THE COMBINED EFFECT OF SYNTHETIC CONDITIONERS AND SOME WATER REGIMES FOR IMPROVING A SANDY SOIL PRODUCTIVITY OF WHEAT PLANT

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ABSTRACT

Field experiment was conducted at Ismailia Agricultural Research Station during 2010/2011 season. The current study aimse to maximizing the degree of utilization of available water resources by using some of natural improvers or synthetic –organic polymer (carboxy methel cellulose-CMC). Also use irrigation regimes with 100, 75 and 50% of the available soil water (ASW). Under sprinkler irrigation system in the sandy soil to study the effect of grown crop as a winter wheat plant (Giza 168 c.v.). Characters studies , yield (plant highs – spike no./m^2 – 1000 grain weight – biological yield– grain yield– straw yield), yield component (harvest Index – grain protein – total carbohydrate), chemical components (grain N ,P and K uptake kg/fed) and water relation (season evapotranspiration – water use efficiency).

The results obtained indicated that the applied organic polymer and irrigation regime with 100% ASW showed significant increases in plant characters followed by irrigation regime at 75% ASW. The lowest values obtained were without applied organic polymer and irrigation regime at 50% ASW . Results indicated the effect of irrigation regime on seasonal evapotranspiration rate by wheat plant where total ET varied from 1651.3, 1238.5 and 825.6 m3 /season for irrigation water regime under 100, 75 and 50% ASW, respectively. The obtained results demonstrated that application of organic polymer had significant effects on WUE. The values was 0.880 kg/m^3 while the lowest value was 0.791 kg/m^3 without application organic polymer. Also the results showed that 50% ASW produced highest WUE (1.048 kg/m^3) followed by irrigation water regime at 75% ASW (0.812 kg/m^3) while the lowest value was obtained by irrigation water regime at 100 % ASW (0.718 kg/m^3).

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INTRODUCTION

The water is a base of life in all countries, all over the world water is considered a limited factor in agriculture expansion. Water is an economically scarce resource in many areas of the world especially in arid and semi- arid region. Water requirements, should be achieved to reach a well scientific use of water. In light of the continued decline in fresh water resources as a result of the doubling of using those resource, ones with maximizing the degree of utilization of available water resources by reducing waste by using some of natural improvers, which can be processed for soil **(Moustaf, et al. 2005)**.

Meyer and Green (1980), recommended that winter wheat irrigation should be scheduled at not mare than 50% of the available soil water depletion to prevent reduction expansive growth.

Nofal-Fatma et al. (2005) indicated that water use efficiency decreased as water depletion increased , and the highest WUE was obtained from irrigation at 20 up to 40 % depletion **Zhang et al. (2005)** indicated that while annual evapotranspiration increased slightly , water use efficiency (WUE) increases .

Abo-Omer (2006) indicated that the highest water consumptive use was obtained from wheat plants exposed to the high levels of water supply in both seasons. the highest values of applied water (3032 and 3052 m^3/fed) were obtained with irrigation at 50% ASMD during entire season at the soil depth 0-60 cm, while the lowest values of applied water (2090 and 2110 m^3/fad.) were obtained with irrigation at 60% ASMD during entire season at the soil depth of 0-30 cm in the second seasons , respectively .

Meleha, (2006) found that water consumptive use increased due to increasing amount of water applied.This study aims to the rationalization of irrigation water through a treatment of the sand soil with synthetic polymer organic compound trade name (Carboxy Methyl Cellulose) under different soil moisture levels varying between 100%, 75% and 50% of the water needs for wheat crop developing under the condition of the experiment, with a questionnaire of positive effect of this synthetic compound at the applied referred to.

MATERIALS AND METHODS

Materials

layout of experiment

A field experiment was carried out on sandy soil at Ismailia Agriculture Research Station Ismailia government. during the winter season of 2010 /2011. The current study aims to horrify the beneficial effects of applying some soil amendments such as synthetic polymers (hydro gel). All the treatments were applied under different irrigation regimes (100, 75 and 50% of water requirement) on wheat plant (*Triticum aestivum* L.) variety (Giza 168). Soil sample was air–dried and sieved to pass through a 2 mm sieve and preserve for some physical and chemical analysis, their results are given in Table (1). The metrological data of experimental area at Ismailia Agriculture Research Station during the winter season of 2010/2011 is illustrated in table (2) and table (3) represent field capacity and soil moisture.

Irrigation System

The experiment was irrigated by a solid set sprinkler system (Fixed one) the lateral spacing was 12 m apart and 10 m sprinkler spacing . Such lateral has a control valve for adjusting the quantity of applied water. Under this type of design, each Fadden has 35 sprinklers. The rate of application was 45.5 m^3 /fed/ hr (sprinkler discharge=1.3 m^3/hr. at 2.5 bar). The quantity of applied water was exactly controlled with excellent uniform distribution of water. Irrigation water was measured by the relationship between sprinkler discharge and the time of application.

Methods

Soil analysis:

- Mechanical analysis was carried out using the pipette method as described by **Piper (1950).**
- Calcium carbonate was measured using calcimeter Collin's **(Piper, 1950).**
- Soil reaction (pH) was measured using glass electrode pH-meter in 1:2.5 soil-water suspension **(Jackson, 1973).**
- Electrical conductivity as well as soluble ions in soil paste extract was determined were measured as described by **Jackson (1973).**

Table(1): Some physical and characteristics of the investigated soil.chemical

Soil characteristics	***Value***
A) Physical properties	
Particle size distribution (%):	
Coarse sand	*11.5*
Fine sand	*65.7*
Silt	*17.20*
Clay	*5.6*
Textural class	*Sandy*
B)Chemical properties	
Organic matter(%)	*0.027*
Calcium carbonate (%)	*1.08*
ECe in dS/m (soil paste)	*2.16*
pH (1:2.5 soil:water suspension)	*7.75*
Soluble cations (m mol$_c$ L^{-1})	
Ca^{++}	*6.44*
Mg^{++}	*11.54*
Na^{+}	*2.78*
K^{+}	*0.88*
Soluble anions (m mol$_c$ L^{-1})	
$CO_3^{=}$	*0.00*
HCO^{-}_2	*2.20*
Cl^{-}	*1.96*
$SO_4^{=}$	*17.48*
Available macronutrients (mg kg^{-1})	
N	*15.05*
P	*4.85*
K	*60.75*
Soil physical properties	
Bulk density g/cm^3	*1.67*
Field capacity %	*4.60*
Wilting point %	*1.33*
Available water %	*3.27*

Table (2): Monthly meteorological data of location during 2010-2011 season

Month	Duration day	Temperature(C°)			Relative Humidity %			Rain fall (mm)	Wind Speed m/sec	P.S.D* (Hr)
		Max	Min	Daily mean	Max	Min	mean		At 2m	
December	1-10	-	-	-	-	-	-	-	-	-
	10-20	26.4	6.9	16.9	53	34	43.5	0.0	3.7	10.0
	20-30	28.3	6.8	18.3	70	43	56.5	0.0	2.0	10.0
January	1-10	21.2	6.8	15.5	73	45	59.0	0.0	1.9	10.1
	10-20	20.8	6.5	13.65	78	57	67.5	13	1.9	10.2
	20-30	23.4	6.8	16.8	71	45	58.0	0.4	2.1	10.5
February	1-10	21.3	7.8	17.0	72	52	62.0	0.4	2.7	10.7
	10-20	24.8	8.6	18.1	60	39	49.5	0.0	3.1	11.0
	20-30	28.9	8.2	18.7	49	29	39.0	0.0	3.1	11.3
March	1-10	30.2	7.8	18.1	64	40	52.0	0.0	3.0	11.5
	10-20	29.3	6	18.7	64	29	49.5	0.0	2.6	11.8
	20-30	26.8	8.4	18.7	65	43	54.0	0.4	3.1	12.2
April	1-10	34.9	11.0	21.4	62	37	49.5	9.0	2.8	12.5
	10-20	38.3	10.4	24.8	43	22	32.5	0.0	3.3	12.8

*P.S.D is possible sunshine duration.

* This data were determined by Agrometarology (Water Requirement Section, Agricultural Research Center).

Table (3) : Field capacity and soil moisture characteristics of experimental soil

Soil depth cm	Field capacity (%)	Available water (%)	Wilting point	Bulk density gm/cm^3
0-15	6.10	4.7	1.40	1.66
15-30	5.80	4.42	1.38	1.68
30-45	3.20	1.99	1.21	1.68
45-60	3.30	1.97	1.33	1.67

- Soil organic matter was determined according to Walkley-Black method using O-phenanthroline ferrous as an indicator **(Black *et al.*, 1965).**
- Sodium and potassium using the Flame photometer.
- Calcium and magnesium by the versinate method.
- Chloride by titration with silver nitrate.

- Carbonate and bicarbonate by titration with HCl.
- The sulphate was calculated by difference.
- Available N was extracted by KCl and determined using Kjeldahl method .Available P was extracted by 0.5 N $NaHCO_3$ solution as described by **Olsen *et al.* (1954),** then measured colorimetrically according to **Jackson (1973).**
- Available K was extracted by ammonium acetate solution as described by **Jackson (1973),** measured by flame photometer.

Plant analysis:

Plant material was digested using a mixture of sulphuric acid and perchloric acid (**Jackson, 1973**) and plant nutrients were determined in the digest as follows:

- Nitrogen was determined using Kjeldahl method **(Chapman and Pratt, 1961).**
- Phosphorus was determined colorimetrically as described by **Piper (1950).**
- Potassium was determined by flame photo meter, **(Jackson, 1973).**

A- Use Water Consumptive

Soil available water calculated as water at field capacity subtracted by water at wilting point. The water consumptive use as total applied water per season m^3 was calculated using the following equation given by **Israelsen and Hansen (1962)**.

$$Cu = D \times Bd \times e_2 - e_1/100$$

Where

Cu= water consumptive use in mm

D= Soil depth (at 60 cm),

Bd= Bulk density (1.67 g cm^{-3}),

e_1= Field capacity (4.60 %) and

e_2= Wilting point (1.33 %).

$$IR = Cu \times A \times T$$

Where

IR = Total amount of irrigation water in fed,

A = area irrigated, fed and

T = No. of irrigation.

B- Water Use Efficiency

Water use efficiency (WUE) in kg/m^3 was calculated for different treatments, the following formula was used .

WUE = grain yield (kg /fad) / seasonal irrigation water m^3/fad.

C- Yield

Plants of each plot were harvested, air dried and weighted and multiplied by 400 to be per Fadden to determine the following characters;

1-Biological yield/fad

2-Grain yield/ fad.

3-Straw yield/ fad

4-Harvest index : was calculated according to the following formula :

Harvest index = (Grain yield/fad / Biological yield) × 100

5-Plant height

6- Number of spikes/m^2.

7-1000-grain weight.

D- Chemical characters

Nitrogen was determined using the improved Kjeldahl method of the **A.O.A.C. (1970)** modified by distilling the ammonia into boric acid. Protein percentage was calculated by multiplying the total nitrogen in the grain by 5.75 for wheat.

Statistical analysis

Analysis of variance and significant differences of the obtained data for the studied treatments were performed according to the described method outlined by **Gomes and Gomes (1984).** The statistical significance was defined at 0.05.

Experimental design and treatments:

The experimental design was split plots, with three replicates. The main plots were irrigation regimes. Synthetic polymer compound (hydro gel) was situated in the sub plot.

Studied factors:

A. irrigation regimes (Main plots):

Three levels of the water requirement as follow:

1-irrigation was supplied at 100% of the water requirement

2-irrigation was supplied at 75% of the water requirement

3-irrigation was supplied at 50% of the water requirement

B- Hydro gel treatment at rate 2g/ lit. (400 lit/ fed.):

1- with hydro gel.

2- without hydro gel.

RESULTS AND DISCUSSIONS

The current work may be for helpful for identifying the best soil water regime and organic polymers practice for some newly reclaimed soils to maximize their productivity and reduces their water requirements, specially for soils that are not partially capable to retain neither water nor nutrients for growing plants. In addition, these soils are poor not only in the nutrient-bearing minerals, but also in organic matter and high porosity which are a storehouse for the essential plant nutrients; in turn the productivity of different crops tends to decrease markedly (**Moustafa *et al.*, 2005).**

Effects of organic polymer and irrigation water regimes on some plants characteristics

Table (4) represent evaluation for effects of studied organic polymer (hydrogel) and irrigation water regimes (100, 75 and 50% from available water) solely on growth of wheat plants during maximum growth stage, growth being expressed as either biological yield content or plant height.

Table (4) shows values representing the responses of wheat plants to organic polymer, irrigation water regimes on biological yield of wheat plants in sandy soil.

Data revealed difference between without or with organic polymer, the latter being higher for biological yield than without one. The calculated mean values were 3514 kg fed^{-1} and 3215 with hydrogel and without hydrogel on biological yields respectively. Biological yield significantly decreased by 9.30% **(Tester, 1990). Tayel et al., (2001)** stated that the increase in water retained in sandy soil treated with

Table (4) Effect of the applied organic polymer and different levels of water regimes treatments on wheat growth characters in sandy soil .

Plant height (cm)				
Organic polymer(O.P)	Water regimes (W.R)			
	100%	75%	50%	Mean
With	59.10	58.00	53.30	56.80
without	58.00	53.00	52.00	54.30
Mean	58.60	55.50	52.65	55.60
L.S.D.0.05	W.R: 2.6 O.P: 0.95 W.R × O.P: 0.367			
Spike no./m^2				
With	83.90	68.00	57.70	69.87
without	73.00	60.80	55.00	62.93
Mean	78.45	64.40	56.35	66.40
L.S.D.0.05	W.R: 0.148 O.P: 0.297 W.R × O.P: 0.280			
Biological yield (kg/fed)				
With	3930	3588	3023	3514
without	3590	3228	2828	3215
Mean	3760	3408	2926	3365
L.S.D.0.05	W.R: 118..9 O.P: 120.8 W.R × O.P: 115.6			

(carboxy methyl cellulose- CMC) may be due to one or more of the following reasons, a) decrease in soil bulk density and the increase in the soil total porosity b) the modification of soil structure and consequently its pore size distribution, c) the higher capacity of CMC for water retention in comparison to sand particles , and the rise in soil hydraulic conductivity accompanying soil structure modification.

Concerning the effect of irrigation water regime on biological yield (kg/fed), results in Table (4) indicate that it is a significant to weights of biological yield under irrigation water regimes , the follow descending order was 100> 75> 50% from available water , respectively. Calculated mean values being 3760 . 3408 and 2926 kg/ fed respectively. Also data obtained showed a marked increase in biological yield reached 28.55 % under 100% of (IWR) comparing with 50% of (IWR). The previous results are in agreement with those reported by **(Omran, 2005).**

In the same line . Data in Table (4) show a trend almost similar to behavior previously mentioned for biological yield of the studied plants; responses of plant height to organic polymer (hydrogel) and irrigation water regimes (100, 75 and 50% from available water). Results also showed that responses to applied organic polymers solely was relatively more than without application, such responses being dependent on plant growth; representative calculated mean values for both with or without hydrogel (organic polymer) was respectively 56.80 and 54.30 cm/plant.

Values representing the parameter of plant height in Table (4), show a trend more or less identical to that characterizing the corresponding parameter of the biological yield. This is true in spite of the effect of with or without hydrogeol and irrigation water regimes (100, 75 and 50 % from available soil water) application.

Positive responses to applied hydrogel were again obtained; such trend being agreeable with data reported by **Moustafa et al. (2005)** who indicated that the application organic hydrogel improved physical, chemical and fertility properties of sandy soil.

This is true in spite of the relative continuity of indicated responses to organic polymers as compared to that of without and irrigation water regimes.

It may be worth mentioning that responses of both biological yield and plant height were almost similar indicating that the suitability of both studied organic polymer, irrigation water regimes applied to wheat plants. In general, the positive responses were obtained with applied 100% irrigation water regimes and with applied hydrogel.

Also, the effect of organic polymer and irrigation regimes 100, 75 and 50% ASW on number of spikes No/m² for the wheat plant are presented in Table (4). The results showed that organic polymers significant affected the number of spikes / m². The largest number of spikes No. / m² was 69.87/m² obtained with hydrogel while the lowest value was 62.93 /m² without hydrogel .the treatment with hydrogel increased spike No/m² by 6.74 %. Table (4) show that irrigation regime at 100% ASW affected the number of spikes/ m² and gave the highest value followed by 75% ASW and irrigation regimes at 50% ASW were as the lowest number of spike No/m² . Similar results were reported by **(Ibrahim et al. 1996**).

On the other hand, Table (5) show the effect of organic polymer on weight of 1000 grain the highest value and the lowest value where 61.27 (g) and 60.03 (g) with and without hydrogel, respectively . The effect of water regime at different levels 100, 75 and 50% ASW were studied. 100% water regime gave the highest value where it was 62.6 g while the lowest value 59.50 g from 50% ASW. The medium value was 60.35 gm from the treatment with water regime at 75 % ASW.

With regard to the effect of organic polymer and water regimes 100, 75 and 50% ASW on grain yield /fed for the wheat plants results are presented in Table (5). Results clearly showed that organic polymer had significant effect on the grain yield / fed. It is worth mentioning that organic polymer produced the highest grain yield /fed 1048 kg/fed while without organic polymer gave the lowest value 950 kg/fed. The grain yield was increased by 39.73 %with organic polymer compared to without one.

Also in the same table showed the effect of water regimes on wheat plants. It is worth mentioning that irrigation at 100% of ASW was produced highest value grain yield 1185 kg/fed. While the lowest value was 808 kg/fed with irrigation water regime at 50% ASW followed by the nearest to the first value 1005 kg/fed with irrigation water regime at 75%ASW.

The effect of organic polymer on straw yield kg/ fed for the wheat plant is presented in Table (5).

Table (5) Effect of the applied organic polymer and different levels of water regimes treatments on wheat yields in sandy soil.

Grain yield (kg/fed)				
Organic polymer (O.P)	Water regimes (W.R)			
	100%	75%	50%	Mean
With	1230	1050	865	1048
without	1140	960	750	950
Mean	1185	1005	808	999
L.S.D.0.05	W.R: 1.169	O.P: 0.797	W.R × O.P: 2.140	
Straw yield (kg/fed)				
With	2700	2538	2158	2465
without	2450	2300	1878	2209
Mean	2575	2413	2018	2337
L.S.D.0.05	W.R: 0.906	O.P: 1.380	W.R × O.P: 2.140	
1000 grain yield (g)				
With	63.40	60.70	59.70	61.27
without	61.80	60.00	58.30	60.03
Mean	62.60	60.35	59.50	60.82
L.S.D.0.05	W.R: 0.106	O.P: 0.336	W.R × O.P: 0.200	

Significant effect of organic polymer on straw yield per feddan . The highest production of the straw yield was associated with organic polymer 2465 kg/ fed. The lowest straw yield was obtained without organic polymer. Also the effect of irrigation regime 100, 75 and 50% ASW in the straw yield per feddan is shown in Table (5).

The highest production of straw yield was associated with irrigation regime at 100% ASW 2575 kg/ fed followed by irrigation water regime at 75% ASW was 2413 kg/fed, which recorder at the lowest mean straw yield recorded was obtained with irrigation regime at 50% ASW was 2018 kg/fed .

The effect of organic polymer on harvest index for the wheat plant is presented in Table (6). Organic polymer had significant effect on Harvest Index. It was 29.84 with organic polymer while without organic polymer the lowest harvest index value 29.20 was obtained. In the same table showed the effect of irrigation regime at 100, 75 and 50%. The highest value was obtained from irrigation regime at 100% ASW 31.53 and 50% ASW gave 27.57 while the irrigation regime at 75% ASW gave 29.30.

Table (6) Effect of the applied organic polymer and different levels of water regimes treatments on harvest index and wheat chemical composition in sandy soil

Harvest index				
Organic polymer (O.P)	Water regimes (W.R)			
	100%	75%	50%	Mean
With	31.30	29.26	28.61	29.84
without	31.75	29.74	26.52	29.20.
Mean	31.53	29.30	27.57	29.52
Grain protein (%)				
With	11.95	9.83	9.26	10.25
without	10.20	9.77	8.78	9.58
Mean	10.98	9.80	9.02	9.93
L.S.D.0.05	W.R: 0.922 O.P: 0.465 W.R × O.P: ns			
Total carbohydrate (%)				
With	72	67	65	68
without	60	59	54	57.67
Mean	66	63	59.5	62.83
L.S.D.0.05	W.R: 0.569 O.P: 0.465 W.R × O.P: ns			

Protein content in wheat grains

According to **Khan et al., (2000)**, grain protein content of wheat is important for improved nutritional value and is also one of the major factor affecting bread-making and pasta quality . However, only exceptional genotypes that combine excellent yield potential and grain protein content, such genotype require a more efficient nitrogen uptake from the soil , as well as a more efficient relocation of nitrogen from senescing tissues to grain .

Data in table (6) shows values representing responses of wheat grain protein to the applied organic polymer. Certain differences were found between with and without organic polymer, the applied organic polymer seemed to be superior.

A comparison between the applied organic polymer and without it revealed non –significant effect on the obtained wheat grain protein, represented by the calculated mean values being 10.35 and 9.58 %, respectively. It is noticed that the beneficial effect of organic polymer compared to without organic polymer. Also the effect of irrigation water regimes at 100, 75 and 50% ASW. Results recorded that protein percentage was significant by irrigation regimes at 100% ASW where the highest value (10.98 %) was obtained followed by irrigation regimes at 75% ASW (9.80%) and the lowest value was (9.02%) obtained by irrigation regimes at 50% ASW. This results are in agreement with those obtained by **(Sharshar and El-Said (2000).**

Total carbohydrate in wheat grains

Data in table (7) reveals differences between both studied soil amendment with organic polymer and non- amendment with organic polymer, soil amendment with organic polymer were more pronounced. Regarding the soil amendment with organic polymer, data showed that amendment with organic polymer attained total carbohydrate content more than non amendment. The calculated mean values were 68 and 57.67 % for applied and non- applied with organic polymer respectively. Data showed the effect of irrigation water regimes under 100, 75 and 50% ASW represented by the calculate mean values were 66, 63 and 59.5 %, respectively.

Nutrient uptake in wheat grain

Nitrogen uptake

Data in table (7) showed the effect of organic polymer on nitrogen uptake in wheat grain. The highest value was 19.26 kg/fed with organic polymer while the lowest was 15.93 kg/fed. The results obtained indicated that the applied organic polymers (hydrogel) increased the total amounts of N and P by increasing the hydrogel up to 2.0 g/kg sand. **Kotb (1994)** mentioned that conditioning the sandy soil with hydrogel increased the content of N, P and K in plants. The effect of water regime at 100, 75 and 50% available soil water. The values were obtained 23.11, 17.03 and 12.65 kg/fed respectively. Results obtained showed that the highest value from irrigation water regimes was at 100% ASW followed by 75 % ASW and the lowest value at 50% ASW. Similar trend were observed by **El-**

Hady et al, (2003) who pointed out that increasing available moisture for plants elongates irrigation frequencies and in turn decrease the quantities of irrigation water needed and costs of irrigation process.

Phosphorus uptake

Data in table (7) reveal that applied organic polymer showed significant and positive increase in phosphorus uptake. The highest value was 6.16 kg/fed while the lowest value was 5.19 kg/fed. It increased by 18.69 %. This is due to their positive effect on nutrients availability in soil and their uptake by the grown plant. Also the effect of irrigation water regime at 100, 75 and 50% from available soil water. The values were 7.73, 5.45 and 3.86 kg/fed, respectively. The obtained results are in consistent with found by **El-Araby and Feleafel (2003)** who reported that leaf N ,P and K contents in tomato plants were significantly affected by irrigation regimes. Irregular irrigation regimes and decreasing the period of irrigation frequency gave highest values of N, P and K concentration.

Table (7) Effect of the applied organic polymer and different levels of water regimes treatments regarding response of N , P and K uptake (kg/fed) by wheat plant in sandy soil .

N-uptake (kg/fed)				
Organic polymer (O.P)	Water regimes (W.R)			
	100%	75%	50%	Mean
With	25.99	17.86	13.93	19.26
without	20.22	16.20	11.37	15.93
Mean	23.11	17.03	12.65	17.60
L.S.D.0.05	W.R: 1.043	O.P: 1.589	W.R × O.P: 0.239	
P-uptake(kg/fed)				
With	8.37	5.81	4.30	6.16
without	7.08	5.09	3.41	5.19
Mean	7.73	5.45	3.86	5.68
L.S.D.0.05	W.R: 0.012	O.P: 0.024	W.R × O.P: 0.239	
K-uptake(kg/fed)				
With	4.27	2.59	1.82	2.89
without	3.08	2.31	1.28	2.22
Mean	3.68	2.45	1.55	2.56
L.S.D.0.05	W.R: 0.001	O.P: 0.003	W.R × O.P: 0.235	

Potassium uptake

Data in table (7) show an opposite trend to the behavior previously mentioned for the uptake of both nitrogen and phosphorus in the studied plant. Responses of potassium in grain to treatment with organic polymer were frequently more obvious compared to treatment without organic polymer. The values were 2.89 and 2.22 kg/fed.

Results also indicated that potassium uptake was affected by irrigation water regime at 100% available soil water followed by 75% available water followed by irrigation water at 50% ASW. The values were 3.68, 2.45 and 1.55 kg/fed respectively.

Water relation

Seasonal evapotranspiration

Burman et al. (1980), defined water consumptive use or evapotranspiration as the evaporation of water from soil plus transpiration of liquid water through plant tissues expressed as the latent heat transfer / unit area or its equivalent depth of water / unit area .

A detailed summary of water consumptive use by wheat under various treatments are presented in table (8) in 2010 -2011. The data clearly show that total E.T. varied from 1651.3, 1238.5 and 825.6 m^3 / season. The total number of irrigation were 12 for irrigation water regimes under 100, 75 and 50% ASW. The time was 2.29, 2.16 and 1.15 hr, respectively.

Table (8) seasonal evapotranspiration under different irrigation regimes on sandy soil

Irrigation regimes	Time hr	Number of Irrigation	Total applied/season m^3
100%	2.29	12	1651.3
75%	2.16	12	1238.5
50%	1.15	12	825.6

Regarding the effect of irrigation regimes on seasonal evapotranspiration rate by wheat plant , results of table (8) show that water consumptive use was increased as the soil moisture was kept wet by increasing the frequency irrigation. The reverse was found to be true where, decreasing the soil moisture or increasing irrigation intervals did result in decreasing seasonal evapotranspiration by wheat plant . The least evapotranspiration rate was brought a bout under dry soil moisture level 50% ASW , where as , the highest water use was obtained under wet treatment 100% ASW .

However, under moist condition 75% ASW, the values fell in between Such phenomena reveal that the increase in water consumptive use depends on the available soil moisture in the root zone. The some observation has been stated by **Saad, et al., (1999).**

Water Use Efficiency (WUE)

The results presented in table (9) prove that all factors studied namely , irrigation regimes and organic polymer had significant effects on WUE kg grains /m3 . The results showed that application of organic polymer produced the highest WUE ,also the results showed that 50% ASW produced the highest WUE followed by 75% ASW , the least WUE were obtained from 100% ASW .

Table (9) Effect of the applied organic polymer and different levels of water regimes on water use efficiency kg/m^3 by wheat plant in sandy soil.

Organic polymer	Water regimes			
	100%	75%	50%	Mean
Water use efficiency (kg/m^3)				
With	0.745	0.848	1.048	0.880
Without	0.690	0.775	0.908	0.791
Mean	0.718	0.812	0.978	0.836

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الملخص العربي

الآثر المشترك للمحسنات التخليقية وبعض معاملات الرى فى تحسين أنتاجية أرض رملية من القمح

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أقيمت تجربة حقلية فى محطة البحوث الزراعية بالأسماعلية عام ٢٠١١/٢٠١٠ . بزراعة نبات القمح الشتوى صنف جيزة ١٦٨ وتهدف هذه الدراسة إلى تعظيم الاستفادة من المصادر المائية المتاحة عن طريق استخدام بعض المحسنات التخليقية (كربوكسى ميثيل سليلوز) هيدروجيل وكذلك ثلاث معاملات رى (الرى عند ١٠٠% من الماء الميسر , الرى عند ٧٥% من الماء الميسر و الرى عند ٥٠% من الماء الميسر تحت نظام الرى بالرش فى الأراضى الرملية وتأثير المعاملات على صفات النمو والمحصول ومكوناتة (طول النبات سم- عدد النباتات فى المتر المربع- وزن ١٠٠٠ حبة- المحصول البيولوجى كجم/ فدان – مجصول الحبوب – محصول القش ودليل الحصاد) وأيضا دراسة جودة الحبوب من خلال النسبة المئوية للبروتين والكربوهيدرات وقياس الصفات الكيميائية عن طريق كمية النتروجين, الفوسفور والبوتاسيوم فى الحبوب كجم / فدان وتقدير البخر نتح بالمتر المكعب لكل معاملة من معاملات الرى وتقدير كفاءة استخدام الماء بالكجم/ متر مكعب. وتشير النتائج المتحصل عليها الى زيادة المحصول ونمو النبات بالمعاملة بالمحسنات التخليقية والمعاملة ١٠٠% من الماء الميسر ويلية المعاملة ٧٥% من الماء الميسر وأقل قيمة كانت من عدم المعاملة بالمحسنات التخليقية والمعاملة ٥٠% من الماء الميسر. وتشير نتائج تاثير معاملات الرى على كمية البخر نتح السنوية على نبات القمح كانت ١٦٥١,٣ , ١٢٣٨,٥ و ٨٢٥,٦ كجم/مترمكعب فى السنة بالمعاملة بالرى ١٠٠, ٧٥ و ٥٠% من الماء الميسر بالتوالى. والنتائج المتحصل عليها توضح إن أضافة المحسنات التخايقية العضوية أعطت تاثير أيجابى معنوى على كفاءة أستخدام الماء وكانت القيم ٠,٨٨٠ كجم/مترمكعب ماء فى السنة بينما القيمة كانت ٠,٧٩١كجم/مترمكعب ماء فى السنة بدون أستخدام المحسنات التخايقية العضوية. النتائج تشير أن المعاملة بماء الرى ٥٠% من الماء الميسر اعطت أعلى قيمة من كفائة استخدام الماء (١,٠٤٨ كجم/مترمكعب ماء فى السنة) يتبعها المعاملة بالرى ٧٥% من الماء الميسر(٠,٨١٢ كجم/مترمكعب ماء فى السنة) وأقل قيمة كانت المعاملة بالرى ١٠٠% من الماء الميسر(٠,٧١٨ كجم/مترمكعب ماء فى السنة).

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