, plant height, heading date and

percentage of crude grain protein. In this concern, reported similar results when they increased N level to wheat up to 192, 240 and 288 kg N/ ha. under sandy soil conditions. Similar results, also, were reported by **(EL-Bana and Aly, 1993 and Abdul Galil *et. al.*, 2003)**.

E- Irrigation intervals × nitrogen fertilizer levels interaction effects:

The results in Tables **(2, 6 and 7)** revealed that interaction of irrigation intervals × nitrogen fertilizer levels proved to be significant, where water irrigation with 15-day intervals at 286 kg N/ ha., gave the highest means for grain yield in both seasons, such as, biological yield, grain weight/ spike, plant height in the first season and no. of grains/ spike, no. of spikelets/ spike, spike length and percentage of crude grain protein in the second season. With regared to the biological yield in the second season, data in **Table (7)** showed that water irrigation with 15- day intervals at 214.5 kg N/ ha gave the highest means compared with other treatments.

F- Cultivars × nitroger fertilizer levels interaction effect:

The interaction between the effects of cultivars and nitrogen fertilizer levels showed a significant effect on both number of spikelets/ spike and spike length in the second studied season only **(Table 2)** Regarding to the number of spikelets/ spike, the results in Table (8) revealed that cultivar Sakha 8 had the highest and lowest means at 286.0 kg N/ ha and control (unfertilized) that were 16.87 and 6.63 spikelets/ spike, respectively

Longest spike mean (10.63 cm) was obtained by Sakha 69 wheat cultivar fertilized with 286.0 kg N/ ha., while the shortest spike mean (4.89 cm) was obtained when Sakha 8 wheat cultivar was unfertilized.

Table (2): Significance of mean squares for some plant traits, grain yield (t/ ha.) and yield components for wheat as affected by irrigation intervals, cultivars and nitrogen fertilizer in 2000/ 2001 and 2001/ 2002 seasons.

S.O.V.	d.f.	Traits and seasons													
		Biological yield (t/ ha.)		Grain yield (t/ ha.)		Harvest index (HI)		No. of Spikes/ m^2		No. of grains/ spike		100-kernel weight (g)		Spike weight (g)	
		2000/ 2001	2001/ 2002	2000/ 2001	2001/ 2002	2000/ 2001	2001/ 2002	2000/ 2001	2001/ 2002	2000/ 2001	2001/ 2002	2000/ 2001	2001/ 2002	2000/ 2001	2001/ 2002
Replications	3	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Irrigation intervals (A)	1	**	**	**	**	NS	NS	**	**	NS	**	**	**	**	**
Error "a"	3	2.138	0.550	0.251	0.013	40.373	5.847	9892.8	112807	98.469	8.674	0.206	0.286	0.014	0.055
Cultivars (B)	1	NS	NS	NS	NS	NS	NS	*	NS	NS	**	NS	NS	NS	NS
A × B	1	NS	NS	NS	NS	NS	NS	*	NS	NS	NS	NS	NS	NS	NS
Error "b"	6	2.098	2.591	0.080	0.156	9.389	9.476	4138.0	2866.6	15.94	8.36	0.248	0.235	0.264	0.044
Nitrogen levels (C)	4	**	**	**	**	NS	**	**	**	**	**	**	**	**	**
A × C	4	**	**	**	**	NS	NS	NS	NS	NS	**	NS	NS	NS	NS
B × C	4	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
A × B × C	4	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Error "c"	48	4.932	1.731	0.152	0.057	24.219	4.901	1595.7	1735.12	22.189	4.316	0.134	0.077	0.092	0.777

*, ** Significant at 0.05 and 0.01 levels, respectively
NS: Not significant

Table (2): Cont.:

S.O.V.	d.f.	Traits and seasons											
		Grain weight/ spike (g)		No. of spikelets/ spike		Spike length (cm)		Plant height (cm)		Heading date (day)		Crude grain protein (%)	
		2000/ 2001	2001/ 2002	2000/ 2001	2001/ 2002	2000/ 2001	2001/ 2002	2000/ 2001	2001/ 2002	2000/ 2001	2001/ 2002	2000/ 2001	2001/ 2002
Replications	3	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Irrigation intervals (A)	1	*	*	**	*	*	NS	*	*	**	*	*	**
Error "a"	3	0.021	0.315	0.801	5.212	0.786	1.167	31.069	34.849	1.012	2.983	0.079	0.069
Cultivars (B)	1	NS	NS	NS	*	NS	**	NS	NS	NS	NS	NS	NS
A × B	1	NS	NS	NS	NS	*	NS	NS	NS	NS	NS	NS	NS
Error "b"	6	0.120	0.102	2.917	1.446	0.716	0.332	52.804	58.515	2.512	0.983	0.195	0.125
Nitrogen levels (C)	4	**	**	**	**	NS	**	**	**	**	**	**	**
A × C	4	*	NS	NS	**	NS	**	**	NS	NS	NS	NS	*
B × C	4	NS	NS	NS	*	NS	*	NS	NS	NS	NS	NS	NS
A × B × C	4	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Error "c"	48	0.060	0.086	1.277	1.352	0.530	0.285	5.077	11.207	1.218	0.566	0.109	0.051

*, ** Significant at 0.05 and 0.01 levels, respectively
NS: Not significant

Table (3): **Effect of interaction between irrigation intervals (I) and wheat cultivars (C) (I×C) on number of spikes/ m^2 and spike length (cm) overall five nitrogen fertilizer levels during 2000/ 2001 growing season:**

Triat	Irrigation intervals (I)	Wheat cultivars (C)		Mean	L.S.D.$_{0.05}$
		Sakha 8	Sakha 69		
Number of spiks/ m^2	15- day Interval (I_1)	486.10	402.25	444.18	I= 70.78 C= 35.2
	30- day Interval (I_2)	324.50	315.90	320.20	IC= 75.53^{++} IC= 49.77^{++}
	Mean	405.30	359.08	382.19	
Spike length (cm)	15- day Interval (I_1)	8.11	9.00	8.56	I= 0.63 C= -
	30- day Interval (I_2)	7.9	7.76	7.83	IC = 0.78^{+} IC = 0.66^{++}
	Mean	8.01	8.38	8.20	

+ : To compare two irrigation means at the same or different levels of cultivars, for each trait

++ : To compare two cultivar means at the same or different levels of irrigation, for each trait

Table (4): Means of harvest index (H.I), No. of grains/ spike, 100- kernel weight (g), spike weight (g), No. of spikelets/ spike, heading date and crude grain protein (%) for two wheat cultivars, two irrigation intervals and five N-Fertilizer levels during 2000/ 2001 winter season.

Treatment	Harvest index (H.I)	No. of grains/ spike	100- kernel weight (g)	Spike weight (g)	No. of spikelets/ spike	Heading date (day)	Crude grain protein (%)
Irrigations intervals:							
15- day	29.19a	30.21a	3.93a	2.38a	13.23a	93.10a	11.75b
30- day	29.66a	23.87a	3.48b	1.92b	11.19b	91.67b	12.07a
Cultivars							
Sakha 8	29.53a	26.00a	3.80a	2.13a	11.81a	92.35a	11.92a
Sakha 69	29.31a	28.08a	3.61a	2.16a	12.62a	92.43a	11.89a
N- fertilizer levels (kg/ha)							
0	27.19a	14.37d	2.19d	1.25d	9.05d	91.38c	10.23e
71.5	29.75a	21.87c	3.45c	1.91c	10.93c	92.13bc	11.51d
143.0	30.96a	27.59b	3.98b	2.31b	12.70b	92.31ab	12.07c
214.5	30.03a	34.93a	4.39a	2.62a	13.88a	93.06a	12.68b
286.0	29.16a	36.43a	4.52a	2.64a	14.49a	93.06a	13.07a
Overall means	29.42	27.04	3.71	2.15	12.21	92.39	11.91

Table (5): Means of harvest index (H.I), No. of spikes/m^2, 100- kernel weight (g), spike weight (g), grain weight/ spike (g), plant height (cm) and heading date (day) for two wheat cultivars, two irrigation intervals and five N-Fertilizer levels during 2001/ 2002 winter season:

Treatment	Harvest index (H.I)	No. of spikes/ m^2	100-kernel weight (g)	Spike weight (g)	Grain weight / spike (g)	Plant height (cm)	Heading date (day)
Irrigations intervals:							
15- day	29.96a	421.23a	3.75a	2.05a	1.51a	68.14a	90.85a
30- day	28.86a	335.00b	3.18b	1.58b	1.06b	63.26b	89.60b
Wheat Cultivars							
Sakha 8	29.36a	383.63a	3.55a	1.81a	1.27a	65.38a	90.00a
Sakha 69	29.46a	372.60a	3.38a	1.83a	1.31a	67.02a	90.45a
N- fertilizer levels (kg/ha							
0	27.58b	272.81d	2.03d	0.91d	0.23d	53.60d	88.37d
71.5	28.83ab	346.50c	3.05c	1.62c	1.00c	65.31c	89.63c
143.0	30.77a	392.18b	3.81b	1.85b	1.44b	68.94b	90.37b
214.5	29.63a	428.43a	4.18a	2.29a	1.84a	71.08ab	91.13a
286.0	30.22a	450.63a	4.25a	2.43a	1.93a	72.07a	91.63a
Overall means	29.41	378.11	3.46	1.82	1.29	66.20	90.23

Table (6): Effect of interaction between irrigation intervals and nitrogen fertilizer level (I×N) on biological yield (t/ ha), grain yield (t/ ha), grain weight/ spike (g) and plant height (cm) of two wheat cultivars during 2000/ 2001 winter season:

Irrigation intervals (I)	N-fertilizer levels Kg/ha (N)	Biological yield (t/ ha)	Grain yield (t/ha)	Grain weight/ spike (g)	Plant height (cm)
15- day (I_1)	0	4.90	1.32	0.68	56.40
	71.5	8.33	2.46	0.99	69.81
	143.0	12.39	3.62	1.18	74.61
	214.5	16.60	4.75	1.82	77.20
	286.0	17.71	4.98	1.94	80.67
	Mean	11.99	3.43	1.32	71.74
30- day (I_2)	0	3.95	1.08	0.63	53.36
	71.5	5.41	1.51	1.02	63.20
	143.0	6.88	2.24	1.27	68.13
	214.5	10.40	3.20	1.48	70.16
	286.0	12.73	3.74	1.54	71.37
	Mean	7.87	2.35	1.19	65.24
Fertilizer's overall mean	0	4.43	1.20	0.66	54.88
	71.5	6.87	1.99	1.01	66.51
	143.0	9.64	2.93	1.23	71.37
	214.5	13.50	3.98	1.66	73.68
	286.0	15.22	4.36	1.74	76.02
Cultivar's overall mean	Sakha 8	10.00a	2.90a	1.27a	67.32a
	Sakha 69	9.86a	2.88a	1.24a	69.66a
Overall means		9.93	2.89	1.26	68.49
	$L.S.D._{0.05}$				
	I	1.04	0.36	0.10	3.97
	N	1.58	0.28	0.18	1.60
	I × N	2.23	0.49	0.24	4.36

Table (7): Effect of interaction between irrigation intervals and nitrogen fertilizer level (I×N) on biological yield (t/ ha), grain yield (t/ ha), no. of grains/ spike, no. of spikelets/ spike, spike length (cm) and crude grain protein (%)of two wheat cultivars during 2001/ 2002 winter season:

Irrigation intervals (I)	N-fertilizer levels Kg/ha (N)	Biological yield (t/ ha)	Grain yield (t/ha)	No. of grains/ spike	No. of spikelets/ spike	Spike length (cm)	Crude grain protein (%)
15- day (I_1)	0	4.18	1.18	8.59	7.47	5.04	9.64
	71.5	9.54	2.77	22.23	9.95	6.77	10.34
	143.0	11.08	3.41	35.29	13.98	8.58	11.35
	214.5	15.24	4.58	44.00	16.75	10.29	12.18
	286.0	15.11	4.65	44.73	16.43	10.34	12.47
	Mean	11.03	3.32	30.97	12.92	8.20	11.20
30- day (I_2)	0	3.40	0.91	6.56	6.34	4.75	10.40
	71.5	5.53	1.58	15.08	9.30	6.49	11.08
	143.0	9.11	2.77	21.72	10.95	7.44	11.81
	214.5	11.81	3.42	27.87	13.23	8.73	12.51
	286.0	13.15	3.84	29.00	15.32	9.84	12.82
	Mean	8.60	2.50	20.05	11.03	7.45	11.72
Fertilizer's overall mean	0	3.79	1.05	7.57	6.91	4.90	10.02
	71.5	7.53	2.17	18.66	9.63	6.63	10.71
	143.0	10.10	3.09	28.51	12.47	8.01	11.58
	214.5	13.52	4.00	35.94	14.99	9.51	12.35
	286.0	14.13	4.25	36.87	15.87	10.09	12.64
Cultivar's overall mean	Sakha 8	10.04a	2.98a	27.13b	11.59b	7.54a	11.52a
	Sakha 69	9.58a	2.84a	23.88a	12.36a	8.11a	11.40a
Overall means		9.81	2.91	25.51	11.98	7.83	11.46
	$L.S.D._{0.05}$						
	I	0.53	0.08	2.09	1.62	NS	0.19
	N	0.94	0.17	1.47	0.83	0.38	0.16
	I × N	1.28	0.23	2.74	1.89	0.89	0.27

Table (8): Effect of interaction between wheat cultivars and N-fertilizer levels (C×N) on number of spikelets/ spike and spike length (cm), during 2000/ 2001 growing season:

Trait	Wheat cultivars (C)	Wheat cultivars (C)					Mean	L.S.D.$_{0.05}$
		0	71.5	143.0	214.5	286.0		
No. of spikelets/ spike	Sakha 8	7.18	9.63	12.00	14.25	14.88	11.59	C= 0.66
	Sakha 69	6.63	9.63	12.93	15.73	16.87	12.36	N= 0.83
	Mean	6.91	9.63	12.47	14.99	15.88	11.98	CN^{+}= 1.24
								CN^{++}=1.17
Spike length (cm)	Sakha 8	4.89	6.47	7.80	9.01	9.55	7.54	C= 0.32
	Sakha 69	4.9	6.79	8.21	10.00	10.63	8.11	N= 0.38
	Mean	4.90	6.63	8.01	9.51	10.09	7.83	CN^{+}= 0.57
								CN^{++}=0.54

+: To compare two cultivar means at the same or different levels of nitrogen, for each trait

++: To compare two nitrogen levels at the cultivars, for each trait

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الملخص العربى

تأثير طول فترات الرى السطحى والتسميد الآوزتى على إنتاجية صنفين من القمح المصرى تحت ظروف الأراضى حديثة الاستصلاح

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أجريت تجربتان حقليتان- بمزرعة كلية الزراعة بدمنهور- فرع جامعة الإسكندرية- بمنطقة البستان- محافظة البحيرة خلال موسمى (٢٠٠١/٢٠٠٠ & ٢٠٠٢/٢٠٠١) وذلك بهدف دراسة تأثير طول فترات الرى السطحى (١٥ يوم- ٣٠ يوم بين رية والتى تليها) على إنتاجية صنفى القمح المصرى (سخا ٨ & سخا ٦٩) حال تسميدها بخمسة مستويات من السماد الآزوتى (صفر- ٧١,٥- ١٤٣- ٢١٤,٥- ٢٨٦ كجم نيتروجين/ هكتار)

استخدم فى هذه الدراسة تصميم القطع المنشقة لمرتين بأربع مكررات حيث خصصت القطع الرئيسية لفترتى الرى بينما تم توزيع صنفى القمح عشوائياً على القطع الفرعية فى حين خصصت القطع تحت الفرعية للمستويات الخمسة من السماد الآزوتى.

وقد أوضحت نتائج هذه الدراسة أن رى نباتات القمح كل ١٥ يوم قد أدى إلى إحداث زيادة معنوية فى متوسطات معظم الصفات المدروسة فى كلا موسمى الدراسة حيث إزداد متوسط كلاً من: المحصول البيولوجى- محصول الحبوب- عدد السنابل/ م^{2}- وزن الـ ١٠٠ حبة- وزن السنبلة- وزن الحبوب/ سنبلة- عدد السنبيلات/ سنبلة- طول النبات- عدد الأيام من الزراعة حتى التزهير وذلك بالمقارنة برى النباتات على فترات ٣٠ يوم/ رية، وعلى العكس فقد أنخفض متوسط البروتين الخام بالحبوب معنوياً- فى حين لم تتاثر صفة معامل الحصاد معنوياً كلا الموسمين- بينما تأثر صفة عدد الحبوب/ سنبلة معنوياً فى الموسم الثانى وكذا تأثرت صفة طول السنبلة فى الموسم الأول.

كذلك أظهرت نتائج الدراسة أن كل الصفات التى تم دراستها- فى كلا الموسمين- بإستثناء صفة عدد السنابل/م^{2} من الموسم الأول- إلى جانب صفات عدد الحبوب/ سنبلة- عدد السنبيلات/ سنبلة وطول السنبلة فى الموسم الثانى- لم تتأثر معنوياً بصنفى القمح. ففى حين أعطى صنف القمح سخا ٨

أعلى متوسط لعدد الحبوب/ سنبلة- مقارنة بالصنف سخا ٦٩ فقد سجل الأخير أعلى المتوسطات بالنسبة لصفتى عدد السنبيلات/ سنبلة وطول السنبلة مقارنة بالصنف الأول.

أكدت نتائج الدراسة وجود تفاعل معنوى بين فترات الرى والأصناف على صفتى عدد السنابل/ م٢ وطول السنبلة فى الموسم الأول.

بالنسبة لتأثير السماد النيتروجينى، فقد أظهرت نتائج الدراسة أن التسميد الآزوتى لنباتات القمح أحدث تأثيرات عالية المعنوية لكل الصفات التى تم دراستها فى كلا الموسمين. بإستثناء صفة معامل الحصاد فى الموسم الأول من الدراسة- حيث كان الاتجاه العام هو زيادة فى متوسطات كل الصفات التى تم دراستها- ماعدا معامل الحصاد فى الموسم الأول- وذلك مع كل زيادة فى معدل التسميد الآزوتى حتى معدل ٢١٤,٥ كجم نيتروجين/ هكتار.

أكدت نتائج هذه الدراسة وجود تفاعل معنوى بين فترات الرى ومستويات الإضافة من السماد الآزوتى على صفتى المحصول الإقتصادى ومحصول الحبوب فى كلا موسمى الدراسة- بينما كان هذا التفاعل معنوياً بالنسبة لصفات عدد الحبوب/ سنبلة- عدد السنبيلات/ سنبلة وطول السنبلة و% للبروتين الخام فى الحبوب وذلك فى الموسم الثانى، فى حين كان هذا التفاعل معنوياً بالنسبة لوزن الحبوب/ سنبلة وطول النبات فى الموسم الأول.

اوضحت نتائج هذه الدراسة أيضاً معنوية التفاعل بين أصناف القمح ومعدلات التسميد الآزوتى فى الموسم الثانى على صفتى عدد السنبيلات/ سنبلة- طول السنبلة.

ومن نتائج هذه الدراسة يمكن التوصية بالتسميد الآزوتى بمعدل ٢١٤.٥ كجم/ آزوت/ هكتار والرى كل ١٥ يوم بين الرية والتى تليها- وذلك فى حالة زراعة أياً من صنفى القمح سخا ٨ أو سخا ٦٩ تحت ظروف الأراضى حديثة الاستصلاح.