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INFLUENCE OF IRRIGATION AND FERTILIZATION ON WATER USE AND EFFICIENCIES OF MAIZE ON SALINE SOIL

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ABSTRACT

Two field experiments were conducted during 1996 and 1997 summer season at Sidi Salem area Kafr El-Sheikh governorate (salt affected soils) using corn variety third hybrid 310, to study the effects of two irrigation water quantity levels (F.C. and F.C. + 15%); potassium, zinc, potassium+zinc fertilization, control treatment and two nitrogen levels of 60 and 120 kg N./fed. Increasing irrigation water quantity from F.C. to F.C. + 15% increased N-fertilizer efficiency, where the values protein content (kg/fed) were increased by 6.23% and 7.69% in the first and second seasons with 60 kg N/fed. Increasing N-fertilization led to increasing actual water consumptive use by corn. Potassium and zinc fertilization increased corn water consumptive use. Soil moisture extracted from the surface layer with was higher all treatments. Increasing irrigation water quantity together zinc and potassium with fertilization led to increasing the amounts of water extracted from 30-60 cm layer and increased water use efficiency by corn.

INTRODUCTION

Maize (*Zea mays,* L.) is one of the most important cereal crop in Egypt and the world. Production of this crop is less than the needs of the local consumption of Egypt. Therefore, efforts are focused on increasing its productivity by growing high yielding new varieties under the most favourable cultural treatments.

Irrigation is one of the most important factors that plays great role in corn production due to its sensitivity to drought (Ibrahim *et al.,* 1992). Okaz *et al.* (1988) also reported that high available soil moisture resulted in significant increase in corn gain yield. Some others reported that the response of maize to fertilizer nitrogen is very dependent on moisture supplies during the growth season. The maintenance of water resources is one of the most important national aims so many researchers have studied water consumption and water use efficiency by corn.

Eid *et al.* (1988) indicated that, the calculated water use of maize was 2888 m^3/fed. while the total applied quantity reached 4470 m^3/fed. with an application efficiency of 65%.

Another researchers studied the relationship between irrigation water quantity and the nitrogen losses from root zone, Artiola (1991) measured as much as 40% of the available NO_3-N lost from the root zone with one 300 mm irrigation on a clay loam soil. Most of the NO_3 losses occurred on the two-thirds of the field closest to the irrigation source and no significant NO_3 losses were measured on the third of the field farthest from the water source.

This aim to study investigate the effect of two irrigation treatments of (1-Irrigation with water quantity limit the soil to F.C. and 2. Irrigation with water quantity limit the soil to F.C. + 15% from it); two nitrogen fertilizer levels (60 and 120 kg/fed.); two potassium fertilizer levels (0 and 48 kg K_2O/fed.) and two zinc levels (0 and 10 kg $ZnSO_4$. $7H_2O$/fed.) on corn water consumptive use; soil moisture percent extracted by corn roots; water use efficiency and actual evapotranspiration of corn on a saline soil at Sidi Salem ,Kafr El-Sheikh Governorate Egypt.

MATERIALS AND METHODS

Two field experiments were carried out at Sidi Salem, Kafr El-Sheikh Governorate, during the two successive seasons of 1996 and 1997 using corn (*Zea mays* L.) variety hybrid 310 to study the influence of two quantity levels of irrigation water i.e., 1. Irrigation with water up to soil field capacity limit (F.C.). 2. Irrigation with water up to soil field capacity + 15% of field capacity moisture content (0.6 from the leaching requirements).

Two rates of zinc as zinc sulfate ($ZnSO_4.7H_2O$) 16.5% i.e., (0 and 10 kg $ZnSO_4.7H_2O$/fed.); two rates of potassium as potassium sulfate 48% K_2O i.e., (0 and 48 kg K_2O/fed.; zinc (10 kg/fed.) and K (48 kg/fed.) were added as a single treatment; and two rates of nitrogen as ammonium sulfate 20.6% N i.e., (60 and 120 kg N/fed.) were applied to study the interaction effect of 16 treatments (2 I x 4 Zn and K x 2 N). Corn grains at the rate of 15 kg/fed. were planted in 18th of May in both 1996 and 1997 before in the dry soil was irrigated.

The experiments were conducted in split-split plot design with four replicates. The main plots were randomly assigned to irrigation water treatments (F.C. and F.C. + 15 from it), the sub plots to zinc and potassium fertilization and sub-sub plots to two levels of nitrogen fertilization. The area of each plot was 3x 4 m^2.

Nitrogen as ammonium sulphate 20.6% was splitted in three equal doses and added just before the second, third and fourth irrigation.

Potassium as potassium sulphate (48% K_2O) was applied on one dose with the first dose of nitrogen as well as zinc. Recommended local dose of phosphorus (30 kg P_2O_5/fed.) was added to the experimental soil as superphosphate (15% P_2O_5) before sowing during the soil preparation. Soil samples were taken to determine the soil moisture content and hence the irrigation dates were fixed to start at 50% depletion of available soil moisture. Soil samples were taken for monitoring the soil moisture content and when 50% depletion of available water was recorded, irrigation was resumed and 48 hours after irrigation soil samples were taken to determine soil moisture content. Mixed soil sample was taken before planting to determine the soil properties (Table 1). Amount of irrigation water applied for different treatments within growing season in cubic meter were calculated for each irrigation and for season by using water flow-meter. Actual consumptive use of water were calculated for the 60 cm soil depth according to Israelson and Hanson (1962) as follows:

$$U = \frac{Q2 - Q_1}{100} \times B_d \times \frac{60}{100} \times 4200$$

Where:

U = Amount of actual consumptive use ($m^3.fed^{-1}$)
Q_2 = Soil moisture % after irrigation.
Q_1 = Soil moisture % before irrigation.
B_d = Bulk density ($gm.cm^{-3}$).

Water use efficiency (W.U.E.) in $kg.m^{-3}$) was measured according to Vitas (1975) formula:

$$W.U.E. = \frac{\text{Grain yield (kg / fed.)}}{\text{Water consumptive use}(m^3/\text{fed.})} ;l$$

The percentage of soil moisture extraction for each soil depth was calculated according to the following formula:

$$S.M.E.P. = \frac{\text{C.U. (layer)}}{\text{C.U. (seasonal)}} \times 100$$

and crop coefficient (KC) is defined as the ratio between actual crop evapotranspiration and potential evapotranspiration of the experimental area:

Table 1:Soil propertiesof the experimental field.

Seasons	Physical properties							
	Mechanical analysis				Field capacity %	Welting Point %	Available Soil moisture	Bulk Density $gm.cm^{-3}$
	Sand %	Silt %	Clay %	Texture				
1996	3.20	30.30	66.50	Clayey	42	22.83	19.20	1.30
1997	3.20	29.40	67.40	Clayey	39	21.20	17.80	1.35

Seasons	Chemical properties					
	pH (1: 2.5) soil-water suspention	EC $dS\ cm^{-1}$ soil past extract	CEC $meq.kg^{-3}$	Total % Carbonate	Organic matter %	ESP %
1996	8.0	5.20	40.7	4.40	1.69	16.24
1997	8.02	5.40	40.7	4.60	1.65	17.07

Seasons	Nutrients status: Available elements ppm						
	N	P	K	Zn	Fe	Mn	
1996	27.0	10.0	670.0	1.8	51.2	18.9	
1997	25.0	8.0	550.0	1.6	44.2	12.3	

RESULTS AND DISCUSSION

Increasing the crop production is an important aim for the researchers. But the quality of this product is very important also, increasing protein content of corn grains gave good indication for feeding value. The effect of irrigation and fertilization on corn protein content are presented in Table 2.

Protein content of corn grain:

Data presented in Table 2 clearly show that, increasing irrigation water quantity from field capacity (F.C) to F.C. + 15% led to increasing nitrogen fertilizer efficiency, where increased protein content of corn grains (kg.fed^{-1}). ∆ increases were 6.23 and 7.69% in the first and second seasons respectively with 60 kg N/fed. level. While with 120 kg N/fed. level ∆ increases were 2.39 and 4.66% in the first and second season respectively. In presence of zinc fertilizer increasing irrigation water from F.C. to F.C. + 15% led to increasing protein content kg/fed. of corn grain. ∆ increases were 2.38 and 9.97% with 60 kg N/fed. level in the first and second season respectively. While in 120 kg N/fed. level ∆ increases of protein content were 1.94 and 7.63% in the first and second season respectively.

With potassium fertilization increasing irrigation water quantity from F.C. to F.C. + 15% increased protein content of corn grain with 60 kg N/fed. level in the second season only. The ∆ increase value was 4.61%, on the other hand no noticed increase was observed in the first season. With 120 kg N/fed. and potassium fertilization ∆ increases of protein content of corn grain were 3.39 and 4.69% in the first and second season respectively. In presence of (zinc + potassium) fertilization treatment increasing irrigation water quantity form F.C. to F.C. + 15% led to increasing protein content kg/fed. of corn grain, with 120 kg N/fed. level in the first season ∆ were 2.53 and 7.63% with 60 and 120 kg N/fed. respectively.

In general increasing irrigation water quantity led to decreasing protein percent of corn grain, but the increase recorded in grain yield due to a valuable increase in protein yield, the increases of corn grain caused increasing protein contents kg/fed. Similar results were reported by Al-Rudha and Al-Younis (1978), Ibrahim *et al.* (1979) and Meleha (1992).

Table 2: Protein content (kg.fed^{-1}.) of corn grain as affected by irrigation and fertilization.

Fertilizer treatments		Field capacity		F.C. + 15%		∆ %	
K, Zn	N	1996	1997	1996	1997	1996	1997
No application	60	295.12	224.98	313.50	242.27	6.23	7.69
	120	350.96	284.25	359.35	297.50	2.39	4.66
Zinc (Zn)	60	331.40	219.64	339.29	241.54	2.38	9.97
	120	406.00	313.00	413.88	336.88	1.94	7.63
Potassium (K)	60	284.25	213.75	282.10	223.60	0	4.61
	120	359.35	310.62	371.54	325.20	3.39	4.69
Zn + K	60	289.50	227.73	287.58	233.49	0	2.53
	120	373.63	332.52	393.88	357.88	5.42	7.63

Plant-fertilizer-water relationships:

1. Actual consumptive use:

The knowledge of consumptive use is a prerequisite for proper scheduling of irrigation and improving the irrigation practices. Many factors affected the plant growth and ultimately the consumptive use. Among these factors are precipitation, radiation, temperature, humidity, wind movement, water supply, water quality, date of sowing, plant density, length of growing season, kind of fertilizers and quantity, cultivation and chemical sprays. Also the physical properties of the soil, which control water movement have its influence. In the present study two of these factors, the water supply and chemical fertilization were considered.

Seasonal water use calculated in cm depth are tabulated in Table 3. Increasing nitrogen fertilization from 60 to 120 kg N fed^{-1}. increased corn water use from 56.1 to 62.4 cm at F.C. treatment and from 62.5 to 67.3 cm at F.C. + 15% treatment (mean values of two seasons). This was due to increasing vegetative growth and hence total area of corn transpiration. With zinc fertilization corn water consumptive use was increased at 60 kg N fed^{-1}. i.e., from 56.1 and 62.5 cm to 58.9 and 63.4 cm with F.C. and F.C. + 15% respectively (mean values of two seasons). With 120 kg N fed^{-1} and zinc fertilizer, corn water use was decreased from 62.4 and 67.3 cm to 61.2 and 66.1 cm with F.C. and F.C.+155 respectively. These results are in agreement with those obtained by Mass (1990) who reported that, crop grown on fertile soil may seem more salt tolerance than those grown with adequate fertility, because fertility is that primary factor limiting growth. However, the addition of extra fertilizer will not alleviate growth inhibition by salinity. Potassium fertilization increased corn water use from 56.1 to 64.6 cm (mean values of two seasons) with 60 kg N fed^{-1}. at field capacity. With 120 kg N fed^{-1} the increases was from 62.4 to 68.4. Under field capacity + 15% treatment the increases were from 62.5 to 66.1 cm at 60 kg N/fed. level and from 67.3 to 71.2 cm at 120 kg N/fed. level. On the other hand (potassium + zinc) fertilization decreased corn water use in the two with all treatments .

Table 3: Water consumptive use (cm) for corn as affected by irrigation and fertilization.

Fertilizer treatments		Field capacity		Mean	Field capacity + 15%		Mean
Zn, K	**N**	**1996**	**1997**		**1996**	**1997**	
No application	60	56.7	55.4	56.1	64.6	60.3	62.5
	120	58.6	56.1	62.4	65.2	69.4	67.3
Zinc	60	58.0	59.7	58.9	62.7	64.1	63.4
	120	60.0	62.3	61.2	64.9	67.2	66.1
Potassium	60	62.9	66.2	64.6	63.9	68.2	66.1
	120	63.5	73.3	68.4	68.7	73.6	71.2
Zn + K	60	46.9	49.6	48.3	52.0	62.6	57.3
	120	50.7	50.8	50.8	52.2	64.3	58.3

In general the increases of water use are correlated with the vegetative growth and plant transpiration. Increasing water quantity from F.C. to F.C. + 15% increased fertilizes efficiency this may be due to leaching the salts from root zone especially that, the experimental soil is salt affected soil (Table 1). These results are in agreement with that obtained by Metwally (1977) who reported that, seasonal rate of corn water consumptive use decreased by decreasing available soil moisture content, and also with those obtained by El-Yamany (1987) and Meleha (1992).

2. Soil moisture extraction pattern for corn:

There are many factors affecting soil moisture extraction pattern for corn for example, tillage, irrigation water quantity, irrigation water quality, soil properties and fertilizers. Data of two soil moisture percent extracted by corn roots from soil layers are present in Table 4. Results show that in all treatments the water extracted from 0-30 cm layer were larger than that of 30-60 cm layer. Increasing irrigation water quantity from F.C to F.C. + 15% increased water extracted from 30-60 cm layer. This due to increasing the deep of leached layer from the salts and increased root distribution. Increasing nitrogen fertilization from 60 to 120 kg N fed^{-1} led to increasing water extracted from 30-60 cm layer. This may be due to increasing root growth, increasing vegetative growth and increasing water requirements for plants. Zinc fertilization increased water extracted from 30-60 cm layer comparing with control under two levels of water. Potassium fertilization led to decreasing water extracted from the second layer (30-60 cm) under F.C. water treatment. On the other hand under F.C + 15% water treatment potassium fertilization increased water extracted from the second layer (30-60 cm). From the present data clear that corn root distribution relevant to the interaction between potassium fertilization and water quantity applied. Potassium + zinc fertilization treatment led to decreasing water extracted from the second layer under two levels of nitrogen (60 and 120 kg N/fed.) as well as under two levels of water irrigation quantity (F.C. and F.C. + 15%) comparing with check treatment (No fertilizers application). Similar results were recorded by Abdel-Hamid *et al.* (1988); Meleha (1992) who conducted that, most of water consumed by corn was extracted from soil surface layer (0-30 cm) and Tisdal *et al.* (1992) who reported that, adequate fertility favors expanded root growth and proliferation, when roots explore the soil a foot deeper, another inch or two inch of water will be obtained.

3. Water use efficiency:

In general, any growth factor that increases yield will improve the efficiency of water use. These factors include tillage, variety, plant spacing, pest control, time of planting and plant nutrient supply.

Data tabulated in Table 5 clearly show that, increasing nitrogen fertilization from 60 to 120 kg N/fed. led to increasing water use efficiency with all fertilizer treatments. This may be due to increasing corn growth and yield. Increasing water quantity from F.C. to F.C. + 15% increased water use efficiency with some fertilizer treatments i.e., with 120 kg N/fed. with all treatments, zinc fertilization and potassium fertilization. Under F.C. water treatment (potassium + zinc) fertilization increased water use efficiency compared with control treatment (No application) i.e., from 1.52 to 1.85 kg/m^3. On the other hand zinc fertilization and potassium fertilization decreased water use efficiency from 1.52% to 1.38 and 1.31 kg/m^3 respectively. Under F.C. + 15% water treatment zinc and (zinc + potassium) fertilization increased water, use efficiency compared with control treatment (No application) i.e., from 1.42 to 1.47 and 1.76 kg/m^3 respectively.

Table 4: Soil moisture percent extracted by corn roots from soil layers as affected by irrigation and fertilization.

Fertilizers treatments		Deep cm	Field capacity		Mean	Field capacity + 15%		Mean
Zn, K	N		1996	1997		1996	1997	
No application	60	0-30	62.3	53.7	58.0	60.7	57.6	59.2
		30-60	37.7	46.3	42.0	39.3	42.4	40.8
	120	0-30	58.9	55.3	57.1	60.6	54.8	57.7
		30-60	41.1	44.7	42.9	39.4	45.2	42.3
Zinc	60	0-30	59.9	55.7	57.8	60.7	54.1	57.4
		30-60	40.1	44.3	42.2	39.3	45.9	42.6
	120	0-30	59.2	55.5	57.4	60.2	53.3	56.8
		30-60	40.8	44.5	42.6	39.8	46.7	43.2
Potassium	60	0-30	61.7	56.9	59.3	59.2	55.5	57.4
		30-60	38.3	43.1	40.7	40.8	44.5	42.6
	120	0-30	58.8	55.3	57.1	59.1	54.5	56.8
		30-60	41.2	44.7	42.9	40.9	45.5	43.2
Zinc + Potassium	60	0-30	61.8	58.9	60.4	60.0	53.2	56.6
		30-60	38.2	41.1	39.6	40.0	46.8	43.4
	120	0-30	65.2	55.7	60.5	59.1	54.9	57.0
		30-60	34.8	44.3	39.5	40.9	45.1	43.0

Table 5: Water use efficiency (kg/m^3) for corn as affected by irrigation and fertilization.

Fertilizer treatments		F.C.		Mean	F.C. + 15%		Mean
Zn, K	N	1996	1997		1996	1997	
No application	60	1.54	1.42	1.48	1.58	1.20	1.39
	120	1.69	1.40	1.55	1.67	1.21	1.44
Mean		1.62	1.41	1.52	1.63	1.21	1.42
Zinc	60	1.43	1.04	1.24	1.55	1.21	1.38
	120	1.73	1.31	1.52	1.79	1.31	1.55
Mean		1.58	1.18	1.38	1.67	1.26	1.47
Potassium	60	1.27	1.15	1.20	1.34	1.24	1.29
	120	1.43	1.39	1.41	1.38	1.46	1.42
Mean		1.34	1.27	1.31	1.36	1.35	1.36
Zn + K	60	1.93	1.57	1.75	1.92	1.40	1.66
	120	1.99	1.90	1.95	2.15	1.56	1.86
Mean		1.96	1.74	1.85	2.03	1.49	1.76

On the other hand potassium fertilization led to decreasing water use efficiency by corn plants under the experimental conditions i.e., from 1.42 to 1.36 kg/m^3. Similar results were stated by Okaz *et al.* (1988), and Meleha (1992) Tisdal *et al.* (1992) reported that adequate fertility helps crops use water more efficiently and more of the crops is produced per inch of water.

4. Crop coefficient (Kc):

The effect of crop characteristics on crop water requirement is indicted by the crop coefficient (Kc) which represents the relationship between reference potential (ETP) and actual crop evapotranspiration. Regarding the effect of different methods for calculating potential evapotranspiration (ETP) in comparison with actual consumptive use (ETa), the data in Table 6 show monthly parallel agreement between the averages of actual consumptive use and potential evapotranspiration calculated by methods of modified penman, Blany-criddle and pan.

Table 6: Actual evapotranspiration compared with potential ET according to pan, Blany-criddle and penman methods and Kc crop for corn.

Month	ETo cm/day			Actual ET cm/day	Kc crop		
	Pan	Blany-criddle	Penman		Pan	Blany-criddle	Penman
1996							
May	0.34	0.39	0.48	0.32	0.94	0.82	0.67
June	0.59	0.52	0.58	0.43	0.73	0.83	0.74
July	0.64	0.51	0.51	0.69	1.08	1.35	1.35
August	0.57	0.46	0.46	0.50	0.88	1.09	1.09
September	0.38	0.35	0.36	0.31	0.82	0.89	0.86
1997							
May	0.47	0.35	0.57	0.45	0.96	1.29	0.79
June	0.52	0.49	0.59	0.49	0.94	1.00	0.83
July	0.47	0.47	0.54	0.67	1.43	1.43	1.24
August	0.46	0.46	0.46	0.30	0.65	0.65	0.65
September	0.42	0.40	0.41	0.29	0.69	0.73	0.71

From results obtained the average crop coefficient of corn in the two growing seasons, using penman method were 0.67, 0.74, 1.35, 1.09 and 0.86 in the first season and 0.79, 0.83, 1.24, 0.65 and 0.71 in the second season for June, July, August and September months respectively. The values of the other two methods were resulted in Table 6. the mean values for the whole two seasons of all methods was 0.94.

It could be noticed that crop coefficient was low at the beginning of the growing seasons, then the values increased and reached its maximum in July at pollination and seed formation stage. It decreased to reach its minimum value at maturity. It can be concluded that the calculated value of 0.89 for (Kc) can be used in calculating the consumptive use of water at the North of Delta area by using the average of penman equation method. These results are in agreement with those obtained by Ainer (1983) who found that the seasonal (Kc) was 0.74 for corn at Gemmiza area and Meleha (1992) who found that the seasonal (Kc) of corn at North Delta was 0.73.

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تأثير كميات الرى ومستويات التسميد على استخدام الماء وكفاءته فى الذرة تحت ظروف الأراضى المتأثرة بالاملاح

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اقيمت تجربتان حقليتان موسمى 1996 و 1997 الصيفى بمنطقة سيدى سالم محافظة كفرالشيخ (أراضى متأثرة بالاملاح) باستخدام صنف الذرة هجين ثلاثى 310 واستخدم تصميم القطع المنشقة المنشقة فى أربعة مكررات شغل القطع الرئيسية اضافة كميتين من مياة الرى الأولى - إضافة كمية مياة توصل الارض إلى السعة الحقلية والثانية إضافة كمية المياة التى توصل الأرض إلى السعة الحقلية + 15% وشغلت القطع الشقية معاملات التسميد بالزنك (10 كجم سلفات زنك للفدان) والبوتاسيوم بمعدل 24 كجم بو$_2$أ فى صورة سلفات بوتاسيوم ومعاملة تشمل الزنك + البوتاسيوم إلى جانب معاملة المقارنة كما شغلت القطع المنشقة المنشقة بمستويين من النيتروجين 60 ، 120 كجم ن للفدان فى صورة سلفات أمونيوم. وتتلخص النتائج فى الاتى:

1- أدت زيادة كمية مياة الرى من السعة الحقلية إلى السعة الحقلية + 15% إلى زيادة كفاءة التسميد النيتروجينى حيث أعطت زيادة فى كمية البروتين بالكيلوجرام للفدان بمقدار 6.23% ، 69.7% فى الموسمين الأول والثانى عند المستوى 60 كجم ن للفدان بينما كانت الزيادة 2.39% ، 4.6% للموسمين الأول والثانى على التوالى مع استخدام 120 كجم ن للفدان.

2- زاد الاستخدام الفعلى للمياة (سم عمق) بزيادة التسميد النيتروجينى من 60 إلى 120 كجم ن للفدان تحت مستويى الرى حيث زادت من 56.1 إلى 62.4 سم مع مستوى الرى (السعة الحقلية) كما كانت الزيادة 62.5 إلى 67.5 سم مع مستوى الرى إلى السعة الحقلية + 15% منها.

3- مع استخدام التسميد بالزنك زاد الاستخدام الفعلى للمياة تحت مستوى 60 وحدة ن للفدان بينما قل فى المستوى الثانى 120 وحدة ن للفدان. كما أدى التسميد البوتاسى إلى زيادة الاستخدام الفعلى للمياة. بينما أدت معاملة التسميد (زنك + بوتاسيوم) إلى انخفاض الاستخدام الفعلى للمياة.

4- بوجه عام كانت كمية المياة الممتصة من الطبقة السطحية للأرض (صفر - 30) أكثر من الممتص من الطبقة الثانية (60-30 سم) مع جميع المعاملات. وأدت زيادة كمية مياة الرى وزيادة التسميد النيتروجينى والتسميد بالزنك إلى زيادة كمية المياة الممتصة من الطبقة (60-30 سم).

5- أدى زيادة معدل التسميد النيتروجينى من 60-120 كجم ن للفدان إلى زيادة كفاءة استخدتم المياة كما أدى استخدام كمية المياة (السعة الحقلية + 15%) إلى زيادة كفاءة استخدام المياة مع استخدام التسميد بالزنك وكذلك البوتاسيوم.

6- بمقارنة الاستخدام الفعلى للمياة بالكمية المحسوبة بثلاثة طرق (بان - بلانى - كريل وبمن) كانت هذه القيم منخفضة فى أول موسم النمو ثم ازدادت حتى وصلت أقصاها فى شهر يوليو ثم تناقصت إلى أقل قيمة عند النضج وكان متوسط القيم للموسمين وجميع الطرق (Kc) هو 0.89 تحت ظروف المنطقة ويمكن استخدام هذه النسبة لحساب الاستخدام المائى لهذه المنطقة.