EFFECT OF IRRIGATION INTERVALS, NITROGEN AND IRON FERTILIZER LEVELS AND SOIL TYPE ON GROWTH AND YIELD OF WHEAT

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Abstract

In a pot experiment, wheat (Sakha 8) was used to investigate the effect of irrigation intervals , three levels of either nitorgen or iron fertlilzer and soil type on dry matter yield and growth characters of wheat plants.The results show that the dry matter yield and growth character values significantly increased under alluvial soil, 8-days irrigation intervals and different nitrogen -iron fertilizer treatments. The interaction between either soil type or irrigation regime and N-Fe fertilizer treatments in respect of the studied characters were significant. Generally , the number of the productive tillers value was significantly correlated with the different factors under consideration.

INTRODUCTION

Wheat is the main winter cereal crop in Egypt and its shortage is the dominant factor in food problem. Hence, fertilization and irrigation factors are of great concern for obtaining high yield. The literature dealing with fertilizers application in wheat are numerous. Khalil *et al.* (1977), Korkor *et al.* (1984), and Abd-El-Latif and El-Tuhamy (1986) reported that increasing nitrogen fertilization levels up to 120 kg N/fed increased grain and straw yield/fed and the yield components characteristics. On the other hand , Shrivastava *et al.* (1970), Sayed (1978) and Hefni (1980), showed that applying Fe increased significantly all yield components characteristics

including grain and straw yields. Viets (1967) and Newbould (1969) revealed that soil water levels play an important role in nutrient availabilty. The present work aims at studying the effect of irrigation regime, nitrogen and iron fertilizer levels and soil type on productivity of wheat plant.

MATERIALS AND METHODS

A pot experiment was carried out using 10 kg of either calcareous and alluvial soils taken from Tahreer province, Northern sector, and Kalubia Governorate at Bahtim, respectively. Some physical and chemical properties of soils under study are given in Table 1. Ten wheat grains (Sakha 8) per pot were sown and the seedlings were thinned to 6/pot after 30 days from palnting. After thinning all pots received potassium sulphate (48 % K_2O) at the rate of 100 kg/ feddan. Superphosphate (15 % P_2O_5) was added before planting at the rate of 150 kg / fed , while nitrogen was added as ammonium nitrate (33.5 %N) at the rates of 0, 40 and 80 kg/fed . Three levels iron (iron sulphate) were added at the rates of 0, 10 and 20 ppm Fe/fed . Both nitorgen and iron fertilizers were added at two equal doses; the first after 30 days from planting and the second after another 30 days. The water regime was applied in two irrigation frequencies; 8 and 16 days, respectively. The amount of water given for irrigation was the same for all treatments (IL/pot) throughout the experimental period. Number of productive tillers/pot, number of spikes/pot , spike length (cm), plant height (cm) and dry matter yield (g/pot) were recorded. Data were statisitically analyzed using Ducan's new multiple range test (Duncan 1955).

RESULTS AND DISCUSSION

Data in Table 2 reveal that the highest values of different growth characters and dry matter yield of wheat plants were found under clay loam soil, while the lowest ones were obtained under the sandy loam calcareous soil. This may be due to the improved soil conditions for plant growth under alluvial soil compared with calcareous soil. Generally, growth charcters and dry matter yield values were signifi-

Table 1. Some physical and chemical properties of soils under investigation soils.

Soil Locations	E. C. mmoh/ cm 25° C	O. M. %	$CaCO_3$ %	Moisture constant %			Particle size distribution %				Texture class	
				F.C.	W.P.	A.W.	Coarse sand	Fine sand	silt	clay		
Bahtim soil	1.55	1.40	2.65	35.5	15.6	19.9	0.71	17.05	36.65	45.62	clay	loam
El-Tahreer soil	3.09	0.80	24.78	21.1	12.0	9.2	14.37	48.34	21.03	15.90	sandy	loam

F.C. = field capacity
W. P. = Wilting point
A.W. = available water

Table 2. Effect of soil type, irrigation regime and nitrogen and iron fertilization on some growth characters and dry matter of wheat plant.

Different treatments	No. of tillers / pot	No. of spike / pot	spike length (cm)	plant length (cm)	Dry matter g/pot
1- soil type					
Alluvial soil	32.66	12.02	10.30	61.94	38.46
Calcareous soil	25.18	10.93	9.87	57.68	34.97
L.S.D. at % 5	N.S.	0.06	0.09	1.28	0.19
at % 1	N.S.	0.34	0.46	2.95	1.08
2-Irrigation period					
I_1 (every 8 days)	29.66	14.78	10.16	63.68	47.39
I_2 (every16days)	28.18	8.17	10.01	55.94	26.14
L.S.D. at % 5	N. S.	0.02	0.03	0.90	0.06
at % 1	N. S.	0.05	0.07	1.50	0.16
3-Fertlization treatments					
t_0	24.25	9.85	9.96	59.25	31.52
t_1	28.75	L2.02	10.12	63.56	38.46
t_2	27.33	12.17	10.06	60.00	38.12
t_3	26.50	10.77	10.22	59.75	34.46
t_4	40.83	9.77	9.58	61.00	31.26
t_5	30.65	11.70	10.27	57.25	37.44
t_6	28.10	12.02	10.19	60.75	38.46
t_7	25.63	12.20	10.10	59.50	39.04
t_8	28.27	12.27	10.26	57.25	40.86
L.S.D. at % 5	N. S.	0.02	0.030	1.42	0.08
at % 1	N. S.	0.03	0.04	1.89	0.09

1_1 = first irrigation period
1_2 = second irrigation period
N. S. = insignificant.

$t_0 = N_o Fe_o$ $t_1 = N_1 Fe_o$ $t_2 = N_2 Fe_o$ $t_3 = N_o Fe_1$ $t_4 = N_o Fe_2$ $t_5 = N_1 Fe_1$ $t_6 = N_1 Fe_2$ $t_7 = N_2 Fe_1$ $t_8 = N_2 Fe_2$

cantly affected by soil type, while the number of productive tillers were insignificant.

Data in Table 2 also show that the highest values of different growth characters and dry matter yield of wheat plant were obtained with the first irrigation interval (8 days) , while the lowest were obtained with 16 days irrigation interval under the two soils . This may be attributed to the fact that under relatively drier treatment the plants were shorter and containing lower number or spikes / plant. Data in Table 2 also indicate that the values of growth characters and dry matter yield of wheat plant increase significantly by shorter irrigation intervals, but differences in value of the number of productive tillers were significant.

Data in Table 3 indicate that the values of growth characters and dry matter yield of wheat plants attained for alluvial soil were higher than those obtained for calcareous one under different irrigation intervals. This may be due to the fact that soil moisture depletion in the root zone in alluvial soil is due to the decrease in number of irrigation (Tsiklauri 1976).

Data in Table 3 showed that the values of growth characters and dry matter yield of wheat plants are significantly affected by the interaction between soil type and irrigation regime. The values of number of productive tillers are also significant.

Table 3. Interaction effect of soil type and irrigation regime on some growth characters and dry matter of wheat plant.

Soil type	Irrigation intervals	No. of tillers /pot	No. of spikes /pot	spikes length (cm)	Plant height (cm)	Dry matter g / pot
Alluvial soil	I_1	33.77	14.98	10.33	66.00	47.93
	I_2	31.55	9.06	10.27	57.88	28.99
Calcareous soil	I_1	25.55	14.85	9.99	61.37	46.65
	I_2	24.81	7.28	9.75	54.00	23.29
L.S.D at	% 5	N. S.	0.02	0.02	0.52	0.05
at	% 1	N. S.	0.04	0.04	0.87	0.13

1_1 = first irrigation intervals (8 days)

1_2 = second irrigation intervals (16 days)

N. S. = insignificant.

Data in Table 2 reveal that values of growth characters and dry matter yield of wheat plant increase significantly by different N and Fe fertilization treatemnts and their combinations under different studied soils. The changes in the number of productive tillers are significant . However data presented in Table 3 reveal, in general, no clear trend in growth characters on dry matter yield values caused by N-Fe fertlizer levels and their combinations. This result is in good agreement with that of Hamdy *et al.* (1962), who reported that the low response to N and Fe fertilizer level might be due to the high fertility of the soil.

Data in Table 4 show that the values of growth characters and dry matter yield of wheat plants obtained with alluvial soil are higher than those obtained with calcareous soil under different N and Fe fertilization treatments . This may be attributed to the role of high organic matter content in improving different soil properties and , consequently, in improving soil productivity, (Pothiraj 1979).

Data in Table 5 indicate that the obtained values of growth characters and dry matter yield of wheat plants are higher with the first irrigation interval (8 days) than with the second irrigation interval (16 days) under different fertilzation treatments. This may be due to the low available moisture content which may reduce soil productivity. Varma (1976), reported that the nutrient uptake by some cereal and leguminous crops increased with increasing soil moisture contents.

Data in Table 4 and 5 reveal that the interaction between either soil type or irrigation regime and N and Fe fertilizer treatments in respect of the studied charcters is significant, except for the values of productive tillers which were insignificant.

The present results lead to the conclusion that the growth characters and dry matter yield of wheat plants are highly affected by irrigation regime, N and Fe fertilization and soil type.

Table 4. Interacrtion effect of soil type and nitrogen and iron fertilization on some growth characters and dry matter of wheat plant.

Soil type	Fert. treat.	No. of tillers/ pot	No. of spikes/ pot	spikes length (cm)	plant length (cm)	Dry matter g/pet
Alluvial soil	t_0	29.00	10.85	9.87	60.00	34.72
	t_1	33.00	12.50	10.45	66.50	40.01
	t_2	25.50	13.50	10.32	60.50	43.20
	t_3	59.66	10.50	9.95	67.50	33.60
	t_4	32.81	11.85	10.45	58.50	37.92
	t_5	31.70	12.05	10.52	62.00	38.56
	t_6	22.76	12.05	10.22	60.50	38.86
	t_7	29.55	13.55	10.50	59.50	42.73
	t_8					
Calcareous soil	t_0	19.50	8.85	10.05	58.50	28.32
	t_1	24.50	11.50	9.80	60.66	36.99
	t_2	29.16	11.85	9.80	59.50	37.90
	t_3	23.00	10.00	9.99	57.00	32.03
	t_4	22.00	9.05	9.22	54.50	28.96
	t_5	28.50	11.50	10.10	56.00	37.90
	t_6	24.50	12.00	9.87	59.50	38.40
	t_7	28.50	12.35	9.99	58.50	39.52
	t_8	27.00	12.20	10.02	55.00	39.40
L.S.D. % 5		N.S.	0.032	0.036	2.019	0.098
%1		N.S.	0.041	0.048	2.685	0.144

t_o = $N_o Fe_o$ t_1 = N_1Fe_o t_2 = N_2Fe_o

t_3 = N_oFe_1 t_4 = N_oFe_2 t_5 = N_1Fe_1

t_6 = $N_1 Fe_2$ t_7 = $N_2 Fe_1$ t_8 = $N_2 Fe_2$

N. S. = insignificant

Table 5. Interacrtion effect of irrigation regime and nitrogen and iron fertilization on some growth characters of wheat plant.

irrigaition interval	Fert. treat.	No. of tillers/ pot	No. of spikes/ pot	spikes length (cm)	plant length (cm)	Dry matter g/pet
I_1 (8 days)	t_0	24.00	11.85	10.02	64.00	37.92
	t_1	29.00	15.85	10.02	67.11	50.72
	t_2	27.50	16.85	10.52	67.00	53.92
	t_3	26.00	13.85	10.12	63.00	44.32
	t_4	50.16	11.35	9.60	63.00	36.32
	t_5	24.20	15.35	9.90	64.50	49.12
	t_6	28.81	14.05	L0.60	62.50	44.96
	t_7	25.76	16.70	10.22	61.50	53.44
	t_8	31.55	17.20	10.30	60.50	55.04
I_2 (16 days)	t_0	24.50	7.85	9.90	54.50	25.12
	t_1	28.50	8.20	10.05	60.00	16.24
	t_2	27.16	7.50	9.60	53.00	24.02
	t_3	27.00	7.70	10.32	56.50	24.64
	t_4	31.50	8.20	9.57	59.00	26.56
	t_5	32.50	9.35	9.95	52.00	29.92
	t_6	32.00	8.70	10.49	57.00	27.84
	t_7	25.00	7.70	9.99	57.50	24.64
	t_8	25.00	8.35	10.22	54.00	26.72
L. S. D.	% 5	N. S.	0.03	0.04	2.01	0.11
	% 1	N. S.	0.04	0.05	2.60	0.15

I_1 = first irrigation period I_2 = second irrigation period

$t_0 = N_o Fe_o$ $t_1 = N_1 Fe_o$ $t_2 = N_2 Fe_o$

$t_3 = N_o Fe_1$ $t_4 = N_o Fe_2$ $t_5 = N_1 Fe_1$

$t_6 = N_1 Fe_2$ $t_7 = N_2 Fe_1$ $t_8 = N_2 Fe_2$

N. S. = insignificant

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تأثير فترات الرى ومستوياته من التسميد بالنيتروجين والحديد ونوع الأرض على الصفات الخضرية والمحصول لنبات القمح

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معهد بحوث الأراضى والمياه – مركز البحوث الزراعية – الدقى – الجيزة

فى تجربة أصص لدراسة تأثيرات ثلاثة مستويات من التسميد النتروجينى (صفر ، ٤٠ ، ٨٠ كجم نتروجين للفدان وثلاثة مستويات من الحديد (صفر ، ١٠ ، ٢٠ جزء فى المليون) حيث أضيف كل من الحديد والنتروجين على دفعتين متساويتين الأولى بعد شهر من الزراعة والثانية بعد شهر من الأولى) وتم رى التجربة على فترتين الأولى كل ٨ أيام والثانية كل ١٦ يوم بمعدل لتر للأصيص فى كل رية ، وقد تم قياس كل من عدد الأشطاء المنتجة وعدد السنابل وطول السنبلة وارتفاع النبات والمحصول وذلك لصنف قمح سخا ٨ والمنزرع فى نوعين مختلفين من الأراضى الأولى أرض رسوبية والثانية أرض جيرية وكانت النتائج المتحصل عليها كالآتى : –

أن الصفات الخضرية والمادة الجافة زادت معنوياً تحت ظروف الرى كل ٨ أيام والأرض الرسوبية والتسميد بالنتروجين والحديد.

كان تأثير التفاعلات المختلفة تحت الدراسة معنوياً على الصفات الخضرية والمادة الجافة لمحصول القمح. وعموماً لم يتأثر عدد الأشطاء الخصبة بالعوامل المختلفة تحت الدراسة