PRELIMINARY STUDY ON THE USE OF METEOROLOGICAL DATA TO CALCULATE CROP WATER REQUIREMENTS FOR WHEAT IN TOSHKA.

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ABSTRACT

The present investigation was carried out at the experimental Farm, Water Studies and Research Complex (WSRC) station, National Water Research Center, Toshka,

Where as use of the wheat crop in the study of the integrated management of water and agriculture as well as an assessment of reference evapotranspiration (ETo) within the meteorological data by using computer programs.

where transactions of different irrigation treatments (60,80,100,120%) of crop evapotranspiration (ETC) with the note that was calculated the amounts of calculated based upon the daily (ETo) measured using penman-monteith method with in every day the irrigation process were carried out at 8 am in the morning.

When the comparison between classes (Egypt 1, Egypt 2) varieties in both seasons under the different irrigation treatments was not significant between varieties in all levels as experiments proved that both (plant height ,spike length ,number of grains/spike, biological weight, grain weight, 1000-grain weight, day of heading, number of spikelet's and straw yield) did not give significant results between (Egypt1, Egypt2) varieties and give a significant results between all different irrigation treatments (60, 80,100,120%) (ETC) as well as give results in Super Absorbent Polymers (SAP) (hydrogel treatment).

-The height wheat crop productivity to (Egypt1, Egypt2) varieties used (120%) ETC treatment and the highest crop productivity was added the

Hydrogel as a (SAP), so this method should be used if there is no problem in irrigation water because it increases productivity.

-The lowest wheat crop productivity to (Egypt1, Egypt2) varieties used (60%) ETC treatment so this method should be applied if we have problem in irrigation to save water.

-The reduction of irrigation water is one of the most important strategies now to face the water scarcity problem accordinary.It can reduce the small proportion of production with reducing irrigation water ratio up to 20-40% from water requirements as ashowed in the experiment to could be a good decision toward saving more water to irrigate more land and achieve the difficult equation which close the gap between production and demand and water scarcity conditions.

Keywords: meteorological data, Toshka, wheat, crop water requirements.

INTRODUCTION

The increase of agricultural production and the reduction of risks that retard development are a fundamental goal emphasized by the agricultural strategies, but how it is achieved?!

Especially that the Egyptian farmer does not find a link with the researchers and decision-makers carring out the researches, that incur more costs, time and effort to reach the positive results.

In this frame, we have tried to shed light on the importance of meteorology and their impact on the agricultural sector and the optimized application of Climatic Data monitored by the agricultural meteorological stations and that will monitor agricultural weather factors such as air temperature, soil temperature, relative humidity, solar radiation, rainfall, evaporation and transpiration (Eid, 1994).

(Eid *et al* 1999) explained that the weather elements have impact on agricultural operations where these elements can reflect a complete picture about atmosphere, optimum sowing dates for each crop, scheduling irrigation of cultivated crops, the most appropriate sowing rates, harmful effect of weather on crops and also the occurrence and places of frost.

Egypt is one of the countries that has limited water resources, which require study and accurately estimate water requirements for different crops. Egyptian desert is suffering from water poverty and hot arid climate as well as poor agricultural soil in nutrients and which is more evident in Toshka. So, we can fostulate a question: can we use software programs in the integrated crop management? The answer is yes, but how?

Using one of the programs made to calculate crop water requirements such as cropwat program, which aims to calculate the daily water requirement or scheduling irrigation for the growing season.

Sustainable agriculture uses the principles of ecology. It is defined as "an integrated system of plant and animal production practices that continues over a long period to meet the humanitarian needs of food, clothing, improving the quality of the environment, optimize the use of existing resources in the fields and develop the level of life for farmers and society as a whole.

The aim of the current study is to manage climate resources by analyzing climate data in the study region for the integrated management of soil and water for sustainable agriculture through the rationalization of water consumption to maximize the productivity available and to achieve agricultural development in Toshka.

MATERIALS AND METHODS

From the previous presentation about integrated management of water and agriculture it is clear that:

- The use of sprinkler irrigation system has been more suitable for wheat than other alternative irrigation systems.
- More metrological data have been collected from Toshka weather station during the period (from 2008 to 2013). The suitable irrigation conditions were found to be in the early morning as shown in table (1) where the minimum temperature, minimum wind velocity and high humidity are convenient with irrigation.

Table(1): Hourly averages of maximum temperature (T max), minimum temperature (T min), relative humidity (Rh) and wind speed (Ws) during the average winter agricultural seasons from 2008 to 2013 for 24 hours at Toshka.

Item / Time	Average T max.(oC)	Average T min.(oC)	Average Rh (%)	Average Ws (m/s)
01:00	17.8	16.3	34.3	2.4
02:00	16.4	14.9	39.7	1.8
03:00	15.3	13.8	43.6	1.8
04:00	14.9	13.6	43.8	1.6
05:00	13.7	13.5	45	1.7
06:00	13.3	13	47.4	1.7
07:00	13	12.4	50.7	1.8
08:00	13.1	12.4	52	1.4
09:00	15.4	14.3	50.3	1.6
10:00	19.9	16.7	41.7	2.7
11:00	21.3	20.9	38	3.4
12:00	23.7	23.2	34.9	2.8
13:00	24.9	25	30.2	3.5
14:00	26.1	26	27.6	3.3
15:00	28.3	26.5	23.9	3.2
16:00	28.8	27	22.4	3.2
17:00	28.1	27.1	22.8	2.2
18:00	27.7	25.8	22.6	2.6
19:00	26.2	22.6	28.6	2.2
20:00	23.1	21	36.6	1.7
21:00	21.8	19.2	43.4	1.4
22:00	20.1	18.5	43.7	2
23:00	19.7	18.8	39.6	2
00:00	19	18.9	39.6	2.1

Experimental Study: The present investigation was carried out at the experimental Farm, Water Studies and Research Complex(WSRC) station, National Water Research Center, Toshka-Abo Simbel City, Aswan, Egypt which is located at latitude of 22o, 24`.11` N longitude of 31o,35`.43` E and of altitude 188 m during the two successive growth seasons of 2013/2014 and 2014/2015. The conducted experiment aimed at studying use of meteorological data in the integrated management of soil and water for sustainable agriculture in Toshka.

These experiments aimed to study the use of meteorological data in the integrated management of soil and water for sustainable agriculture in Toshka by using wheat crop in the study.

The water use efficiency of wheat crop was measured for these crops which have been irrigated by ground water resource (a deep well).

Where the use of the wheat crop in the study of the integrated management of water and agriculture as well as an assessment of reference evapotranspiration (ETo) within the meteorological data used computer programs and used the split plot in the experience were the irrigation levels arranged in the main plots while the subplots were randomly assigned to tested cultivars.

Grain rate was 60 kg/fed Grains were sown on the 18th of November in both seasons, designed system testing sectors full random number five plots in all tests where transactions of different irrigation treatments (60, 80,100,120%) of crop evapotranspiration (ETC) under sprinkler irrigation system with a plot area of 10 m 2, with the note that was calculated the amounts of calculated based upon the daily (ETo) measured using penman-monteith method with in every day during the irrigation process were carried out at (8 am) in the morning.

Studying the response of the wheat crop varieties (Egypt 1, Egypt 2) showed exposure to water stress during the growing period as well as (Hydrogel) for innovative water serving technique for optimizing crop yield at a rate of (6.5kg/fed) (150gm/100m2) where added in the second experiment through mixed polymer with the soil to increase the soil retain water efficiency.

In the first season experiment 2013/2014 where the comparison between different irrigation treatments (60, 80,100,120%) of crop evapotranspiration (ETC) under sprinkler irrigation system and the results between all different irrigation treatments for (Egypt1, Egypt2) varieties were significant.

In the second season 2014/2015, another factor was added in addition to the basic experience in the previous season in order to confirm that the results between all different water levels and accurately were significant, as experiments proved that the results were significantly not only with different water levels without adding other factors adding but also after adding the other factor in the experiment (hydrogel).

When the comparison between classes (Egypt 1, Egypt 2) varieties in both seasons under the different irrigation treatments was not significant between varieties in all levels where experiments proved that both plant height ,spike length ,number of grains/spike, spike weight, biological weight, grain weight, 1000-grain weight, day of heading, number of spikelet's did not give significant results between (Egypt1, Egypt2) varieties and give a significant results between all different irrigation treatments (60, 80,100,120%) (ETC) as well as give results in Hydrogel treatment.

Wheat experiments.: In this section, the experimental design and agricultural treatment will be discussed as a follow:-

Experimental design.: The system of sectors testing had design in five full random plots in all tests where transactions of different irrigation treatments (60, 80,100,120%) of crop evapotranspiration (ETC) under sprinkler irrigation system with a plot area of 10 m2, with the note that was calculated the amounts of calculated based upon the daily (ETo) measured using penman-monteith method with in every day during carried out the irrigation process were carried out at 8 am in the morning.

A field experiment in wheat were carried out in split plot design with five replication (R1, R2, R3, R4, R5) and four treatments expressed as (60, 80,100,120%) of crop evapotranspiration (ETC) respectively for Egypt 1, Egypt 2 varieties under sprinkler irrigation system.

The bounded was selected with buffer zone (10 m width) to avoid the interaction between sprinklers. The plot units were with an area of 100 m2 (almost 1/40 fed). The sprinkler system is constant (Brass impact rotate, Rain Baird, USA) with lateral line length of 72 m and 12 m space. Each line has 6 rotate sprinklers about 1.0 m above the ground with a flow rate of 1.2-1.4 m3 / hour at 2-3 bars.

The agricultural treatment.Irrigation: Irrigation treatments were started after completion of germination, 14 days after planting. Wheat plants were irrigated daily at 8:00 o'clock in the morning using the calculated amount of water based on ETo and crop factor for each growth period (FAO 56) as summarized in table 3.4. The amounts of irrigation water were varied according to the variation in climate demands of each growth period. The irrigation times were varied according to the amounts of irrigation water and discharge rate. In the winter seasons of 2013/2014 and 2014/2015, wheat seeds (Egypt1, Egypt2 varieties) were sown on November 18 in both seasons, with a rate of 60 Kg / fed under sprinkler irrigation system. Wheat plants were harvested on March 30 and March 31 in the first and second seasons for (Egypt1, Egypt2 varieties), respectively. All agriculture practices were applied at the recommendations set by the Ministry of Agriculture. Nitrogen, phosphorus and potassium fertilizers were added according to the recommended levels. Nitrogen was applied as ammonium nitrate (33.5% N) at a level of 100 Kg N /fed. This amount was divided into 4 equal doses, which were applied before the flowering. Phosphorus in the form of super phosphate (15.5% P2O5) was added at a level of 200 kg/fed., in one dose before planting. Potassium in the form of potassium sulphate (48% K2O) was added in two equal portions at a level of 100 kg/fed at the late growth stage.

Calculation of irrigation water requirement:

2.1 Reference evapotranspiration (ETo): The reference ET0 was estimated, using available meteorological data of Toshka station. The water model (Zazueta and Smajstrala 1984) was used to calculate reference ET0 by Modified Penman, Jensen and Haise, Doorenbos & Pruitt and pan evaporation, while CROPWAT model -which using in the study- was used to calculate (Penman Monteith Smith 1991).

The Penman–Monteith (PM) method is the most recommended method for estimating reference evapotranspiration (ETo). The PM equation requires several parameters to be available, either measured or computed.(Alazba 2001).

2.2 FAO Penman-Monteith equation (Allen *et al.*, 1998): The panel of FAO experts recommended the adoption of the Penman-Monteith combination method as a new standard for reference evapotranspiration and advised on procedures for calculation of the various parameters. By defining the reference crop as a hypothetical crop with an assumed height of 0.12 m having a surface resistance of 70 s m-1 and an albedo of 0.23, closely resembling the evaporation of an extension surface of green grass of uniform height, actively growing and adequately watered. The developed FAO Penman-Monteith method overcomes shortcomings of the previous FAO Penman method and provides values more consistent with actual crop water use data worldwide.

The equation is as follows:

$$ET_0 = \frac{0.408\,\Delta\left(R_n - G\right)\gamma\,\dfrac{900}{T+273}\,u_2\left(e_s - e_a\right)}{\Delta + \gamma\left(1 + 0.34u_2\right)}$$

Where: ET_0 = Reference evapotranspiration (mm day $^{-1}$).
R_n = Net radiation at the crop surface (MJ m $^{-2}$ day $^{-1}$).
G = Soil heat flux density (MJ m $^{-2}$ day $^{-1}$).
T = Mean daily air temperature at 2 m height (^{o}C).
u_2 = Wind speed at 2 m height (m s $^{-1}$).
e_s = Saturation vapour pressure (kPa).
e_a = Actual vapour pressure (kPa).
e_s-e_a = Saturation vapour pressure deficit (kPa).
Δ = Slope vapour pressure curve (kPa $^{o}C^{-1}$).
γ = Psychometric constant (kPa $^{o}C^{-1}$).

2.3 Crop evapotranspiration (ETc). (Allen, 1998) . Crop evapotranspiration depends on many factors, weather parameters, crop characteristics, management and environment aspects are factors affecting evaporation and transpiration. According to (Allen et al. 1998), the ETC is calculated according to the following equation:-

$$ET_c = ET_0 \times Kc$$

Where:- ETc = Crop evapotranspiration. ET0 = Reference evapotranspiration.
Kc = Crop coefficient.

2.4.Crop coefficient (Kc): The Crop coefficient reflects the crop characteristics on the crop evapotranspiration. The Kc is calculated as the dimensionless ratio of the ETc and the ET0 . as follow (Allen et al., 1998)

$$K_c = \frac{ET_c}{ET_0}$$

Where: ETc = Actual crop consumptive use measured from the field in mm/day.
ET0 = Reference evapotranspiration (mm/day)

2 5 Irrigation water use efficiency (IWUE): The irrigation water use efficiency (IWUE) values were calculated as follows: (Vits, 1965).

$$IWUE = \frac{Grain\ or\ Seed\ yield\ (Kg\ /\ fed.)}{Irrigation\ water\ requirements\ (m^3\ /\ fed.)}$$

The amount of required irrigation water for different irrigation systems was calculated using the area of different irrigation systems as follow:

IR= ETcrop x A

Where: IR: irrigation water required (L).

A: The plot area (0.25fed).

Irrigation water applied for treatments 60% ETc = IR x 0.6 (L).

Irrigation water applied for treatments 80% ETc = IR x 0.8. (L).

Irrigation water applied for treatments 100% ETc = IR x 1.0 (L).

Irrigation water applied for treatments 120% ETc = IR x 1.2. (L).

RESULTS AND DISCUSSIONS

Irrigation water is one of the most important inputs in crop production. The arid regions suffer from water shortage due to its scarcity and irregular distribution. The management of water resources in arid regions requires good knowledge and great skills especially in the case of limited water supply. Adding too much or too little water may cause a serious damage for crops; therefore water requirement must be carefully determined. Water use for agricultural crops is important for adequate water management in arid and semiarid areas where irrigation is necessary and water is limited and expensive. Egypt is forced to implement serious efforts towards the equilibrium between its limited water supply and demand.

Where the use of the wheat crop in the study of the integrated management of water and agriculture as well as an assessment of reference evapotranspiration (ET0) within studied the meteorological data of Toshka weather station, which were used in the calculated, during the growth seasons are present in Table 2 by using computer programs.

Table (2): Average monthly meteorological data of Toshka weather station during the growth seasons

Element / Month	Rain mm/day	W.S (m/sec)	Sunshine hours/day	RH (%)	Temperatur Min (oc)	Temperatur Max (oc)	SR (watt/m2/	ET0 (mm) Penman-Monteith
2013/2014 Winter Season								
November	0	2.5	10.9	32.93	15.51	31.23	160.79	5.55
December	0	2.44	10.6	36.33	10.78	26.81	145.85	4.54
January	0	2.7	10.7	36.5	16.44	24.57	143.8	4.77
February	0	2.99	11.17	25.2	11.12	28.18	189.12	6.19
March	0	3.09	11.7	35.23	12.99	24.22	222.65	5.98
2014/2015 Winter Season								
Novembe	0	2.36	10.9	32.6	12.23	28.29	163.62	5.29
December	0	2.54	10.6	35.78	9.69	26.02	146.17	4.54
January	0	2.20	10.7	41.1	8.4	24.2	157.8	4.08
February	0	2.60	11.17	30.8	12.5	28.1	176	5.68
March	0	3.10	11.7	20.9	13.5	30.3	223.3	7.38

(RH): relative humidity (WS): wind speed (SR) : solar radiation

1. Calculation of irrigation water requirement: Irrigation was carried on every day. The amounts of irrigation water add to different irrigation regimes during the growth seasons and some climatic data of Toshka weather station were used in the calculated, during the growth seasons are present in Tables 3,4 by using computer programs presented.

Table (3): Total amount of irrigation water of wheat crop season 2013/14 in different irrigation regimes experiment calculated based upon Et0.

Growing Period	Growing Season 2013/14									
	ET_0 mm/ period	ET_o mm/ day	K_c	ET_c mm/ day	I.E (%)	L.R	CWR (mm/ period)			
							60%	80%	100%	120 %
18-27/11/2013	54.67	5.47	0.3	16.40	0.75	1.2	8.86	11.81	14.76	17.71
28-7/11/2013	51.73	5.17	0.3	15.52	0.75	1.2	8.38	11.17	13.97	16.76
8-17/12/2013	46.66	4.67	0.3	14.00	0.75	1.2	7.56	10.08	12.60	15.12
18-27/12/2013	42.53	4.25	0.46	19.56	0.75	1.2	10.56	14.09	17.61	21.13
28-6/12/2013	41.37	4.14	0.74	30.61	0.75	1.2	16.53	22.04	27.55	33.06
7-16/1/2014	40.91	4.09	1.02	41.73	0.75	1.2	22.53	30.04	37.56	45.07
17-26/1/2014	41.72	4.17	1.15	47.98	0.75	1.2	25.91	34.54	43.18	51.82
27-4/1/2014	45.54	4.55	1.15	52.37	0.75	1.2	28.28	37.71	47.13	56.56
5-14/2/2014	52.67	5.27	1.15	60.57	0.75	1.2	32.71	43.61	54.51	65.42
15-24/2/2014	62.16	6.22	1.15	71.48	0.75	1.2	38.60	51.47	64.34	77.20
25-6/2/2014	71.18	7.12	0.99	70.47	0.75	1.2	38.05	50.74	63.42	76.11
7-16/3/2014	74.22	7.42	0.71	52.70	0.75	1.2	28.46	37.94	47.43	56.91
17-26/3/2014	62.29	6.23	0.43	26.78	0.75	1.2	14.46	19.28	24.11	28.93
Total water							280.90	374.53	468.16	561.79

ET0): Reference evapotranspiration (Kc) Crop coefficient (ETC) Crop evapotranspiration :(I.E) : Irrigation efficiency (L.R) Lavement requirements (CWR): Crop water requirements.

Table (4): Total amount of irrigation water of wheat crop season 2014/15 in different irrigation regimes experiment calculated based upon Et0

Growing Period	Growing Season 2014/15									
	ET_0 mm/ period	ET_o mm/ day	K_c	ET_c mm/ day	I.E (%)	L.R	CWR (mm/ period)			
							60%	80%	100%	120%
18-27/11/2014	55.97	5.60	0.3	16.79	0.75	1.2	15.11	9.07	12.09	18.13
28-7/11/2014	51.68	5.17	0.3	15.50	0.75	1.2	13.95	8.37	11.16	16.74
8-17/12/2014	46.52	4.65	0.3	13.96	0.75	1.2	12.56	7.54	10.05	15.07
18-27/12/2014	43.70	4.37	0.46	20.10	0.75	1.2	18.09	10.86	14.47	21.71
28-6/12/2014	44.78	4.48	0.74	33.14	0.75	1.2	29.82	17.89	23.86	35.79
7-16/1/2015	46.91	4.69	1.02	47.85	0.75	1.2	43.06	25.84	34.45	51.68
17-26/1/2015	49.87	4.99	1.15	57.35	0.75	1.2	51.62	30.97	41.29	61.94
27-4/1/2015	54.29	5.43	1.15	62.43	0.75	1.2	56.19	33.71	44.95	67.43
5-14/2/2015	59.55	5.96	1.15	68.48	0.75	1.2	61.63	36.98	49.31	73.96
15-24/2/2015	64.25	6.43	1.15	73.89	0.75	1.2	66.50	39.90	53.20	79.80
25-6/2/2015	66.13	6.61	0.99	65.47	0.75	1.2	58.92	35.35	47.14	70.71
7-16/3/2015	61.85	6.19	0.71	43.91	0.75	1.2	39.52	23.71	31.62	47.43
17-26/3/2015	46.85	4.69	0.43	20.15	0.75	1.2	18.13	10.88	14.50	21.76
Total water							291.1	388.1	485.1	582.1

ET0): Reference evapotranspiration (Kc) Crop coefficient (ETC) Crop evapotranspiration : (I.E) : Irrigation efficiency (L.R) Lavement requirements (CWR): Crop water requirements.

Irrigation water use efficiency (IWUE): In irrigated agriculture in arid and semi-arid regions where water resources are limited and/or diminishing, and where rainfall is limited, crop water use efficiency (WUE) became of crucial and of important consideration. Even with using the newly developed irrigation systems that using different sources of energy and with resent increases in energy prices, have many farmers asking how to manage inputs to maximize efficiency of their water resources. Regardless of the situation, it’s crucial that growers get the most out of every cm of available water, on the WUE is to be assessed to adopt the irrigation management practices that maximize the outcome of each unit of irrigation water (Vits 1965).

In this part of the present work, irrigation water use efficiency (IWUE) was calculated as a ratio between the total dry mater (kg fed-1) and the amount of irrigation water used (m3 fed-1). Data presented in Tables 5 and 6 summaries the effects of the irrigation regimes on both varieties in both seasons, and their interaction on (IWUE) total dry matter produced by wheat plants grown in different irrigation treatments.

With increasing the amount of irrigation water from 60 to 120% ETc the IWUE decreased in both growth seasons. In 2013/14 growth season the high difference in IWUE of the 60 and 120% ETc treatments could be a direct result of losing some plants by bird attack as mentioned previously. In 2014/15, growth season the same happened therefore this explains the increase in IWUS with applying only 60% of the required irrigation water by crop (ETc). The irrigation water use efficiency is increased as a direct result of reducing the accumulation of dry matter with a rate less than that of reducing the amount of irrigation water. (Simonne *et al.,* 2006;Elmaloglou and Diamantopoulos, 2009;Elmaloglou and Diamantopoulos ,2007).

Table (5): Yield and irrigation water use efficiency (IWUE) of sprinkler - irrigated wheat crop grown in irrigation regimes to both varieties in 2013-14 season.

Factor	Crop Water Requirements Season 2013-2014											
	Grain Yield (kg/fed)			Irrigation Water Applied (m3/fed)			Crop Water Use Efficiency (kg/m3)			Irrigation Water Use Efficiency (kg/m3)		
Irrigation	Misr 1	Misr 2	Mean	Misr 1	Misr 2	Mean	Misr 1	Misr 2	Mean	Misr 1	Misr 2	Mean
60%	1562.4	1360.8	1461.6	1679.76	1679.76	1679.76	0.93	0.81	0.87	0.7	0.59	0.65
80 %	1747.2	1722	1734.6	2073.01	2073.01	2073.01	0.84	0.83	0.84	0.63	0.61	0.62
100 %	2066.4	2108.4	2087.4	2466.27	2466.27	2466.27	0.84	0.85	0.85	0.63	0.62	0.63
120 %	2234.4	2259.6	2247	2859.52	2859.52	2859.52	0.78	0.79	0.79	0.59	0.58	0.59
Mean	1902.6	1862.7	1882.65	2269.64	2269.64	2269.64	0.85	0.82	0.83	0.64	0.60	0.62
LSD $_{0.05}$	I=1.64 V =NS I X V =NS			القيم واحدة لأن كميه لمياه المضافة لصنفى القمح ثابتة فى نفس المستوى								

Table (6): Yield and irrigation water use efficiency (IWUE

Factor		Crop Water Requirements Season 2014-2015											
		Grain Yield (kg/fed)			Irrigation water applied (m3/fed)			Crop Water Use Efficiency (kg/m3)			Irrigation Water Use Efficiency (kg/m3)		
Irrigation	Hydrogel	Misr 1	Misr 2	Mean	Misr 1	Misr 2	Mean	Misr 1	Misr 2	Mean	Misr 1	Misr 2	Mean
60 %	with	1814.40	1755.60	1785.00	1222.5	1222.5	1222.5	**1.48**	**1.44**	**1.46**	**1.11**	**1.08**	1.10
	control	1604.40	1545.60	1575.00	1222.5	1222.5	1222.5	1.31	1.26	1.29	0.98	0.95	0.97
		1709.40	1650.60	1680.00	1222.5	1222.5	1222.5	1.40	1.35	1.38	1.05	1.02	1.04
80 %	with	2016.00	2125.20	2070.60	1630	1630	1630	**1.24**	1.3	1.27	**0.93**	0.98	0.96
	control	1822.80	1797.60	1810.20	1630	1630	1630	1.12	1.10	1.11	0.84	0.83	0.84
		1919.40	1961.40	1940.40	1630	1630	1630	1.18	1.2	1.19	0.89	0.91	0.90
100 %	with	2368.80	2394.00	2381.40	2037.5	2037.5	2037.5	**1.16**	1.17	1.17	**0.87**	0.88	0.88
	control	2175.94	2192.40	2184.17	2037.5	2037.5	2037.5	1.01	1.08	1.05	0.80	0.81	0.81
		2272.37	2293.20	2282.78	2037.5	2037.5	2037.5	1.09	1.13	1.11	0.84	0.85	0.85
120 %	with	2528.40	2478.00	2503.20	2445	2445	2445	**1.03**	1.01	1.02	**0.78**	0.76	0.77
	control	2310.00	2293.20	2301.60	2445	2445	2445	0.94	0.94	0.94	0.71	0.70	0.71
		2419.20	2385.60	2402.40	2445	2445	2445	0.99	0.98	0.98	0.75	0.73	0.74
Mean		2080.09	2072.7	2076.4	1833.75	1833.75	1833.75	**1.16**	1.16	1.16	0.88	0.87	0.88
LSD $_{0.05}$		I=1.24 H =0.63 V =NS I X V = NS H X V = NS I X H X V = NS											

Wheat yield and yield components.: Wheat is a major strategic food grain crop successfully grown under limited water conditions, Therefore its growth and high productivity depend mainly on the proper water management. The various crop development stages posses different sensitivities to moisture stress where time, duration and the degree of the stress all affect yield. Water management that maximize yield per unit of water consumed by plant are highly desired.

A. Morphological characters:

A.1.Dayes of heading: The data in table (7) show that days to heeding were significant affected by different irrigation treatments in both seasons to (Egypt1, Egypt2) varieties .The results reveal that a reduction in number of dates to heading recorded when plants under (60, 80%) Etc and where increase number of days to heading recorded when plants under (100,120%) Etc and also effect was significant with (SAP) (hydrogel) treatment. The lowest values of day numbers were obtained at the (60%) ETC treatment (42.8, 42.6) day in the first season and (42.6, 42.8) day in the second season. The highest values of day number obtained at the (120%) ETC treatment (59, 59) day in the first season and (59, 59) day in the second season. In addition to the plants under (SAP) hydrogel treatment in the second season exerted a significant effect (60.4, 60.8) day to (Egypt1, Egypt2) varieties respectively. The results are in line with those obtained by (Abd El-Mogied ,1990).

A.2. Plant height (cm): The results in table (8) reveal that different irrigation treatments exerted significant effect on plant height in both seasons to (Egypt1, Egypt2) varieties. In general, the plants under (60, 80%) Etc was shorter than the plants under (100,120%) Etc. Also increasing water levels and adding hydrogel increased plant height where a reduction in irrigation water to (60, 80%) Etc exerted a significant effect on plant height when compared with (100,120%) Etc for (Egypt1, Egypt2) varieties as well as hydrogel treatment or when adding hydrogel. The lowest values of plants height obtained at the (60%) ETC treatment (85.2, 86) cm in the first season and (84.2, 85.2) cm in the second season. The highest values of plants height were at the (120%) Etc. treatment (95.2, 97.7) cm in the first season and (91.2, 92) cm in the second season. In addition to the plants under (SAP) hydrogel treatment in the second season exerted a significant effect (98.8, 97.8) cm to (Egypt1, Egypt2) varieties respectively. These results are in accordance with those obtained by (Hassaan, 2003; Golam and Goswami, 2004; Mohamed, 2007; Hefzy, 2009).

A.3. Spike length (cm): Data presented in table (9) and show that Irrigation treatments exerted a significant effect on Spike length in both seasons to (Egypt1, Egypt2) varieties. The lowest values of Spike length obtained at the (60%) ETC treatment (9.2, 9.3) cm in the first season and (9.2, 9.7) cm in the second season. The highest values of Spike length obtained at the (120%) ETC treatment (12.1, 11.4) cm in the first season and (11.9, 12.2) cm in the second season. In addition to the plants under (SAP) hydrogel treatment in the second season exerted a significant effect (12.1, 12.3) cm to (Egypt1, Egypt2) varieties respectively. These results are in line with those obtained by Abd El-Mogied, 1990; Mohamed and Tammam, 1999; Shivani *et al*,. 2001; and Mohamed, 2007).

B. Yield and yield components

B.1. No of spikes per square meter: The data in table (10) show that Irrigation treatments exerted a significant effect on Number of spikes / M2 in both seasons to (Egypt1, Egypt2) varieties. The lowest values of spikes number obtained at the (60%) ETC treatment (301, 335.2) and (331, 324) in the first season and second season to (Egypt1, Egypt2) varieties respectively. The highest values of spikes number obtained at the (120%) ETC treatment (420, 422.2) and (417.8, 423.4) in the same arrangement with confirm note the significant effect between water treatments and not significant effect between (Egypt1, Egypt2) varieties by using hydrogel treatment were obtained at the (120%) ETC treatment (452.4, 453.4) respectively. These results are in agreement with those obtained by (Hassan,2003;Salem, 2005;Khalil, *et al.*, 2006;Mohamed, 2007;Hefzy,2009).

B.2. Number of grains per spike: The results in table (11) indicate that Plants exposed to drought decreased number of grains / spike significantly in both seasons to (Egypt1, Egypt2) varieties. While in the (60%) ETC treatment obtained the lowest number of grains (44, 46.2) (49.2, 43.2) in the first season and second season to (Egypt1, Egypt2) varieties respectively. While in the (120%) ETC treatment obtained the highest number of grains (64.4, 66.6) (65, 63.2) in the same arrangement with confirm note the significant effect between water treatments and not significant effect between (Egypt1, Egypt2) varieties by using hydrogel treatment were obtained at the (120%) ETC treatment (74.6, 71.4). These results are in harmony with those obtained by (Shivani *et al.*, 2001;Hassaan, 2003;Salem, 2005;Mohamed, 2007;Hefzy, 2009).

Biological yield kg per m2: The results in table (12) indicate that Irrigation treatments and hydrogel treatment exerted a significant effect to biological yield obtained high values when increasing water and highest values when using hydrogel for the interaction between Irrigation treatments exerted a significant effect in biological yield in both seasons in (Egypt1, Egypt2) varieties respectively. The highest values obtained at (120%) etc with hydrogel adding in the second season (1.27,1.27) kg/m2 and the lowest values obtained at (60%) etc without hydrogel adding in the first season (0.88,0.77) kg/m2. These results are in line with those obtained by (Almasian et al., 2006;Mohamed, 2007).

B.3. Grain yield /fed. (Ardab): These presented data in Table (13) show that Irrigation treatments and hydrogel treatment exerted a significant effect on wheat grain yield obtained high values when increasing water and the highest values when using hydrogel. In the first season at the (60, 80,100,120%) ETC obtained (10.42,11.65,13.78,14.9) ardab to (Egypt1) variety respectively and (9.07,11.48,14.6,15.06) ardab to (Egypt2) variety respectively while obtained (10.7,12.15,14.51,15.4) ardab to (Egypt1) variety in the second season while obtained (12.10,13.14,15.79,16.86) in the same variety but with out adding hydrogel .As for the (Egypt2) variety were obtained (10.3,11.98,14.62,15.29) ardab without adding hydrogel while obtained(11.7,14.17,15.96,16.52) ardab with hydrogel adding, although this relationship is positive by increase irrigation water and hydrogel adding the grain yield increasing. These results are in harmony with those obtained by (Aly,2005;Mohamed 2007;Hefzy,2009).

B.4. 1000 – Grain weight (gm): The results in Table (14) and figure 7 indicate that the interaction between Irrigation treatments and hydrogel treatment exerted a significant effect to seed index and not significant in (Egypt1, Egypt2) varieties. The highest values of seed index obtained at

(120%) ETC (41.57, 40.28) respectively in the second season after adding hydrogel. These results in accordance with those obtained by (Shivani et al., 2001;Hassaan, 2003).

B.5. Straw yield per fed (ton): The results in table (15) indicate that Irrigation treatments and hydrogel treatment exerted a significant effect to straw yield obtained high values when increasing water and highest values when using hydrogel there for the interaction between Irrigation treatments exerted a significant effect in straw yield in both seasons in (Egypt1, Egypt2) varieties respectively. The highest values obtained at (120%) etc with hydrogel adding in the second season (3.36,3.42) ton and the lowest values obtained at (60%) etc without hydrogel adding in the first season (2.13,2.34) ton. These results are in line with those obtained by (Almasian *et al.*, 2006;Mohamed ,2007;Hefzy, 2009).

B.6. Harvest index (H. I): The data in table (16) reveal that Irrigation treatments maybe exerted a significant effect or no exerted to harvest index but hydrogel adding exerted a significant effect. These results are in harmony with those obtained by (Rayan et al., 2000;Khalil et al., 2006;Mohamed, 2007;Hefzy, 2009).

Table (7): Effect of different irrigation treatments and hydrogel on days to heading. to (Egypt1, Egypt2) varieties

Factor		**2013/14**		**Mean**	**2014/15**		**Mean**
		Variety			**Variety**		
Irrigation	**Hydrogel**	**Misr 1**	**Misr 2**		**Misr 1**	**Misr 2**	
60 %	with	-	-	-	49.80	49.40	49.60
	control	42.8	42.6	42.7	42.60	42.80	42.70
		42.8	42.6	42.7	46.20	46.10	46.15
80 %	with	-	-	-	55.20	54.40	54.80
	control	49.4	49.4	49.4	45.40	45.20	45.30
		49.4	49.4	49.4	50.30	49.80	50.05
100 %	with	-	-	-	58.60	58.40	58.50
	control	57	56.6	56.8	55.80	56.20	56.00
		57	56.6	56.8	57.20	57.30	57.25
120 %	with	-	-	-	60.40	60.80	60.60
	control	58.2	58.6	58.4	59.00	59.00	59.00
		58.2	58.6	58.4	59.70	59.90	59.80
Mean		51.85	51.8	51.83	53.35	53.28	53.31
LSD 0.05		1 = 3.12 V = NS I x V = NS			I = 1.26	H = 1.09	V = 2.18
		I=IRRIGATION H=HYDROGEL V=VARIETY			I x H = NS	I x V = NS	H x V = NS
					I x H x V = NS		

Table (8): Effect of different irrigation treatments and hydrogel on plant heightto (Egypt1, Egypt2) varieties

Factor		2013/14		Mean	2014/15		Mean
		Variety			Variety		
Irrigation	Hydrogel	Misr 1	Misr 2		Misr 1	Misr 2	
60 %	with	-	-	-	85.60	85.50	85.55
	control	85.2	86.0	85.6	84.20	85.40	84.80
		85.2	86.0	85.6	84.90	85.45	85.18
80 %	with	-	-	-	88.70	86.70	87.70
	control	85.1	84.9	85	85.60	84.80	85.20
		85.1	84.9	85	87.15	85.75	86.45
100 %	with	-	-	-	93.10	93.90	93.50
	control	93.6	93.7	93.65	91.50	90.90	91.20
		93.6	93.7	93.65	92.30	92.40	92.35
120 %	with	-	-	-	98.80	97.80	98.30
	control	95.2	97.7	96.45	92.00	91.60	91.80
		95.2	97.7	96.45	95.40	94.70	95.05
Mean		89.77	90.58	90.18	89.94	89.58	89.76
LSD 0.05		1 = 4.45 V = NS I x V = NS			I = 3.8	H = 2.04	V = NS
					I x H = NS	I x V = NS	H x V = NS
					I x H x V = NS		

Table(9): Effect of different irrigation treatments and hydrogel on spike length (cm) to (Egypt1, Egypt2) varieties

Factor		2013/14		Mean	2014/15		Mean
		Variety			Variety		
Irrigation	Hydrogel	Misr 1	Misr 2		Misr 1	Misr 2	
60 %	with	-	-	-	10.10	9.40	9.75
	control	9.2	9.3	9.25	9.20	8.70	8.95
		9.2	9.3	9.25	9.65	9.05	9.35
80 %	with	-	-	-	11.30	11.00	11.15
	control	10.6	10.7	10.65	10.00	10.90	10.45
		10.6	10.7	10.65	10.65	10.95	10.80
100 %	with	-	-	-	11.40	11.40	11.40
	control	10.8	11.1	10.95	10.50	10.60	10.55
		10.8	11.1	10.95	10.95	11.00	10.98
120 %	with	-	-	-	12.10	12.30	12.20
	control	12.1	11.4	11.75	11.90	12.20	12.05
		12.1	11.4	11.75	12.00	12.25	12.13
Mean		10.68	10.63	10.65	10.80	10.81	10.81
LSD 0.05		1 = 1.49 V = NS I x V = NS			I = 1.14	H = 055	V = NS
					I x H = NS	I x V = NS	H x V = NS
					I x H x V = NS		

Table (10): effect of different irrigation treatments and hydrogel on no of spikes / m2 to (Egypt1, Egypt2) varieties

Factor		2013/14		Mean	2014/15		Mean
		Variety			Variety		
Irrigation	Hydrogel	Misr 1	Misr 2		Misr 1	Misr 2	
60 %	with	-	-	-	353.60	370.40	362.00
	control	301	335.2	318.1	331.40	323.80	327.60
		301	335.2	318.1	342.50	347.10	344.80
80 %	with	-	-	-	400.00	416.20	408.10
	control	354.4	362.4	358.4	364.20	363.00	363.60
		354.4	362.4	358.4	382.10	389.60	385.85
100 %	with	-	-	-	439.20	444.20	441.70
	control	396	396.2	393.1	390.40	393.20	391.80
		396	396.2	393.1	414.80	418.70	416.75
120 %	with	-	-	-	452.40	453.40	452.90
	control	420.6	422.2	421.4	417.80	423.40	420.60
		420.6	422.2	421.4	435.10	438.40	436.75
Mean		368	377.50	372.8	393.63	398.45	396.04
LSD 0.05		1 = 1.49 V = NS I x V = NS			I = 23.59	H = 21.61	V = NS
					I x H = NS	I x V = NS	H x V = NS
					I x H x V = NS		

Table (11): Effect of different irrigation treatments and hydrogel on no of grains / spike to (Egypt1, Egypt2) varieties

Factor		2013/14 Variety		Mean	2014/15 Variety		Mean
Irrigation	**Hydrogel**	**Misr 1**	**Misr 2**		**Misr 1**	**Misr 2**	
60 %	with	-	-	-	56.80	55.00	55.90
	control	44	46.2	45.1	49.20	43.20	46.20
		44	46.2	45.1	53.00	49.10	51.05
80 %	with	-	-	-	66.80	64.20	65.50
	control	50	50.48	50.24	52.08	53.00	52.54
		50	50.48	50.24	59.44	58.60	59.02
100 %	with	-	-	-	70.60	71.60	71.10
	control	64.6	64	64.3	62.60	63.60	63.10
		64.6	64	64.3	66.60	67.60	67.10
120 %	with	-	-	-	74.60	71.40	73.00
	control	64.4	66.6	65.5	65.00	63.20	64.10
		64.4	66.6	65.5	69.80	67.30	68.55
Mean		55.75	56.82	56.29	62.21	60.65	61.43
LSD $_{0.05}$		1 = 9.64 V = NS I x V = NS			I = 4.42	H = 3.36	V = NS
					I x H = NS	I x V = NS	H x V = NS
					I x H x V = NS		

Table(12): Effect of different irrigation treatments and hydrogel on biological yield kg per m2 to (Egypt1, Egypt2) varieties

<table>
<tr><th colspan="2" rowspan="2">Factor</th><th colspan="2">2013/14</th><th rowspan="3">Mean</th><th colspan="2">2014/15</th><th rowspan="2">Mean</th></tr>
<tr><th colspan="2">Variety</th><th colspan="2">Variety</th></tr>
<tr><th>Irrigation</th><th>Hydrogel</th><th>Misr 1</th><th>Misr 2</th><th>Misr 1</th><th>Misr 2</th><th></th></tr>
<tr><td rowspan="2">60 %</td><td>with</td><td>-</td><td>-</td><td>-</td><td>1.03</td><td>1.00</td><td>1.01</td></tr>
<tr><td>control</td><td>0.88</td><td>0.77</td><td>0.83</td><td>0.89</td><td>0.87</td><td>0.88</td></tr>
<tr><td></td><td></td><td>0.88</td><td>0.77</td><td>0.83</td><td>0.96</td><td>0.93</td><td>0.95</td></tr>
<tr><td rowspan="2">80 %</td><td>with</td><td>-</td><td>-</td><td>-</td><td>1.12</td><td>1.22</td><td>1.17</td></tr>
<tr><td>control</td><td>0.97</td><td>0.97</td><td>0.97</td><td>1.05</td><td>0.98</td><td>1.01</td></tr>
<tr><td></td><td></td><td>0.97</td><td>0.97</td><td>0.97</td><td>1.09</td><td>1.10</td><td>1.09</td></tr>
<tr><td rowspan="2">100 %</td><td>with</td><td>-</td><td>-</td><td>-</td><td>1.33</td><td>1.35</td><td>1.34</td></tr>
<tr><td>control</td><td>1.13</td><td>1.15</td><td>1.14</td><td>1.22</td><td>1.22</td><td>1.22</td></tr>
<tr><td></td><td></td><td>1.13</td><td>1.15</td><td>1.14</td><td>1.28</td><td>1.28</td><td>1.28</td></tr>
<tr><td rowspan="2">120 %</td><td>with</td><td>-</td><td>-</td><td>-</td><td>1.41</td><td>1.40</td><td>1.41</td></tr>
<tr><td>control</td><td>1.23</td><td>1.26</td><td>1.25</td><td>1.27</td><td>1.27</td><td>1.27</td></tr>
<tr><td></td><td></td><td>1.23</td><td>1.26</td><td>1.25</td><td>1.34</td><td>1.34</td><td>1.34</td></tr>
<tr><td colspan="2">Mean</td><td>1.05</td><td>1.04</td><td>1.05</td><td>1.16</td><td>1.16</td><td>1.16</td></tr>
<tr><td colspan="2" rowspan="3">LSD 0.05</td><td colspan="3" rowspan="3">1 =0.12 V = NS
I x V = NS</td><td>I = 0.11</td><td>H =0.05</td><td>V = NS</td></tr>
<tr><td>I x H = NS</td><td>I x V = NS</td><td>H x V = NS</td></tr>
<tr><td colspan="3">I x H x V = NS</td></tr>
</table>

Table(13): Effect of different irrigation treatments and hydrogel on grain yield / fed (ardab) to (Egypt1, Egypt2) varieties

<table>
<tr><th colspan="2" rowspan="2">Factor</th><th colspan="2">2013/14</th><th rowspan="3">Mean</th><th colspan="2">2014/15</th><th rowspan="2">Mean</th></tr>
<tr><th colspan="2">Variety</th><th colspan="2">Variety</th></tr>
<tr><th>Irrigation</th><th>Hydrogel</th><th>Misr 1</th><th>Misr 2</th><th>Misr 1</th><th>Misr 2</th><th></th></tr>
<tr><td rowspan="2">60 %</td><td>with</td><td>-</td><td>-</td><td>-</td><td>12.10</td><td>11.70</td><td>11.90</td></tr>
<tr><td>control</td><td>10.42</td><td>9.07</td><td>9.74</td><td>10.70</td><td>10.30</td><td>10.50</td></tr>
<tr><td></td><td></td><td>10.42</td><td>9.07</td><td>9.74</td><td>11.40</td><td>11.00</td><td>11.20</td></tr>
<tr><td rowspan="2">80 %</td><td>with</td><td>-</td><td>-</td><td>-</td><td>13.44</td><td>14.17</td><td>13.80</td></tr>
<tr><td>control</td><td>11.65</td><td>11.48</td><td>11.56</td><td>12.15</td><td>11.98</td><td>12.07</td></tr>
<tr><td></td><td></td><td>11.65</td><td>11.48</td><td>11.56</td><td>12.80</td><td>13.08</td><td>12.94</td></tr>
<tr><td rowspan="2">100 %</td><td>with</td><td>-</td><td>-</td><td>-</td><td>15.79</td><td>15.96</td><td>15.88</td></tr>
<tr><td>control</td><td>13.78</td><td>10.06</td><td>13.92</td><td>14.51</td><td>14.62</td><td>14.56</td></tr>
<tr><td></td><td></td><td>13.78</td><td>10.06</td><td>13.92</td><td>15.15</td><td>15.29</td><td>15.22</td></tr>
<tr><td rowspan="2">120 %</td><td>with</td><td>-</td><td>-</td><td>-</td><td>16.86</td><td>16.52</td><td>16.69</td></tr>
<tr><td>control</td><td>14.9</td><td>15.06</td><td>14.98</td><td>15.40</td><td>15.29</td><td>15.34</td></tr>
<tr><td></td><td></td><td>14.9</td><td>15.06</td><td>14.98</td><td>16.13</td><td>15.90</td><td>16.02</td></tr>
<tr><td colspan="2">Mean</td><td>12.68</td><td>12.42</td><td>12.55</td><td>13.87</td><td>13.82</td><td>13.84</td></tr>
<tr><td colspan="2" rowspan="3">LSD $_{0.05}$</td><td colspan="3" rowspan="3">1 = 1.64 V = NS
I x V = NS</td><td>I = 1.24</td><td>H =0.63</td><td>V = NS</td></tr>
<tr><td>I x H = NS</td><td>I x V = NS</td><td>H x V = NS</td></tr>
<tr><td colspan="3">I x H x V = NS</td></tr>
</table>

Table (14): Effect of different irrigation treatments and hydrogel on 1000-grains weightto (Egypt1, Egypt2) varieties

Factor		**2013/14 Variety**		**Mean**	**2014/15 Variety**		**Mean**
Irrigation	**Hydrogel**	**Misr 1**	**Misr 2**		**Misr 1**	**Misr 2**	
60 %	with	-	-	-	34.55	34.31	34.43
	control	32.46	31.58	32.02	31.92	32.94	32.43
		32.46	31.58	32.02	33.23	33.63	33.43
80 %	with	-	-	-	35.92	36.14	36.03
	control	34.53	33.47	34.0	33.53	35.47	34.50
		34.53	33.47	34.0	34.73	35.81	35.27
100 %	with	-	-	-	38.51	38.96	38.73
	control	35.24	35.01	35.12	35.77	36.95	36.36
		35.24	35.01	35.12	37.14	37.95	37.55
120 %	with	-	-	-	41.57	40.28	40.93
	control	37.11	36.6	36.85	36.98	37.03	37.01
		37.11	36.6	36.85	39.28	38.65	38.97
Mean		34.84	34.17	34.51	36.09	36.51	36.30
LSD 0.05		1 = 1.71 V = NS I x V = NS			I = 2.02	H =1.11	V = NS
					I x H = NS	I x V = NS	H x V = NS
					I x H x V = NS		

Table(15): Effect of different irrigation treatments and hydrogel on straw yield per fed (ton) to (Egypt1, Egypt2) varieties

Factor		2013/14 Variety		Mean	2014/15 Variety		Mean
Irrigation	**Hydrogel**	**Misr 1**	**Misr 2**		**Misr 1**	**Misr 2**	
60 %	with	-	-	-	2.49	2.44	2.47
	control	2.13	1.88	2.0	2.13	2.10	2.11
		2.13	1.88	2.0	2.31	2.27	2.29
80 %	with	-	-	-	2.70	2.98	2.84
	control	2.31	2.34	2.33	2.58	2.31	2.44
		2.31	2.34	2.33	2.64	2.64	2.64
100 %	with	-	-	-	3.20	3.27	3.23
	control	2.66	2.73	2.7	2.96	2.92	2.94
		2.66	2.73	2.7	3.08	3.09	3.09
120 %	with	-	-	-	3.39	3.42	3.40
	control	2.91	3.02	2.97	3.01	3.06	3.03
		2.91	3.02	2.97	3.20	3.24	3.22
Mean		2.5	2.49	2.46	2.81	2.81	2.81
LSD 0.05		1 = 0.42 V = NS I x V = NS			I = 2.68	H =1.39	V = NS
					I x H = NS	I x V = NS	H x V = NS
					I x H x V = NS		

Table(16): Effect of different irrigation treatments and hydrogel on harvest index (H. I) to (Egypt1, Egypt2) varieties

Factor		2013/14 Variety		Mean	2014/15 Variety		Mean
Irrigation	**Hydro gel**	**Misr 1**	**Misr 2**		**Misr 1**	**Misr 2**	
60 %	with	-	-	-	42.19	41.97	42.08
	control	42.4	41.96	42.18	42.99	42.38	42.69
		42.4	41.96	42.18	42.59	42.18	42.38
80 %	with	-	-	-	42.72	41.59	42.16
	control	43	42.44	42.72	41.45	43.81	42.63
		43	42.44	42.72	42.09	42.70	42.39
100 %	with	-	-	-	42.54	42.29	42.42
	control	43.9	43.96	43.93	42.35	42.91	42.63
		43.9	43.96	43.93	42.44	42.60	42.52
120 %	with	-	-	-	42.75	42.00	42.38
	control	43.46	42.91	43.19	43.48	42.89	43.18
		43.46	42.91	43.19	43.11	42.45	42.78
Mean		43.19	42.81	43	42.56	42.48	42.52
$LSD_{0.05}$		1 = NS V = NS I x V = NS			I = NS	H = 048	V = NS

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استخدام بيانات الأرصاد الجوية فى حساب الاحتياجات المائية لمحصول القمح في توشكي.

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المستخلص

أجريت هذه الدراسة في مزرعة تجارب الأبحاث الزراعية بمجمع الدراسات والبحوث المائية بمدينة أبوسمبل السياحية – توشكي – أسوان – مصر فى الموسم الشتوى لعامى ٢٠١٣/٢٠١٤، ٢٠١٤/٢٠١٥ .وذلك لدراسة استخدام بيانات الأرصاد الجوية في الإدارة المتكاملة للتربة والمياه للزراعة المستدامة بتوشكي.

تم استخدام محصول القمح فى دراسة الادارة المتكاملة للمياه والزراعة وكذلك تم تقدير البخر نتح المرجعى من بيانات الأرصاد الجوية باستخدام برامج الحاسوب وقد تم تصميم التجربة فى قطع منشقة حيث تم وضع مستويات الرى فى القطع الرئيسية بينما تم وضع الأصناف المستخدمة من المحصول المنزرع فى القطع الفرعية.

تم دراسة مدى استجابة محصول القمح صنفى (مصر ١، مصر ٢) للتعرض للاجهاد المائى خلال فترة نموه بالإضافة إلى المعاملة بالبوليمرات الفائقة الامتصاص (الهيدروجل) كتقنية مبتكرة لتوفير المياه من أجل محصول جيد أو تحسين المحصول حيث تمت الإضافة فى تجربة الموسم الثانى عن طريق خلط البوليمرات مع التربة لزيادة كفاءة إحتفاظ التربة بالماء.

عند المقارنة بين صنفى (مصر ١، مصر ٢) خلال موسمى الزراعة وتحت المعاملات المائية المختلفة كان التأثير غير معنوي بين الصنفين فى كل المعاملات حيث أثبتت التجارب أن كلاً من طول النبات وطول السنبلة وعدد الحبوب فى السنبلة ووزن محصول الحبوب والوزن البيولوجى ووزن القش ووزن ١٠٠٠ حبة وتاريخ طرد السنابل وعدد السنابل تعطى نتائج غير معنوية بين صنفى (مصر ١، مصر ٢) وتعطى نتائج معنوية بين معاملات الرى المحتلفة (٦٠-٨٠-١٠٠-١٢٠ %) من الاحتياجات المائية وأيضا تعطى نتائج معنوية عند معاملة التربة بالبوليمر فائق الامتصاص (الهيدروجل) .

التوصيات العامة:

- إن أعلى إنتاجية لمحصول القمح لصنفى مصر١،مصر٢ كانت عند إستخدام كمية مياه رى (١٢٠%) من الاحتياجات المائية الكلية للنبات وإزدادت الإنتاجية بإضافة البوليمرات فائقة الإمتصاص (الهيدروجل) ونظرا لزيادة الإنتاج بهذه الطريقة فيمكن إستخدامها فى حالة عدم وجود مشكلة فى وفرة المياه.
- إن أقل إنتاجية لمحصول القمح لصنفى مصر١،مصر٢ كانت عند إستخدام كمية مياه رى (٦٠%) من الاحتياجات المائية الكلية للنبات وبناءا على ذلك يمكن التوصية باستخدام هذه الطريقة (٦٠% احتياج مائى +هيدروجل) فى حالة عدم وفرة المياه حيث تعتبر هذه الطريقة فعالة لإدخار المياه.
- إن خفض مياه الرى يعتبر واحد من أهم الاستيراتيجيات المقترحة الآن من أجل مواجهة أزمة ندرة المياه وبناءا على ذلك يمكن تخفيض نسبة قليلة من الإنتاج مع تقليل مياه الرى بنسب معينة تصل إلى ٢٠ % أو٤٠% إحتياج مائى كما فى التجربة حيث يمكن أن يكون قرارا جيدا نحو إدخار مياه أكثر لرى المزيد من الأراضى وتحقيق المعادلة الصعبة وهى تغطية الفجوة بين الإنتاج والطلب فى ظل ظروف ندرة المياه .
- التجربة مكونة من عاملين فى الموسم الأول هما مستويات الرى والمقارنة بين صنفى قمح مصر ١ ومصر ٢ أما الموسم الثانى تم إدخال عامل ثالث للتأكيد على صحة النتائج (تم دراسة مدى استجابة محصول القمح صنفى (مصر ١، مصر ٢) للتعرض للاجهاد المائى خلال فترة نموه بالإضافة إلى المعاملة بالبوليمرات الفائقة الامتصاص (الهيدروجل) كتقنية مبتكرة لتوفير المياه من أجل محصول جيد أو تحسين المحصول حيث تمت الإضافة فى تجربة الموسم الثانى عن طريق خلط البوليمرات مع التربة لزيادة كفاءة إحتفاظ التربة بالماء) .
- تجربة الموسم الأول ٢٠١٣/٢٠١٤ تم فيها تطبيق المقارنة بين معاملات الرى المختلفة ٦٠-٨٠-١٠٠-١٢٠ من الاحتياجات المائية تحت نظام الرى بالرش وكانت النتائج معنوية بين جميع معاملات الرى المختفة بالنسبة لصنفى (مصر١، مصر٢). تجربة الموسم الثانى ٢٠١٤/٢٠١٥ تم تطبيق إضافة عامل أخر بالإضافة إلى التجربة الأساسية التى تمت فى الموسم السابق وذلك للتأكيد بأن النتائج معنوية بين جميع المعاملات المائية المختلفة والتأكيد على دقة النتائج حيث أثبتت التجارب أن النتائج كانت معنوية ليس فقط بين معاملات المياه المختلفة بدون إضافة عوامل أخرى ولكن أيضاً بعد إضافة عامل أخر فى التجربة وهو الهيدروجل.
- وهذا تفسير لسؤال حضرتك هل التجربة مكونة من عاملين أو ثلاث عوامل وأيضا تفسير ليه جدول رقم ٥ يختلف عن جدول رقم ٦.