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IMPACT OF IRRIGATION INTERVALS AND ZINC FOLIAR SPRAYING IN PRESENCE OF SHALLOW WATER TABLE ON MAIZE AND COTTON YIELDS AT NORTH NILE DELTA

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ABSTRACT

Two field experiments were conducted at Sakha Agric. Res. Station, Kafr El-Sheikh Governorate during the summer seasons of 1999 and 2000. The situation lies and represents the conditions of North Nile Delta. The aim of this study was to find out the effect of different irrigation intervals and zinc foliar spraying on maize and cotton yields as well as some water parameters. In addition to define a simple equation to predict contribution of water table to crop water needs for such crops under study in North Nile Delta. A split plot design with four replicates was practiced. The irrigation intervals; 12, 18 and 24 days occupied the main plots. While zinc foliar spraying; control, 0.05% and 0.1% Zn as EDTA were arranged in the sub plots.

The obtained results could be summarized as follows:

1. The highest mean values of both maize grain and seed cotton yields were obtained under irrigation every 18 days and zinc foliar spraying of 0.1% as EDTA. The interaction between the stated treatments resulted in highest yields per each unit of seasonal water duities as so called maximum irrigation efficiency.
2. Average values of seasonal soil moisture depletion (S.M.D.) for maize were 51.33, 48.85 and 41.51 cm. under irrigation intervals 12, 18 and 24 days, respectively. The corresponding values of S.M.D. for cotton were 68.77, 57.25 and 51.17 cm. for the previously treatments.
3. The water table contribution to water use of maize was 14.13, 16.54 and 18.13% under irrigation intervals of 12, 18 and 24 days respectively.
4. Under shallow water table conditions, the irrigation intervals could be extended to promote the use of such shallow groundwater by growing plants and reducing the water needs of the crops. While the corresponding values of cotton were 15.58., 19.52 and 12.35% for the stated treatments.
5. High pronounced value of 0.997 as a coefficient of determination for each crop was detected from the relation between water table depth in (m) as independent variable (X) and the ET portion as % which supplied from water table as dependent variable (Y).

Regression equations were:
Maize : Y = 0.509-0.381 (X).
Cotton: Y = 0.605-0.504 (X).

INTRODUCTION

In Egypt, as the population increase rapidly, efforts are continuously directed to meet the increasing demand for both food and fiber. water table in extensive areas of the arable lands in Egypt is relatively shallow. e.g. about 70-90 cm. The effective tool to manage shallow groundwater owing to offset the serious hazard is through extending the intervals between irrigations to promote use of such shallow groundwater by growing plants. Ayars and

Schoneman (1986) managed to get 20% of a cotton crop water requirement from shallow groundwater. The yield of seed cotton was significantly higher with 24 days, lesser or greater irrigation intervals reduced the cotton yield. Irrigation water use efficiency was found to be higher in case of 30 days irrigation interval (Mohamed *et al.*, 1994). Irrigation requirements for cotton was found to be 66.97 cm. in North Delta and water consumptive use ranged between 52.62 and 59.12 cm. with an average of 56.87 cm. (El-Mowelhi *et al.*, 1986).

Several studies have been conducted to determine the response of corn to water table conditions. In general, studies concluded that the percentage of groundwater contribution to corn water duities amounted 25-35% of the annual need at 105 cm. water table depth, while it contributed 50-60% of the need at 60 cm. water table depth (Kruse *et al.*, 1993). The total average of evapotranspiration of maize was 56.6 cm. at Giza and water use efficiency was 1.19 kg grains/m^3 water (Sadik *et al.*, 1995). The water consumptive use for corn at Sakha was 57.3, 51.0 and 45.5 cm. for the 14, 21 and 28 days irrigation intervals respectively (El-Yamani, 1987). Concerning the lack of micronutrients in many Egyptian soils that found recently and unexpected constraint to maximize agricultural production. Zinc is one of these micronutrients which are required for the production of different yield crops. Abd El-Maksoud (1990) as well as Singh *et al.* (1983) and Tisdal *et al.* (1985) who reported that corn is one of the annual crops that are sensitive to zinc deficiency. In this respect, several investigators have studied the effect of foliar fertilization of micronutrients on yield and quality of Egyptian cotton such as; El-Gala *et al.* (1979), Monged *et al.* (1980) and Hegazy *et al.* (1990) who obtained an increase in growth yield and fiber quality of cotton due to foliar spray with zinc.

The objective of this study is to find out the effect of irrigation intervals and zinc foliar spraying in presence of shallow groundwater table on:

1. Yield of maize and cotton.
2. Contribution of water table in water use for both crops.
3. To calculate the maximum irrigation efficiency for both crops.
4. To predict water table contribution in crop water use for maize and cotton grown in North Nile Delta.

MATERIALS AND METHODS

This study was conducted at Sakha Agricultural Research Station Farm, Kafr El-Sheikh Governorate during the summer of 1999 and 2000 to find out the effect of irrigation intervals and zinc spray on maize and cotton yields and water parameters in presence of shallow water table. The area is situated at 31° 07 altitude, 30° 57 longitude. It has an elevation of about 6 meters above mean sea level. Meteorological data at Sakha Station during the two seasons had been daily recorded and their mean monthly values are presented in Table (1).

Soil of the experimental field was clayey in texture and non-saline-non alkaline as shown in Table (2a and 2b).

Soil chemical analysis in soil paste extract was determined according to Richards (1969) and physical properties of soil were determined according to Black (1965). The design of the experiments was split plot with four replicates. The irrigation intervals were assigned to the main plots and zinc foliar sprays were arranged in the sub plots. The plot size was 42 m^2 = 1/100 fed. and the plots were isolated by levels of 1.5 meters to avoid the effect of lateral movement of irrigation water. However, at harvesting time, the two outer rows were left in order to eliminate border effects, the remaining area studied was used for yield determinations and the other studied crop characters.

Table (1): Meteorological data at Sakha Station during the two seasons.

Months	Temp. (°C) Max.	Min.	Mean	Relative humidity %	Wind speed km/day	Solar radiation cal./cm²/day	Evaporation cm./day
First season, 1999							
April	25.4	9.3	17.35	59.7	124.3	434.2	0.46
May	29.5	15.5	22.5	55.7	140.3	522.5	0.6
June	31.2	18.2	24.7	57.7	172.3	566.4	0.69
July	31.6	21.3	26.45	69.8	143.5	575.2	0.81
August	32.2	23.1	27.65	69.5	96.6	588.6	0.71
September	32.2	18.8	25.5	62.4	83.4	586.5	0.61
October	30.6	15.3	22.95	64.3	65.2	526.7	0.43
Second season, 2000							
April	24.5	12.0	18.25	57.7	114.5	415.7	0.35
May	29.5	15.3	22.4	57.3	138.9	525.3	0.46
June	32.2	20.2	26.2	56.4	124.0	590.7	0.59
July	32.6	21.5	27.05	68.3	91.7	591.5	0.71
August	33.9	21.6	27.75	68.0	110.9	604.3	0.71
September	31.3	18.6	24.95	66.53	103.03	567.4	0.61
October	27.5	14.5	21.00	56.9	122.0	478.8	0.53

Table (2a): Some physical and chemical properties of the experimental field.

Depth cm.	Particle size distribution: Sand %	Slit %	Clay %	Texture class	EC dS/m	SARe	pH	Available zinc ppm	Cations meq/L: Na^+	K^+	Ca^{++}	Mg^{++}	Anions meq/L: $CO^=_3$	HCO^-_3	Cl^-	$SO^=_4$
0-30	28.0	29.1	42.9	Clayey	3.38	4.28	7.81	1.8	13.4	0.8	12.5	7.1	0.0	3.3	11.9	21.0
30-60	27.1	29.8	43.1	Clayey	3.6	4.91	7.93	1.1	16.1	0.7	13.0	8.5	0.0	3.3	20.4	14.6
60-90	27.9	28.7	43.4	Clayey	3.79	4.31	7.96	0.9	14.6	0.7	15.8	6.8	0.0	3.0	14.5	20.4

Table (2b): Soil moisture characteristics of the experimental field.

Depth cm.	Field capacity %	Wilting point %	Available soil moisture %	Bulk density g/cm³
0-15	43.9	23.96	20.04	1.24
15-30	39.0	21.2	17.8	1.36
30-45	37.0	20.11	16.89	1.39
45-60	36.2	19.67	16.53	1.47
Average	39.03	21.21	17.82	1.37

The treatments were as follows:

1. Main plots (irrigation intervals):

 1.1. Irrigation every 12 days.

1.2. Irrigation every 18 days.
1.3. Irrigation every 24 days.

2. Sub plots (zinc spray)
   2.1. Control.
   2.2. 0.05% Zn (as EDTA).
   2.3. 0.1% Zn (as EDTA).

Maize (single hybrid 323) cultivar was sown in June 6, 1999, while cotton (Giza 85) cultivar was planted in April 4, 2000. Maize and cotton crops were planted in rows of 60 cm. apart and the distance between hills was 25 cm. for maize and 20 cm. for cotton.

Fertilizers were added at the rate of 120 and 70 kg N/fed. in the form of urea (46% N) for maize and cotton and 15 kg P_2O_5/fed. for each crop. Foliage spray with zinc was applied twice at 45 and 60 days from sowing. All agronomic practices were done as the recommended practices, being adopted for maize and cotton plants.

Maize was harvested in each plot in September, 28, 1999 while cotton was picked twice in Sep. 15 and October 20, 2000.

The following studied characters are:

1. Maize.
   1.1. Grain yield in ardab/fed. (Ardab = 140 kg).
   1.2. Weight of 100 grains (g).
   1.3. Row numbers.
   1.4. Plant height (cm.).
2. Cotton.
   2.1. Seed cotton yield in kentar/fed. (one kentar = 157.5 kg).
   2.2. Seed index = the weight of 100 cotton seeds.
   2.3. Lint percentage = $\frac{\text{Weight of lint cotton}}{\text{Seed cotton weight}} \times 100$
   2.4. Lint index = $\frac{\text{Seed index lint percentage}}{100}$ - lint percentage
   2.5. Plant height (cm.) was measured at the first picking.
3. Water parameters:

3.1. The crop evapotranspiration:

To find out the maize and cotton evapotranspiration (ETc), the calculated reference evapotranspiration (ET_o), was multiplied by crop factor (Kc), values were quoted from F.A.O. (Doorenbos *et al.*, 1979) as follows:

$$ETc = ET_o \times Kc$$

3.1.1. Reference evapotranspiration (ET_o): was calculated by modified Penman as follows:

$$ET_o = C\ [W.Rn + (1-W).\ F(U).\ (ea-ed)].$$

Where:

ET_o = Reference crop evapotranspiration in mm/day
W = Temperature related weighing factor
Rn = Net radiation in equivalent evaporation on mm/day.
F(U) = Wind-related function

ea-ed = Difference between the saturation vapour pressure at mean air temperature, and the mean actual vapour pressure of the air, both in mbar.

C = Adjustment factor.

3.2. Soil moisture depletion (SMD): was calculated using the following equation [Israelson and Hansen, 1962).

$$SMD = \sum_{i=1}^{i=n} \frac{\theta_2 - \theta 1}{100} \times Dbi \times Di$$

Where:

SMD : is soil moisture depletion (cm.) in the effective root zone (60 cm.).

θ_2 : Soil moisture percent after irrigation.

θ_1 : Soil moisture percent before next irrigation

Dbi : Bulk density in g/cm^3

Di : Depth of soil layer (cm.).

i : Number of the soil layers sampled in the root zone depth (cm.).

3.3. Amount of irrigation water applied (I.W.): was calculated based on refilling the effective root zone for each irrigation and recorded for different treatments by using a cut-throat flume (20 x 90 cm.), Eany (1975).

3.4. Seasonal water applied: was calculated as described by Giriappa (1983):

$$Wa = IW + Er + S$$

Where:

IWs irrigation water applied, Er effective rainfall and S contribution of the groundwater table to crop consumptive use.

3.5. Contribution of the groundwater table: was calculated as described by Kharshenko *et al.*, 1971.

$$CWT = PET/e^{NH}$$

Where:

PET : Potential evapotranspiration, mm/day

N : A characterized factor depends on soil texture and growth stage.

H : Water table depth in meters.

3.6. Optimum irrigation efficiency: It was calculated according to **Shmuli (1973)**.

$$\text{Maximum irrigation efficiency} = \frac{\text{Obtained yield}}{\text{Seasonal water applied}}$$

Data collected during the growing seasons were statistically analyzed according to the method described by Snedecor and Cochran (1980).

RESULTS AND DISCUSSION

Yield and yield attributes characters:
Effect of irrigation intervals on:
A. Maize:

The mean values of maize grain yield, weight of 100 grains, rows number and plant height as affected by irrigation intervals are presented in Table (3). It is clear from the results that there was a significant effect of the irrigation intervals at the 1% level of significance on the average values of maize grain yield. On the other hand, weight of 100 grains, row number and plant height were not significantly affected. It is obvious that the highest mean value of maize grain yield (26.79 ardab/fed.) was obtained at irrigation every 18 days, whereas the lowest one (21.44 ardab/fed.) was obtained at irrigation every 12 days. This finding is to be expected since common irrigation scheduling is neglecting the water table contribution whereas it may lead to unsufficient aeration and caused drainable problems and ultimately reduced the maize yield.

Table (3): Effect of different irrigation intervals and zinc foliar spray on yields of maize, cotton and their components.

Treatments	Maize grain yield and its components				Cotton yield and its components				
	Maize grain yield ardab/fed.	Weight of 100 grain (gm)	Rows No.	Plant height cm.	Cotton seed yield kentar/fed.	Plant height cm.	Lint percentage	Lint index	Seed index gm
Irrigation intervals every 12 days (I_1)	21.44	35.64	12.4	278.4	5.85	108.1	37.65	3.65	10.54
Every 18 days (I_2)	26.79	38.35	12.6	287.8	6.45	119	39.47	4.14	11.53
Every 24 days (I_3)	23.44	37.5	12.5	286.1	6.04	113.1	38.36	3.87	10.9
Mean	23.89	37.16	12.5	284.1	6.11	113.4	38.49	3.89	10.99
F. test	**	ns	ns	ns	**	ns	*	**	*
LSD 0.05	0.87	-	-	-	0.16	-	1.17	0.18	0.51
LSD 0.01	1.45	-	-	-	0.26	-	-	0.3	-
Zinc foliar spray control	22.46	34.59	11.9	268.7	5.77	106.4	36.97	3.44	9.89
Zn 0.05% (Zn1)	24.22	37.92	12.65	289.9	6.09	113.7	38.59	3.97	10.99
Zn 0.1% (Zn2)	25.0	38.98	12.92	293.8	6.48	120.1	39.92	4.25	12.1
Mean	23.89	37.16	12.5	284.1	6.11	113.4	38.49	3.89	10.99
F. test	**	**	**	**	**	*	**	**	**
LSD 0.05	0.37	0.99	0.391	10.45	0.23	10.03	0.82	0.14	0.26
LSD 0.01	0.53	1.39	0.548	14.67	0.32	-	1.15	0.2	0.37
Interaction, irrigation x zinc	ns	ns	ns	ns	ns	ns	ns	ns	**

B. Cotton:

It is noticed from Table (3) that there was a significant effect of the irrigation intervals on the average values of seed cotton yield, lint percentage, lint index and seed index. On the other hand, plant height was not significantly affected. The highest mean value of seed cotton yield (6.45 kentar/fed.) was produced at irrigation every 18 days, whereas the lowest value (5.85 kentar /fed.) was obtained at irrigation intervals of 12 days. The increment in seed cotton yield was 10.26% and 3.25% for 18 and 24 days irrigation intervals compared to irrigation intervals of 12 days. These results are in agreement with those obtained by Mohamed *et al.*, 1994.

Effect of foliar spray with zinc on:

A. Maize:

Data presented in Table (3) indicate that maize grain yield, weight of 100 grains, rows number and plant height were significantly affected at the 1% level of significance by spraying with zinc. The highest mean values were recorded by spraying zinc at 0.1%. The foliar application with zinc resulted in increments of 7.84 and 11.31% over the control treatment (untreated plants) for 0.05 and 0.1% zinc spraying respectively. These results are in harmony with Abd El-Maksoud (1990).

B. Cotton:

Data in Table (3) indicate that foliar spray with zinc at 0.05 and 0.1% resulted in a significant increase in seed cotton yield and its contributing characters. Data also revealed that seed cotton yield responded to foliar spray with zinc. The increment in seed cotton yield was 5.55 and 12.31% for zinc spray at 0.05 and 0.1%, respectively over the control.

These results are in agreement with those obtained by Hegazy *et al.* (1990).

It can be concluded that spraying maize and cotton plants with zinc fertilizer can improve the vegetative growth and play an important role in metabolic processes and this in turn in plant growth.

Effect of interaction:

The interaction between irrigation intervals and foliar application of Zn was not significant for all tested maize and cotton characteristics except cotton seed index where the interaction was significant.

Water parameters of maize and cotton:

Crop evapotranspiration (maize and cotton):

The traditional method in calculating actual evapotranspiration which based on the soil moisture depletion in the soil of deep water table. Under the condition of the present study which characterized by shallow water table, the soil moisture depletion is not the proper method (Hansen *et al.,* 1979). Therefore, the indirect method of crop evapotranspiration estimation based on the reference evapotranspiration (ETo) and crop coefficient (Kc) was used.

The obtained values in Table (4) of maize and cotton evapotranspiration were 53.45 and 81.46 cm., respectively.

Table (4): Water parameters as affected by different irrigation intervals for maize (season, 1999) and cotton (season, 2000).

Water parameters	Maize			Cotton		
	Irrigation intervals			Irrigation intervals		
	I_1	I_2	I_3	I_1	I_2	I_3
Calculated evapotranspiration (cm.)	53.45	53.45	53.45	81.46	81.46	81.46
Soil moisture depletion (cm.)	51.33	48.85	41.51	68.77	57.25	51.17
Water applied (cm.)	66.26	61.03	55.4	73.95	67.45	62.45
Upward flow (cm.)	7.54	8.84	9.69	12.69	15.9	17.39
Seasonal water applied (cm.)	73.80	69.87	65.09	86.64	83.35	79.84
Percent of evapotranspiration contributed from water table (%)	14.13	16.54	18.13	15.58	19.52	21.35

Soil moisture depletion (S.M.D.):

The obtained results in Table (4) show that the soil moisture depletion values were affected by different irrigation intervals. Average values of seasonal soil moisture depletion for maize were 51.33, 48.85 and 41.51 cm. for irrigation intervals every 12, 18 and 24 days respectively. Similar trend was reported by El-Yamani (1987). Concerning the soil moisture depletion for cotton crop the corresponding values of S.M.D. were found to be 68.77, 57.25 and 51.17 cm. for the irrigation intervals every 12, 18 and 24 days, respectively. The results coincide with those of E-Mowelhi *et al.* (1986). Such findings indicated that the maximum soil moisture depletion which consist of the water consumed by growing plants, and or the water percolated downward or upward the water table was detected with irrigation intervals every 12 days. On the other side, under the long irrigation intervals of 18 and 24 days the contribution from water table to crop consumptive use may be obtained.

Upward flow and percent of evapotranspiration:
Contributed from water table (%):

As shown in Table (4), upward flow and contribution of water table to maize and cotton water use increased by increasing the irrigation intervals. Mean values of the upward flow increased from 7.54 to 8.8 and to 9.69 cm. for irrigation intervals of maize very 12, 18 and 24 days, respectively. These values equal to 14.13, 16.54 and 18.13% from the seasonal consumptive use of maize as calculated by modified penman method as ETc. Concerning cotton crop, the average values of upward flow were 12.69, 15.9 and 17.39 cm. for irrigation intervals every 12, 18 and 24 days, respectively. These values are equal to 15.058, 19.52 and 21.35% from the seasonal consumptive use of cotton. It is noticed from the results that the contribution of water table for cotton is greater than maize, this could be attributed to that the cotton plants have deeper roots and can extract more water table which exceeded than that of maize plants.

These results are in agreement with those obtained by Eid *et al.* (1999), who mentioned that the contribution from water table to crop consumptive use was pronounced under the long irrigation intervals.

Amount of irrigation water and seasonal water applied:

Seasonal water applied includes irrigation water and upward flow from water table for each treatments as shown in Table (4). The average irrigation water applied of the studied treatments of maize crop were 66.26, 61.03 and 55.4 cm. for irrigation intervals every 12, 18 and 24 days respectively. While seasonal water applied which included (IW + upward flow) of maize was found to be 73.8, 69.87 and 65.09 cm. for the same previously treatments. This wide range of seasonal water applied depends on irrigation intervals and contribution from water table to crop evapotranspiration. Regarding cotton crop, data indicate that the irrigation intervals every 12 days received the highest amount of irrigation water applied (73.95 cm.) and seasonal water applied (86.64 cm.). While irrigation at 24 days treatment received the lowest values (62.45 and 79.84 cm.) for irrigation water applied and seasonal water applied respectively.

It can be concluded that, under shallow water table condition, the irrigation intervals should be extended to promote use of shallow groundwater and reduce the needs of crops for irrigation. Hence improving soil and water management practices can be resulted in maintaining water table depth at a deeper level to achieve an efficient crops production.

Maximum irrigation efficiency:

Maximum irrigation efficiency determines the capability of the plants to convert the applied water to crop yield.

Mean values of maximum irrigation efficiency as affected by irrigation intervals and foliar application of zinc are illustrated in Table (5). The obtained data show that the maximum irrigation efficiency (1.34 and 0.31 kg/m^3 of seasonal water applied) for maize and cotton were recorded from interaction between irrigation every 18 days and 0.1% zinc foliar application. While the lowest values are (0.92 and 0.24 kg/m^3 of seasonal water applied) resulting from combination between irrigation every 12 days and untreated plants by foliar application of zinc. These results could be attributed to the significant differences among the maize grain yield and seed cotton yield as well as differences between the seasonal water applied. Similar trend was reported by Mohamed *et al.* (1994).

Table (5): Maximum irrigation efficiency (kg/m^3) as affected by different irrigation intervals and zinc foliar spray for maize, 1999 and cotton (2000).

Treatments		Maize			Cotton		
Irrigation intervals	Zinc foliar spray	Grain yield kg/fed.	Seasonal water applied m^3/fed.	Maximum irri. eff. kg/m^3	Cotton seed yield kg/fed.	Seasonal water applied m^3/fed.	Maximum irri. eff. kg/m^3
Every 12 days	W0	2862.13	3099.60	0.92	874.13	3638.88	0.24
	Zn1	3027.4	3099.60	0.98	915.08	3638.88	0.25
	Zn2	3116.23	3099.60	1.01	976.5	3638.88	0.27
Every 18 days	W0	3497.6	2934.54	1.2	951.3	3500.7	0.27
	Zn1	3817.7	2934.54	1.30	1020.6	3500.7	0.29
	Zn2	3934.57	2934.54	1.34	1077.3	3500.7	0.31
Every 24 days	W0	3071.93	2733.78	1.12	899.33	3353.28	0.27
	Zn1	3326.2	2733.78	1.22	945	3353.28	0.28
	Zn2	3448.23	2733.78	1.26	1008	3353.28	0.3

Relationship between water table depth and upward flow rate:

The soil's water retention and transmission properties are key elements in the ability of crops to extract water from water table. Under cropped conditions water is extracted from the soil and water table by evaporation and plant water uptake.

Figs. (1 and 2) present the relationship between water table depth (m) as input or independent factor (X) and the upward flow rate expressed as % evapotranspiration (ET) of maize and cotton as output or dependent factor (Y). The interaction between water table depth and corresponding % ET supplied by water table was evaluated by statistical analysis. Correlation coefficients and regression equations were used as the analysis tool, results are tabulated in Table (6). It is clear that highly significant correlation was obtained between the water table depth and % ET supplied by water table of 0.997 and 0.997 for maize and cotton at irrigation intervals every 24 days. The regression equations that fit this interaction are:

for maize; $Y = 0.509 - 0.381\,(X)$, $r^2 = 0.997$

for cotton; $Y = 0.605 - 0.504\,(X)$, $r^2 = 0.997$

as Y = % ET supplied by water table

X = water table depth in meter.

Table (6): Coefficients of linear regression equations relating water table depth (m) to upward flow rate expressed as % ET of maize (season, 1999) and cotton (season, 2000) supplied by water table.

Irrigation intervals	Maize			Cotton		
	Equation parameters					
	a	b	R^2	a	b	R^2
I_1 every 12 days	0.507	-0.377	0.989	0.461	-0.32	0.989
I_2 every 18 days	0.522	-0.406	0.796	0.55	-0.432	0.995
I_3 every 24 days	0.509	-0.381	0.997	0.605	-0.504	0.997

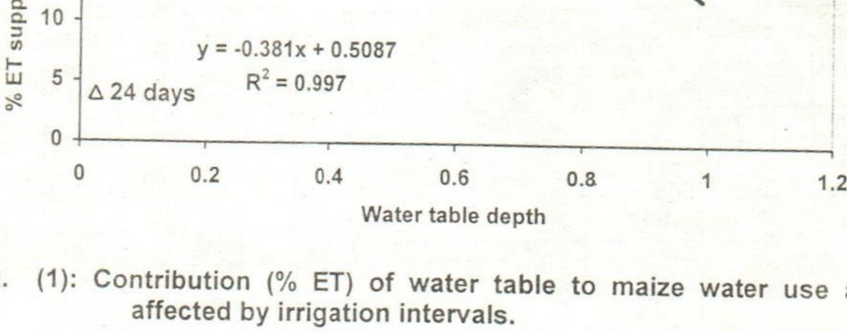

Fig. (1): Contribution (% ET) of water table to maize water use as affected by irrigation intervals.

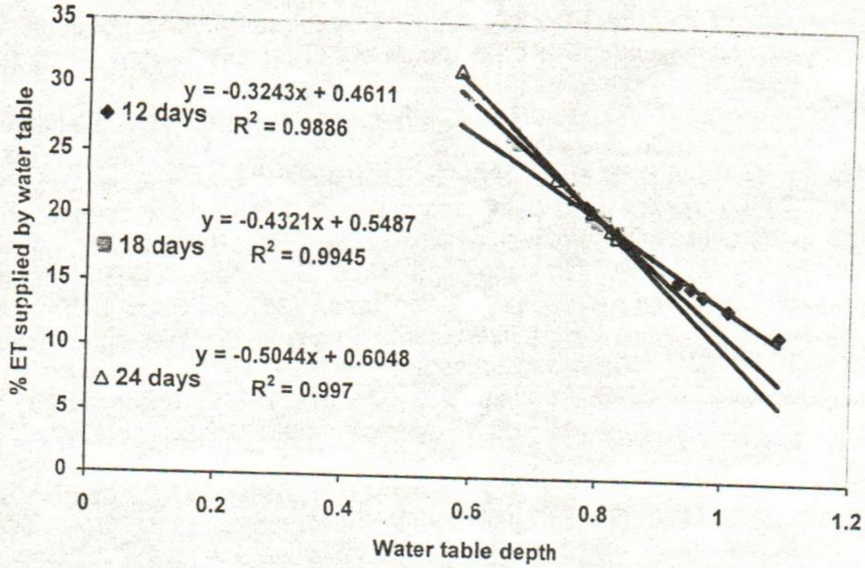

Fig. (2): Contribution (%ET of water table to cotton water use as affected by irrigation intervals.

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تأثير فترات الرى والرش بالزنك تحت ظروف الماء الأرضى الضحل على محصولى الذره والقطن فى منطقة شمال الدلتا

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أقيمت تجربتين حقليتين فى الموسم الصيفى ١٩٩٩ ، ٢٠٠٠م بمحطة البحوث الزراعية بسخا ــ محافظة كفر الشيخ لدراسة تأثير ثلاث فترات للرى والرش بالزنك على محصولى الذره والقطن وبعض العلاقات المائية وأيضا إيجاد معادلة للتنبؤ بمدى مساهمة الماء الأرضى فى الاحتياجات المائية لكل من الذره والقطن بمنطقة شمال الدلتا. واستخدم فى هذه الدراسة نظام القطع المنشقة مرة واحدة حيث وضعت فترات الرى فى المعاملات الرئيسية وهى الرى كل ١٢ ، ١٨ ، ٢٤ يوم بينما الرش بالزنك رتبت كعاملات شقية وهى الكنترول ، تركيز ٠,٠٥% ، ٠,١% على صورة مخلبية.

ويمكن تلخيص النتائج المتحصل عليها فيما يلى:

١- حققت معاملة الرى كل ١٨ يوم والرش بتركيز ٠,١% أعلى محصول من حبوب الذره والقطن الزهر وكذا أعلى كفاءة استخدام لوحدة المياه المضافة للمحصول.

٢- كان متوسط عمق الرطوبة الأرضية المستنفذة للذره ٥١,٣٣ ، ٤٨,٨٥ ، ٤١,٥١سم لمعاملات الرى كل ١٢ ، ١٨ ، ٢٤ يوم على الترتيب بينما القيم المناظرة لمحصول القطن ٦٨,٧٧ ، ٥٧,٢٥ ، ٥١,١٧سم لنفس معاملات الرى.

٣- ساهم الماء الأرضى بنسب ١٤,١٣ ، ١٦,٥٤ ، ١٨,١٣% فى الاحتياجات المائية لمحصول الذره لمعاملات الرى كل ١٢ ١٨ ، ٢٤ يوم بينما بلغت مساهمة الماء الأرضى بالنسب ١٥,٥٨ ، ١٩,٥٢ ، ٢١,٣٥% فى الاحتياجات المائية لمحصول القطن لنفس المعاملات المذكورة.

٤- يمكن التوصية بطول فترة الرى تحت ظروف الماء الأرضى الضحل للسماح بزيادة الاستفادة من مساهمة الماء الأرضى وتقليل الاحتياجات المائية للمحاصيل.

٥- أمكن الحصول على أعلى قيمة لمعامل التحديد (٠,٩٩٧) لمحصولى الذره والقطن وأمكن استنتاجها من العلاقة بين عمق الماء الأرضى بالمتر كمتغير مستقل س ، والنسبة المئوية لمساهمة الماء الأرضى كمتغير تابع ص ، وأمكن الحصول على هذه المعادلات:

- الذرة : ص = ٠,٥٠٩ ــ ٠,٣٨١ (س)
- القطن : ص = ٠,٦٠٥ ــ ٠,٥٠٤ (س)