

EFFECT OF WATER IRRIGATION QUANTITY AND COMPOST RATES ON SOME WHEAT VARIETIES UNDER SANDY SOIL CONDITIONS OF WEST DELTA REGION CONDITIONS.

Harb, O. M. S.¹; G. H. Abd El -Hay¹ ; M. A. Hager¹; M.K.Hassanien² and M. M. Abou El –Enin¹

1. Agronomy Dep., Fac. of Agric., Al-Azhar Univ., Cairo, Egypt

2. Central Laboratory For Agricultural Climate, ARC. , Giza, Egypt.

ABSTRACT

Two field experiments were performed in EL-Husain farm, Giza governorate under the condition of sandy soil during 2009/2010 and 2010/2011 seasons, to study the impact of three amount of water irrigation 60, 70 and 90% from evapotranspiration rate (1461 m³) and three compost rates 2, 4 and 6 ton/fad. on some growth, yield and its components of two wheat varieties (Sakha 93 and Gemmeiza 9).

Results of the two seasons showed that ,by increasing the water irrigation amount from 60 to 70 or 90 % of the evapotranspiration (1461 m³) led to gradually significant increases for leaf area/plant , dry weight /plant, No. of spikes/ m² ,weight of grains /spike , No. of grains/spike , weight of 1000 grains, grain yield /fad. and harvest index .Compost rates had significant impacts on previous characteristics, during the two experimental seasons. The best compost rate was (6 ton/fad) which gave the best results for these traits as compared with the lowest rate (2 ton/fad).

Results revealed that, Gemmeiza 9 wheat variety exceeded Sakha 93 wheat variety significantly for above mentioned measurements during the two seasons.

As for the first and second order interactions between the tested factors, results in the two trial seasons revealed that, most of the interactions had significant effects on that character. It wealthy mentions that significant interaction effect was found between the three factors under testing during the two seasons. The highest values for previous characters were obtained by sowing Gemmeiza9 with adding irrigation quantity of 90% from evapotranspiration and practicing 6 ton compost per fad.

INTRODUCTION

Wheat is the most important cereal crop as stable food grain in Egypt, where the local production is not sufficient to supply the annual demand of the increasing population, this caused gap between production and consumption. Hence, increasing wheat production is the most important possibility for reducing the wheat gap and reach self sufficiency of wheat production.

To achieve the obvious aim, it could be realized by two ways: First: expanding the area sown second: improving the yield per unit area sown. Wheat areas in sandy soils have gradually increased over the last few years, du to the limitation of agricultural land in the old valley. Sandy soils are very much considered in the plain of horizontal expansion in Egypt. Such soils are characterized by their bulk density and low values of native nutrient content and the high leaching losses of applied fertilizers and water irrigation.

Acton and Gregorich (1995) pointed that the application of compost as organic matter to such soil is desperately needed, to increase soil nutrients and minimize nutrient loss due to leaching, as well as improve moisture holding capacity of sandy soil.

Ibrahim *et al.* (1996) studied the effect of irrigation regime on yield of wheat. Results demonstrated that plant height, flag leaf area, No. of tillers and spikes/m², No. of grains/spike, weight of 1000 grain, straw and biological yields were significantly decreased by exposing wheat plants to water stress.

Sadek and Abo-Warda (1998) found progressive and significant increase in grain yield, 1000-grain weight and No. of grains/spike with increasing the amount of water applied under the condition of sandy soil (2080, 3330 and 4580 m³/ha.).

EL-Hinnawy (1999) examined seven wheat genotypes under these moisture regimes (irrigation at 25, 50 and 75 % depletion of soil available water. Results indicated that, moisture more than 50% depletion of soil available water reduced grain yield.

To overcome the sandy soils problem, it requires great efforts to improve its hydro-physical properties, as well as its productivity.

El-Sayed *et al.* (2000) found that the tested wheat cultivars Gemmeiza 5, 7, and 9 showed significant variations in all studied traits. Gemmeiza 9 surpassed the other two cultivars in number of spikes/m², number of grains/spike, grain weight/spike, 1000-grain weight, grain and straw yields/fed followed by Gemmeiza 7.

Lewandowski (2002) clarified that organic matter increases the nutrient holding capacity of soil. So, it is a pool of nutrients for plants. Organic matter binds nutrients, preventing them from becoming permanently unavailable to plants.

Matter *et al.* (2007) reported that grain yield of wheat cultivar Sakha-93 increased by using organic fertilizer. The highest wheat grain yield was obtained with treatment consisted of 1.2: 0.66: 1.5: 2.5 ton/fad. from farmyard manure, chicken manure, town red use and sewage sludge, respectively.

Zeidan *et al.* (2009) found that significant differences were detected among the three wheat cultivars in all characters during both seasons and their combined. Sids-1 cultivar was superior and gave the highest value of all studied characters followed by Giza-168 while Sakha-93 showed the lowest values in all studied characters.

This investigation was carried out, to find out the effect of water irrigation quantity and organic fertilizer (compost) rates on growth, yield and yield components of wheat.

MATERIALS AND METHODS

Two field experiments were carried out during two successive growing seasons of 2009/2010 and 2010/2011 at Al-Husain farm – kilo 64 Cairo Alexandria desert province of Giza governorate, Egypt to investigate the effect of irrigation water quantity and compost rates on growth and yield of two wheat cultivars under the condition of fixed sprinkler irrigation system in sandy soil.

Tested agricultural factors:

A – Water irrigation quantity:

60, 70 and 90 % from evapotranspiration rate (1461m³) which determined according to Irri-Clac program in Central Laboratory For Agricultural Climate, ARC., Giza, Egypt.

B – Compost fertilizer rates: 2, 4 and 6 ton per fadden.

C – Wheat varieties:

The varieties of wheat (*Triticum aestivum*, L.) tested in this study were:

- 1- Sakha-93 which is characterized by resistance to rust disease, and salinity.
- 2- Gemmeiza-9 (V2) which is characterized by resistance to rust disease, echoes and drought, also it enjoys high productivity and quality in central and south Delta and the newly reclaimed soils.

Soil samples were collected at experimental site for two seasons to depth of 30, 60 and 90cm.before sowing for chemical and mechanical analysis which recorded in Tables (1 and 2) respectively, which determined according Page *et al.* (1982) While Chemical analyses for compost fertilizer are given in Table (3). Regarding with the analysis results for water irrigation sample is given in Table (4).

Table (1): Chemical analysis of soil in at experimental site.

season	Depth (Cm)	PH (1 : 2.5)	EC (ppm)	Total N (ppm)	Organic Matter (%)
2009/2010	30 cm	8.4	512	20	0.2
	60 cm	8.3	192	30	0.35
	90 cm	8.2	179.2	10	0.69
2010/2011	30 cm	8.2	568	23	0.47
	60 cm	8	375	41	0.57
	90 cm	8.1	206	15	0.8

Table (2): Mechanical analysis of soil experimental site.

Seasons	Sample Depth (Cm)	%			Texture
		clay	sand	silt	
2009/2010	30 cm	5.28	84.72	10	Loamy sand
	60 cm	2.32	95.68	2	Sand
	90 cm	4.32	93.68	2	Sand
2010/2011	30 cm	6.7	83.3	10	Loamy sand
	60 cm	4.2	93.4	2.4	Sand
	90 cm	5.3	91.6	3.1	Sand

Table (3): Chemical analysis for compost fertilizer sample.

Micronutrients(ppm)				Macronutrients (%)		
Fe	Mn	Zn	Cu	N	P	K
776	534	52	18	0.76	0.11	1.14
O.C%		O.M%		C/N		
9.7		16.7		12.76		

Table (4): the analysis results for water irrigation sample:

Seasons	EC(ppm)	PH	soluble anions (m.moq/L)				soluble cations (m.moq/L)			
			CL ⁻	SO4 ⁻	CO3	HCO3	Ca ⁺⁺	Mg ⁺	Na ⁺	K ⁺
2009/2010	2720	7.5	24.44	10.54	-	2	19	11.5	18.5	0.22
2010/2011	3436	7.9	37.8	13.61	0.5	2.28	28	13.7	21.8	0.27

Experimental field included eighteen treatments which were the combination of three levels of water irrigation quantity, three rates of compost fertilizer and two wheat varieties. A split- split plot design with three replicates

was used, the main plots were randomly devoted to the irrigation quantity treatments and the sub plots were randomly devoted to the compost fertilizer rates while the sub-sub plots were randomly assigned to the two wheat varieties and then combined analysis was used for two seasons.

The experimental plot area was 22m² (11x2m). There were 8 rows in each plot spaced 20 cm apart. The planting date was at 24/11/2009 for the first season, while it was at 26/11/2010 in the second season. Calcium super phosphate (15.5% P₂O₅) was added before sowing at the rate 150 kg. /fad. As well as, potassium was added as potassium sulphate (48%) at the rate of 100 kg/fad. The Seeding rate was 60 kg. /faddan in two seasons. Nitrogen was added as ammonium sulfate (20.6 %) at the rate of 360 kg. /fad. in five equal portions through the irrigation system. The first, second, third, fourth and fifth portion were added after 14, 22, 34, 42 and 54 day from sowing, respectively. Irrigation treatments started after 30 day of planting date, the plots were irrigated at each 4 days interval as spring irrigation. The two wheat varieties were harvested after 147 day of planting date in 2009/2010 season and after 159 day in 2010/2011 season.

Studied attributes:

A. Growth attributes: a random sample of ten plants were taken at 90 days after sowing for determined traits as follows:

1. leaf area per plant (cm²) which was calculated as follows formula described by Voldeng and Simposn (1967): (Length x maximum width x 0.79)
2. Dry weight per plant (gm) which was estimated after drying the plant to temperature 105-110 ° C for 24 hours.

B. yield components:

1. Number of spikes per m² was determined from a random sample of one m² taken from each plot.
2. Weight of 1000 grain (gm) was obtained from the weight of 1000 grain taken at random from each plot.
3. Number of grains per spike: was recorded from a sample of 10 main spikes collected from 10 randomly selected plants in each plot.
4. Weight of grains per spike (gm).

C. Yield:

1. Grain yield per faddan (kg) which determined from all plants in each plot. and converted to kg/fad.

2. Harvest index (HI) was calculated as:

$$HI = \text{Grain yield (fad.)} / \text{Total Biological yield (fad.)} * 100.$$

Statistical analysis: All data were exposed to the proper statistical analysis according to Gomez and Gomez (1984). The mean values were compared at 5% level of significance using least significant differences (L.S.D) test.

RESULTS AND DISCUSSION

A- Effect of irrigation treatments:

Results of the combined analysis for the two experimental seasons of 2009/2010 and 2010/2011. presented in Tables 5 and 6, indicate that irrigation treatments had significant effect on wheat leaf area/plant, dry weight /plant, No. of spikes/m², weight of 1000 grains, No of grains/spike, weight of grains /spike, grain yield/fad. and harvest index were increased

significantly by (57.09%), (56.98%), (24.16%), (18.78 %), (15.38 %), (63.33%), (47.86 %) and (29.03%) respectively by adding water irrigation at the rate of 90% from evapotranspiration (ET) as compared with the application of 60% from ET which awarded the lowest values for that treats during experimental seasons. These results may be due to water defect during either of vegetative and pre-flowering stages which led to decrease water supply and nutrients which led to decrease leaf area /plant and dry weight/plant furthermore containing of water lack starting from developing flowers primordial till ovules fertilization may be led to the low appearance of florets primordial and decrease fertile flowers which in turn reduced No. of grains/spike, economic yield /fad. and harvest index, but under the condition of 90% of ET may be increased nutrient uptake and adequate supply of them to wheat plants for proper growth and metabolic process. These results also confirmed by Ibrahim *et al.* (1996) and Sadek and Abo-Warda (1998).

B-Effect of compost fertilizer rates:

With regard to compost fertilizer rates as organic matter, results of the previous studied characters recorded in Tables 5 and 6, reveal that adding compost at the rate of 6 ton/fad. led to significantly increase all the values of the previous studied characters, as compared with the lowest rate of 2 ton/fad. By adding 6 ton/fad. led to gain the greatest values for leaf area /plant (277.6 cm²/plant), dry weight /plant (14.2 gm), No. of spikes/m² (327), weight of 1000 grains (44.8 gm), No. of grains/spike (78.0), grain yield (1765 /fad (kg), weight of grains/spike (4.5 gm) and harvest index (0.38). These results may be attributed with increase the addition of compost rate to 6 ton/fad. increased the exchangeable capacity of sandy soil, also may be led to increase the collecting of soil particles to improve its water holding capacity and its action exchange capacity. Similar results were obtained by Acton and Gregorich (1995) and Lewandowski (2002).

C-Variance between varieties:

Results presented in Tables 5 and 6, reveal that wheat varieties (Sakha 93 and Gemmeiza 9) were significantly differed in its leaf area/plant, dry weight/plant, No. of spikes/plant, grain weight/plant, No. of grains/spike, 1000 grain weight, grain yield/fad. and harvest index also, Gemmeiza 9 wheat variety excelled Sakha 93 wheat variety for above mentioned measurements during the experimental seasons due to Gemmeiza 9 wheat variety characterized by resistance to rust disease, echoes and drought as well as it enjoys high productivity and quality in newly reclaimed soils as compare Sakha 93 wheat variety. This results confirmed by El-Sayed *et al.* (2000) and Zeidan *et al.* (2009).

E- The interaction effect of factors under study:

Irrigation treatments x compost rates interaction had significant effect on leaf area/plant, dry weight/plant, No. of spikes/plant, 1000 grain weight, grain weight/plant, No. of grains/spike, grain yield/fad. and harvest index in the experimental seasons. Results revealed that all above mentioned measurements gradually increased by increasing the quantity of water irrigation from 60% to 70 % and 90% of evapotranspiration rate of wheat under all compost rates under study.

Improved the utilization of the high quantity of water irrigation which reflected to increase the above mentioned traits. Results also revealed that wheat varieties tested significantly differed under the irrigation levels tested. Gemmeiza-9 wheat variety scored the greatest values for the above mentioned characters through all irrigation levels as compared with Sakha 93 under the effect of the same irrigation treatments during the experimental seasons.

As for compost rates x wheat varieties interaction effect results in Tables 5 and 6 show significant measured characters during the two seasons. Gemmeiza-9 wheat variety showed its superiority under the condition of each of 2 or 4 or 6 ton compost /fad.

Regarding to the second order interaction irrigation x compost x wheat varieties. Results in Tables 5 and 6 reveal that Gemmeiza-9 wheat plants utilized the greatest amount of water irrigation at the level of 90 % of evapotranspiration rate under the condition of 6 ton compost/fad. get the significant greatest values of leaf area/plant, dry weight/plant, No. of spikes/plant, 1000 grain weight, grain weight/plant, No. of grains/spike, grain yield/fad. and harvest index as compared with the other of this interaction treatments during the experimental seasons.

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تأثير كميات مياه الري ومعدلات السماد العضوى على بعض اصناف القمح تحت ظروف الاراضى الرملية بمنطقة غرب الدلتا .

أسامه محمدسعدالدين حرب* , جمال الدين حسن عبدالحى* , محمد أحمد هاجر* , مسعد قطب حساتين** و مؤمن محمد أبو العينين*

* قسم المحاصيل , كلية الزراعة , جامعة الأزهر , مدينة نصر – القاهرة – مصر.

** المعمل المركزى للمناخ الزراعى , مركز البحوث الزراعية – الجيزة – مصر.

اقامت تجربتان حقليتان خلال موسمي ٢٠١٠/٢٠٠٩ & ٢٠١١/٢٠١٠ م بمزرعة الحسين , الكيلو ٦٤ طريق مصر اسكندرية الصحراوى محافظة الجيزة . وذلك لدراسة تأثير ثلاث كميات من مياه الري (٦٠ , ٧٠ , ٩٠ % من البخر نتح ١٤٦١ م^٢) مع ثلاثة معدلات من السماد العضوى (الكومبوست) (٦,٤٤,٢ طن/فدان) على الناتج الاقتصادى ومكوناته فى صنفين من القمح (سحا ٩٣, جميزة ٩) ولقد تم استخدام تصميم القطع المنشقة مرتين مع تكرار كل معاملة ثلاث مرات ويمكن تلخيص نتائج الدراسة كمايلى :

أولا : التأثير الفردى:

أظهرت النتائج ان الصفات قيد الدراسة (مساحة الاوراق سم^٢ /نبات - الوزن الجاف/نبات-ناتج الحبوب كجم/فدان – دليل الحصاد – وزن الاف حبة /جم – وزن حبوب السنبله/جم – عدد السنابل /م^٢ – عدد حبوب السنبله) تأثرت معنويا بمعاملات الري قيد الدراسة حيث زادت تدريجيا مع زيادة كمية مياه الري المضافة من ٦٠ حتى ٩٠ % من البخر نتح الذى يبلغ ١٤٦١ م^٢.

كما تأثرت معنويا بمعدلات السماد العضوى حيث زادت تدريجيا مع زيادة معدل السماد العضوى المضاف للفدان من ٢ حتى ٦ طن.

أياضا أظهرت النتائج اختلافات معنويه بين الاصناف المدروسه حيث تفوق الصنف جميزه ٩ على الصنف سحا ٩٣ فى جميع الصفات السابقه .

ثانيا : التأثير التثاينى

كان للتفاعل التثاينى تأثير معنوى واضح فى كلا الموسمين كمايلى:

(١) أثر التفاعل بين (الري والسماد) على الصفات قيد الدراسة حيث اعطت معاملة الري عند ٩٠% مع اضافة ٦ طن كومبوست اعلى القيم للصفات السابق دراستها بينما كانت اقل القيم من تطبيق الري عند ٦٠% مع اضافة الكومبوست بمعدل ٢ طن /فدان.

(٢) أثر التفاعل بين (الري والاصناف) أظهر الصنف جميزة ٩ قدرة عالية على كفاءة الاستفادة من المستويات العالية من الماء ٩٠% وانعكس هذا على اعطاء أعلى القيم للصفات السابق ذكرها بينما أظهر الصنف سحا ٩٣ أقل قدرة على الاستفادة من مياه الري عند مستوى ٦٠% من البخرنتح.

(٣) أثر التفاعل بين (السماد والاصناف) أعطى الصنف جميزة ٩ أعلى القيم للصفات السابق ذكرها مع اضافة السماد بمعدل ٦ طن /فدان .

ثالثا: التأثير الثلاثى :

أظهرت النتائج ان الصفات قيد الدراسة قد تآثرت معنويا بالتفاعل الثلاثى بين معاملات الري والسماد مع الاصناف حيث تفوق الصنف جميزه ٩ على الصنف سحا ٩٣ فى الصفات قيد الدراسة عند ريه بمعدل ٩٠% من البخرنتح مع اضافة الكومبوست بمعدل ٦ طن /فدان.

قام بتحكيم البحث

كلية الزراعة – جامعة المنصورة

كلية الزراعة – جامعة الأزهر

أ.د / محمود سليمان سلطان

أ.د / الغريب عيد الغريب

Table (5): Quantity of water irrigation and compost rates affecting leaf area/plant (cm²), Dry weight per plant (gm), No. of spikes/m² and weight of 1000 grain (gm) for Sakha93 (V1) and Gemmieza-9(V2) wheat varieties in combined analysis of 2009/2010 and 2010/2011 seasons.

Treatments		Leaf area /plant (cm ²)			Dry weight (gm) per plant			No. of spikes/m ²			weight of 1000 grain (gm)		
Irrigation	Compost	V1	V2	Mean	V1	V2	Mean	V1	V2	Mean	V1	V2	Mean
	C1 (2 ton)	147.5	178.1	162.8	7.8	9.0	8.4	232	246	239	34.0	37.5	35.8
I 1 (60%)	C2 (4 ton)	155.5	206.8	181.1	8.8	10.1	9.4	258	288	273	36.0	38.5	37.3
	C3 (6 ton)	173.9	216.8	195.3	9.5	10.7	10.1	277	314	296	37.0	43.5	40.3
Mean		158.9	200.5	179.7	8.7	9.9	9.3	255	282	269	35.7	39.8	37.8
	C1 (2 ton)	170.5	190.5	180.5	10.0	12.4	11.2	296	300	298	38.5	41.0	39.8
I 2 (70%)	C2 (4 ton)	227.7	238.2	232.9	10.8	13.2	12.0	299	313	306	41.5	46.0	43.8
	C3 (6 ton)	284.6	282.8	283.7	14.8	15.2	15.0	312	342	327	44.0	48.0	46.0
Mean		227.6	237.1	232.3	11.9	13.6	12.7	302	318	310	41.3	45.0	43.2
	C1 (2 ton)	196.8	235.2	216.0	10.3	11.7	11.0	302	322	312	42.0	44.0	43.0
I 3 (90%)	C2 (4 ton)	274.3	280.1	277.2	15.1	15.6	15.3	321	347	334	43.5	44.0	43.8
	C3 (6 ton)	331.1	376.3	353.7	16.0	18.9	17.4	344	371	358	47.5	48.5	48.0
Mean		267.4	297.2	282.3	13.8	15.4	14.6	322	347	334	44.3	45.5	44.9
G.M. of V.		218.0	245.0	231.5	11.4	13.0	12.2	293	316	304	40.4	43.4	41.9
	C1 (2 ton)	171.6	201.2	186.4	9.3	11.0	10.2	276	289	283	38.2	40.8	39.5
G.M. of C	C2 (4 ton)	219.1	241.7	230.4	11.5	12.9	12.2	292	316	304	40.3	42.8	41.6
	C3 (6 ton)	263.2	292.0	277.6	13.4	14.9	14.2	311	342	327	42.8	46.7	44.8
LSD at 5% for													
Irrigation (I)		13.4			0.9			9.3			1.8		
Compost (C)		13.4			0.9			9.3			1.8		
Varieties (V)		11.0			0.7			7.6			1.4		
I x C		23.3			1.5			16.2			3.1		
I x V		18.9			1.2			13.2			2.5		
C x V		18.9			1.2			13.2			2.5		
I x C x V		32.9			2.2			22.9			4.3		

Table (6): Quantity of water irrigation and compost rates affecting No. of grains / spike, weight of grains / spike (gm), Grain yield /fad(kg) and harvest index for Sakha93(V1) and Gemmieza-9(V2) wheat varieties in combined analysis of 2009/2010 and 2010/2011 seasons.

Treatments		No. of grains / spike			Weight of grains / spike (gm)			Grain yield /fad(kg)			Harvest index		
Irrigation	Compost	V1	V2	Mean	V1	V2	Mean	V1	V2	Mean	V1	V2	Mean
	C1 (2 ton)	53	61	57	2.10	2.50	2.30	933	1271	1102	0.260	0.310	0.290
I 1 (60%)	C2 (4 ton)	64	68	66	2.80	3.20	3.00	1253	1341	1297	0.290	0.330	0.310
	C3 (6 ton)	72	74	73	3.40	4.00	3.70	1320	1476	1398	0.320	0.340	0.330
Mean		63	68	65	2.80	3.20	3.00	1169	1363	1266	0.290	0.330	0.310
	C1 (2 ton)	60	65	63	3.50	3.90	3.70	1203	1420	1312	0.330	0.340	0.340
I 2 (70%)	C2 (4 ton)	68	75	72	4.00	4.20	4.10	1527	1603	1565	0.350	0.360	0.360
	C3 (6 ton)	76	82	79	4.40	4.70	4.60	1593	1767	1680	0.370	0.380	0.380
Mean		68	74	71	4.00	4.30	4.10	1441	1597	1519	0.350	0.360	0.360
	C1 (2 ton)	65	69	67	4.00	4.80	4.40	1256	1552	1404	0.350	0.390	0.370
I 3 (90%)	C2 (4 ton)	74	78	76	4.80	5.00	4.90	1898	2087	1993	0.410	0.410	0.410
	C3 (6 ton)	80	84	82	5.10	5.50	5.30	2146	2290	2218	0.420	0.440	0.430
Mean		73	77	75	4.60	5.10	4.90	1767	1976	1872	0.390	0.410	0.400
G.M. V.		68	73	70	3.80	4.20	4.00	1459	1645	1552	0.340	0.370	0.360
	C1 (2 ton)	59	65	62	3.20	3.70	3.50	1131	1414	1273	0.310	0.350	0.330
G.M. of C	C2 (4 ton)	69	74	71	3.80	4.20	4.00	1559	1677	1618	0.350	0.370	0.360
	C3 (6 ton)	76	80	78	4.30	4.70	4.50	1686	1844	1765	0.370	0.390	0.380
LSD at 5% for													
Irrigation (I)					0.10						0.018		
Compost (C)					0.10						0.018		
Varieties (V)					0.08						0.014		
I x C					0.18						0.031		
I x V					0.15						0.025		
C x V					0.15						0.025		
I x C x V					0.26						0.044		