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Effect of Different Levels of Nitrogen Fertilization and Irrigation Intervals on Barley Plants Productivity in Newely Reclaimed Areas.

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ABSTRACT

The present work was carried out during two successive seasons at Kalabsha Agricultural Research Station, to study the effect of different levels of nitrogen 0, 15, 30 and 45 kg/fed. on growth characters and yield of Barley plants under different irrigation intervals, 4, 8 and 12 days. Number of leaves, plant height, number of spikes as well as fresh weight of leaves and stems were increased by nitrogen fertilization. The highest number of tillers at first season was obtained by 45 kg N/fed. The highest significant increase in growth characters, straw and grain yield were obtained by using 30 kg N/fed. Plant height, number of leaves, and panicles as well as fresh weight of leaves, panicles and stems increased with shortening the irrigation frequancy to 4 days. Prolonging the irrigation intervals from 4 to 8 and 12 days decreased growth characters, straw and grain yield/fed. at both seasons. The interaction between irrigation and nitrogen fertilization showed positive

effect on growth characters, straw and grain yield/fed. Increasing nitrogen level up to 30 kg/fed. was more effective under the shorter irrigation frequency than those under the wider ones.

INTRODUCTION

Barley is one of the most important cereal crop in Egypt, the average yield per feddan is low, this may be due to irrigation regime and Nitrogen application. Lynch et al. (1979) working on spring 5 barley cv. reported that there was an average increase in grain yield of 11 kg/ha. for each kg/ha. Nitrogen application. Risk and others (1984) also mentioned that barley plants responded to nitrogen application up to 150 kg/ha. by increasing the number of fertile tillers. Ammonium nitrate 120 kg/ha. markedly improved grain yield and size of spring barley (Pain et al., 1978). Similar results were obtained by El-Kholei and Bayoumi (1982). On the other hand, Lynch and Others (1979) and Kahnt (1981) reported that, the increase in the rate of nitrogen application have little effect on grain yield. Similar results were obtained by Pedersen and Jorgensen (1976).

The maximum average yield of barley grain was obtained by application of 35 kg N/ha. as mentioned by Kuizenga (1977). Similar results were obtained by Kandera (1976).

J hansson (1977) revealed that irrigation increased grain yield irrespective of method of N application. However Malhotra and Cheema (1977) concluded that pre-sowing irrigation alone or with two irrigation during the growth period increased the average grain yield. Hooda, and Kalra (1981) also mentioned that dry matter production increased with increasing nitrogen rate for irrigated barley plants than for rainfed crops. Similar results were obtained by Pesant and Cheng (1984). However, Radnev and Vasilev (1973). Concluded that the highest average grain yield was obtained by two irrigations applied compared with plants received only one irrigation.

The aim of this study is to evaluate the effect of different levels of Nitrogen on growth characters and yield of barley plants under different irrigation frequencies.

MATERIAL AND METHODS

Two field experiments were carried out at Kalabsha Agricultural Research Station N.R.C. at High Dam Lake 1983 - 1984 and 1984 - 1985 growing winter seasons to study the effect of nitrogen and irrigation on barley plants cultivar (Giza 121).

Barley grains were sown at 24 November of 1984 and 1985 two successive seasons. The soil was sandy chemical and mechanical analyses of the soil are illustrated in Table (A).

A split plot design with 4 replicates were used in both seasons. Calcium superphosphate, and potassium sulphate by the rates of 200 and 100 kg/fed. were added before sowing. Nitrogen was added broadcasting as 3 equal portions after 1,2 and 3 months from sowing. The following irrigation interval treatments were : 4, 8 and 12 days.

The soil fertilization treatments with each irrigation interval were :

1. Unfertilized (control).
2. 15 kg N/fed. as (Ammonium nitrate).
3. 30 " " " (" ").
4. 45 " " " (" ").

The obtained data were statistically analyzed according to Snedicor and Cochran (1967).

Four plants were chosen from every treatment at time of emergency, panicles and the following measurements of growth were taken.

1. Plant height (in cm).
2. Number of leaves.
3. Fresh weight of leaves (in g).
4. Fresh weight of panioles (g).
5. Fresh weight of stems (g).

Yield :

1. Number of tillers.
2. Number of panicles.
3. 5 panicles weight.
4. Weight of grain of 5 panicles.
5. Straw yield.
6. Grain yield.

RESULES AND DISCUSSION

Data of the vegetative growth and straw as well as grain yields of barley plants as affected by irrigation, nitrogen and the interaction are shown in Tables (1,2 and 3) respectively.

1. Vegetative growth :

Data presented in Table (1 A) showed differences in plant height as well as number of leaves at both seasons due to irrigation intervals. The highest value for plant height and number of leaves were obtained when the irrigation interval was 4 days. Prolonging irrigation interval depressed both number of leaves and plant height. Similar results was obtained by Johanson (1977) on barley.

Results in Table (2 A) showed that plant height and number of leaves/plant generally increased by increasing N level up to 30 kg/fed. However, applying more than

30 kg/fed. N reduced this increase. In this connection it may be mentioned that Finkner and Vernal (1971), reported that nitrogen increased plant height of wheat plants.

The interaction between irrigation and N fertilization as shown in Table (3 A) revealed that the higher values of plant height and number of leaves were recorded by adding 30 kg N/fed. at 4 days irrigation interval at both season.

The increase in plant height and number of leaves by shortening irrigation intervals, and increasing N fertilization was recorded by El-Zeiny (1971) and Hussein (1968) on maize plants.

Number of panicles increased at both seasons when the irrigation intervals shorted to 4 days, increasing irrigation intervals from 8 - 12 days showed insignificant decreasing effect. On the other hand extending irrigation intervals, had no significant effect on number of tiller.

Increasing N levels up to 45 kg/fed. increase significantly number of tiller while 30 kg/fed. was sufficient to increase number of panicles at the first season. However, applying Nitrogen more than 30 kg/fed. was not sufficient to cause any aditional significant effect. It seems from the data recorded, that nitrogen fertilization not only enhance vegetative growth of barley plants represented

plant height and number of leaves but also accelerate reproductive growth through the increase in number of tiller and number of panicles. Similar results were obtained by Hagrass (1972) on wheat.

The interaction between irrigation and N level as shown in Table (3 A) revealed that 30 kg N/fed. was sufficient to increase both number of tillers and panicles in both seasons, when irrigation interval was reduced to 4 days (Kirby, 1969). Increasing irrigation interval to 8 or to 12 days, the level of 45 kg N/fed. was effective in increasing number of tillers to the highest values at both seasons.

Fresh weight :

As shown in Table (2) increasing N level up to 30 kg/fed. increased significantly the fresh weight of leaves at both seasons as compared with the control treatment. Moreover, increase in N level up to kg/fed. reduced this increase. These results are in agreement with those of Hussein and Firgany (1978) and Thalooth (1978) on wheat plants.

The increase of nitrogen level resulted in increases in the fresh weight of stems and panicles in spite of the abscence of significante in some cases at both seasons, the highest values were recorded by adding N fertilizers

at 15 kg/fed. However, any increase in nitrogen above 15 kg/fed. reduced that increases.

The interaction between irrigation and N fertilization react significantly on fresh weight of leaves, stems and panicles, 30 kg/fed. was suffficient when plants were irrigated every 4 days, whereas at longer irrigation intervals, 45 kg was effective.

Weight of 5 panicles and their grains :

Data in Table (1 b) showed that prolonging irrigation intervals up to 12 days, decreased significantly weight of 5 panicles as well as weight of their grains in both seasons, However, the highest values were obtained when irrigation interval was shortened to 8 days.

As shown in Table (2) weights of 5 panicles with increased by adding nitrogen fertilization as compared with control plants.- However, in the first season the weight was not significantly increased with increasing nitrogen level over 15 kg/fed. and for 30 kg/fed. in the second season. The increase in weight of 5 panicles with N level was found to be related to grain weight of the 5 panicles.

The interaction between irrigation and N fertilizers shown in Table (4) revealed that increasing N level from

0 - 45 kg/fed. increased weight of 5 panicles and their grains. In spite of the absence of significance in some cases, the data show that whereas the highest weight was obtained by adding 30 kg/fed. with irrigation frequancy of 4 days, prolonging the irrigation interval showed a significant decreasing effect.

Straw yield :

It is clear from the results in Table (2 b) that extending irrigation interval from 4 to 12 days, significantly decreased straw yield in both seasons while increasing N level from 0 to 45 kg/fed. increased straw yield significantly. This increase may be due to the role of N in increasing the vegetative growth. Kandera (1974) and Kristan (1974) came to the same conclusions.

Concerning the interaction between irrigation and nitrogen fertilization, data in Table (3) showed an increase in straw yield by increasing the nitrogen level. However, the highest straw yield were obtained with irrigation interval of 4 days with 45/fed. at both seasons. At the longer irrigation interval 8 and 12 days the level of 30 kg/fed. was sufficient to increase straw yield at both seasons.

Grain yield :

Significant differences in grain yield were obtained in both seasons due to extending irrigation intervals. However, grain yield decreased significantly by prolonging irrigation intervals from 4 to 8 and 12 days at both seasons. The linear relation between barley grain yield and the amount of water was found by Power et al. (1973). Senlivy (1971) demonstrated that irrigation increased sugar content of the over wintering barley plant by 15.20 times; compared with barley grown under rain fed conditions as water stress may be depress the activity of several enzymes in the leaves.

Grain yield was significantly affected by nitrogen fertilizers as the highest value was obtained by using 30 kg N/fed. in both seasons. This results are in agreement with Dilz et al. (1975) who mentioned that, 30 kg N/fed. was the best for barley. Moreover, the increase in N decreased this increase significantly. Similar results were obtained by Kuizenga (1977) who mentioned that the maximum grain yield of barley was obtained by application of 30 kg N/fed.

Interaction between irrigation treatments and nitrogen fertilization (Table 3) showed that, increasing nitrogen dose significantly increased grain yield whatever the irrigation interval used as compared with the unfertilized plant

at both seasons of experiment. However, the highest yield was obtained by adding 30 kg N/fed. and irrigation interval of 4 days at both seasons, this level was less effective by increasing irrigation intervals to 8 and 12 days.

It might be concluded from these results that grain yield is highly affected by water stress. Increasing nitrogen level up to 45 kg N/fed. slightly decreased this increase when the plants were irrigated every 8 or 12 days at both seasons.

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Table (1,A) : Effect of irrigation of growth and yield of barley.

Irrigation intervals	Plant height in cm.		No. of leaves/ plant		No. of panicles		No. of tillers		Fresh weight/plant (g)					
									Leaves		Panicles		Stems	
	1984	1985	1984	1985	1984	1985	1984	1985	1984	1985	1984	1985	1984	1985
4	75.97	73.95	18.22	18.05	2.22	2.25	3.62	3.50	3.40	3.30	1.82	1.73	9.37	9.90
8	67.92	67.35	17.35	17.42	2.12	2.05	3.30	3.37	2.72	2.67	2.45	2.42	8.01	7.06
12	64.67	64.00	13.87	14.72	1.97	1.60	3.62	3.48	3.22	3.15	2.87	2.72	10.77	10.95
L.S.D. 5 %	8.95	6.50	2.53	1.40	0.42	0.44	0.58	0.41	0.081	0.059	0.09	0.077	0.29	0.32

Table (1,B) :

Irrigation intervals	Yield characters/plant				Yield/fed.			
	5 panicles weight (g)		Grains of 5 panicles (g)		Straw ton.		Grain kg.	
	1984	1985	1984	1985	1984	1985	1984	1985
4	6.60	6.22	4.50	4.32	1.556	1.419	1110.725	1035.64
8	6.72	6.42	5.25	5.09	0.944	0.913	800.400	8090.20
12	5.50	5.35	4.80	4.59	0.625	0.631	662.610	649.06
L.S.D. 5 %	0.434	0.280	0.280	0.225	0.1147	0.045	49.32	50.28

Table (2,A) : Effect of nitrogen fertilizers on growth characters of barley.

N Fertilizers kg N/fed.	Plant height in cm.		No. of Leaves /plant		No. of tillers		No. of panicles		Fresh weight/plant					
									Leaves		Panicles		Stems	
	1984	1985	1984	1985	1984	1985	1984	1985	1984	1985	1984	1985	1984	1985
Unfertilized	63.00	61.83	11.90	12.06	2.83	3.00	1.90	1.66	1.63	1.56	1.93	1.78	7.00	6.37
15	75.50	73.36	12.23	17.06	3.15	3.16	2.63	2.56	3.13	3.00	3.50	3.40	12.42	12.07
30	73.92	73.86	19.56	19.40	3.91	3.73	2.66	1.90	4.10	4.03	2.36	2.30	10.50	10.84
45	66.30	66.40	17.23	18.40	4.16	3.66	1.73	1.73	3.60	3.56	1.95	1.70	7.59	7.09
L.S.D. 5 %	10.33	7.51	2.67	1.61	0.67	0.47	0.51	0.42	2.60	0.068	0.06	0.09	0.33	0.38

Table (2,B) :

N Fertilized kg N/fed.	5 panicles weight (g)		Grains of 5 panicles (g)		Straw yield/fed. ton.		Grain yield/fed. kg	
	1984	1985	1984	1985	1984	1985	1984	1985
Unfertilized	5.96	5.83	4.76	4.32	0.5077	0.4919	572.0	561.7
15	6.87	6.20	6.10	4.99	1.2290	1.0882	1024.3	1005.6
30	6.83	6.26	5.70	5.09	1.1820	1.1550	1080.5	1032.5
45	6.00	5.90	4.43	4.27	1.2370	1.2156	746.9	712.6
5 %	0.5019	0.321	0.321	0.082	0.132	0.213	56.95	58.06

Table (3 a) : Interaction between irrigation and nitrogen fertilization on barley yield and its components.

Irrigation	Fertilization	Plant height (cm)		No. of leaves /plant		No. of pahioles/ plant		No. of tillers/ plant		Fresh weight g /plant					
										Leaves		Panicles		Stems	
		1984	1985	1984	1985	1984	1985	1984	1985	1984	1985	1984	1985	1984	1985
4	0	64.6	62.5	10.5	10.0	2.0	2.0	2.5	2.7	1.5	1.4	1.6	1.4	7.80	6.82
	15	86.7	81.6	18.5	19.0	2.2	2.5	3.0	3.2	3.4	3.3	2.0	2.0	14.00	14.35
	30	79.2	76.9	28.7	28.2	3.0	2.5	5.5	4.7	5.6	5.5	2.0	1.8	10.32	13.60
	45	73.4	74.6	15.2	15.0	1.7	2.0	3.5	3.2	3.1	3.0	1.7	1.7	5.32	4.85
8	0	65.2	64.2	13.5	13.5	2.5	2.0	2.5	2.7	2.0	2.0	2.6	2.5	6.25	5.62
	15	65.8	65.2	14.5	14.2	3.0	3.2	3.7	3.7	2.6	2.4	4.0	4.0	9.37	8.45
	30	65.7	65.1	12.0	12.2	2.0	2.0	2.7	2.7	2.6	2.6	1.3	1.3	7.97	6.52
	45	62.0	61.5	19.2	19.2	1.0	1.0	4.5	4.2	3.7	3.7	1.9	1.9	8.42	7.65
12	0	59.2	58.8	11.7	12.7	1.2	1.0	3.5	3.5	1.4	1.3	1.6	1.4	6.95	6.67
	15	74.0	73.3	18.7	18.0	2.7	2.0	2.7	2.5	3.4	3.3	4.5	4.2	13.90	13.42
	30	74.9	74.2	18.0	18.0	2.5	2.2	3.7	3.7	4.1	4.0	3.8	3.8	13.22	12.42
	45	63.6	63.1	21.0	21.0	1.5	1.2	4.5	4.2	4.0	4.0	1.6	1.5	9.03	11.22
L.S.D. 5 %		17.90	13.01	4.63	2.8	0.446	0.736	1.17	0.825	4.5	0.119	0.18	0.155	0.583	0.698

Table (3 b) : Interaction between irrigation and nitrogen fertilization on barley yield and its components.

Irrigation	Fertilization	5 Panicles weight (g)		Grains of 5 panicles wt. (g)		Straw yield/fed. ton.		Grain yield/fed. kg.	
		1984	1985	1984	1985	1984	1985	1984	1985
4	Unfertilized	6.80	5.60	4.80	4.20	0.6372	0.6250	591.2	588.90
	15	7.10	6.60	4.50	4.50	1.8775	1.5195	1056.6	1000.77
	30	7.50	7.70	7.90	7.80	1.7165	1.6130	1546.9	1367.00
	45	7.00	7.00	4.80	4.60	1.9960	1.9440	1234.4	145.77
8	Unfertilized	6.00	7.00	3.80	3.50	0.5760	0.5790	645.9	634.92
	15	7.10	6.30	5.90	5.50	1.0960	0.9852	958.5	963.40
	30	7.30	6.50	5.90	6.10	1.1227	1.1515	981.4	1022.50
	45	6.50	5.90	5.40	5.10	0.9845	0.9385	606.8	616.70
12	Unfertilized	5.10	4.90	5.70	5.10	0.3100	0.2917	479.2	460.10
	15	6.40	5.70	4.90	5.90	0.7520	0.7600	1058.0	1052.75
	30	7.70	6.60	5.50	5.20	0.7090	0.7100	713.4	707.95
		4.50	4.20	3.10	3.00	0.7320	0.7645	399.6	375.45
L.S.D. 5 %		0.869	0.55	0.14	0.25	0.2295	0.095	98.65	100.57

Table (A) : Chemical and mechanical analyses of Kalabsha soil.

Depth (cm.)	Chemical analyses										
	pH in (1:2.5 susp.)	$CaCO_3$ (%)	E.C. in (1.5 mmhos/cm)	Cations (meq/100 gm soil)				Anions (meq/100 gm soil)			
				Na^+	K^+	Ca^{++}	Mg^{++}	CO_3	HCO_3	Cl^-	SO_4^{--}
0-30	8.1	5.31	0.65	2.10	0.28	1.80	0.30	-	0.40	2.0	1.95
30-60	8.3	0.17	0.37	0.75	0.17	2.10	0.20	-	0.30	1.8	2.00

Mechanical analyses

Organic matter (%)	Coarse sand (%)	Fine sand (%)	Silt (%)	Clay (%)	Texture
0.24	21.9	63.9	12.0	1.2	Sandy soil