EFFECT OF IRRIGATION REGIMES ON POTATO PRODUCTIVITY IN SANDY SOILS UNDER SPRINKLER AND DRIP IRRIGATION SYSTEMS

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ABSTRACT: *A field experiment was conducted at Ali Mubarak agricultural research station (30º 35´ N, 30° 15´ E, and 32 m above sea level), El-Bustan area, El-Behiera Governorate, Egypt in winter seasons of 2008-2009 and 2009-2010. The aim was to study the effect of four irrigation regime s (I_1 = irrigation with amount of water equals 125% of potential evapotranspiration (ETp) determined by class A pan, 100% ETp, 75% ETp, and 50% ETp), and two irrigation systems (sprinkler and drip) on potato fresh yield, potato dry matter, starch percentage, water requirements, water consumption, and water utilization efficiency (WUtE), as well as developing local potato crop coefficient (Kc). A split plot experimental design with four replicates was used. The main plots were assigned to the irrigation systems (drip and sprinkler), and the sub-plots were assigned to the irrigation treatments. Potato (Spunta variety) was used in the present experiment. Results revealed that drip irrigation recorded significant increase in fresh potato yield by 23.0 and 7.0% in the 1ˢᵗ and 2ⁿᵈ seasons, respectively as compared with sprinkler irrigation system. Under the experimental conditions, that potato fresh yield increases by increasing amount of irrigation water up to $ETp_{125\%}$ in the two growing seasons. The highest yields of potato were 14.325 and 17.902 tonfed⁻¹ in the 1ˢᵗ and 2ⁿᵈ seasons, respectively, were obtained from $ETp_{125\%}$ irrigation regime with drip irrigation system. The $ETp_{125\%}$ irrigation regime produced the highest values of potato dry mater and starch% reached (2.358 and 2.975 tonfed⁻¹) and (18.8 and18.5%), respectively, in the 1ˢᵗ and 2ⁿᵈ seasons. The highest fresh potato yields e.g. 14.325 and 17.902 tonfed⁻¹ were obtained with $ETp_{125\%}$ irrigation regime under drip system, in the 1ˢᵗ and 2ⁿᵈ growing seasons, respectively. Seasonal water requirements for potato crop under drip irrigation system were 35.0 and 38.6 cm in the 1ˢᵗ and 2ⁿᵈ seasons, respectively. Seasonal water consumptive use values for potato crop under drip irrigation system were 27.8 and 32.0 cm in the in the 1ˢᵗ and 2ⁿᵈ seasons, respectively. The highest WUtE average value of 11.37 kg potato yield/m³ applied water resulted from the interaction between $ETp_{100\%}$ irrigation regime and the drip irrigation system. The 2-year average value of local potato crop coefficient (Kc) was 0.81 under drip irrigation.*

Key words: *Sprinkler and drip irrigation systems, irrigation regimes, Seasonal water consumptive use, Seasonal water requirements, potato fresh and dry potato yields, Crop coefficient(Kc)*

INTRODUCTION

Water scarcity is a vital problem confronts farmers and agricultural scientists in the irrigated areas of arid and semi-arid regions. Knowledge of the proper amounts of irrigation water is essential to maximize yield of different crops. Improper irrigation water management accounts for significant water losses in some large irrigation schemes. Consequently, the use of modern and highly efficient irrigation systems in irrigation operation and scheduling is essential for the reduction of irrigation water demands (Brown, 1999). Potato (*Solanum tuberosum* L.) is considered one of the most important vegetable crops all over the world (Rowe, 1993). The ideal conditions for potato growth include high and nearly

constant soil matric potential, high soil oxygen diffusion rate, adequate incoming radiation, and optimal soil nutrients. Among the environmental factors, soil water is a major limiting factor in the production and quality of potatoes. Many irrigation experiments have shown that potato is relatively sensitive to moisture stress (Porter *et al.,* 1999; and Faberio *et al.,* 2001). The successful irrigation management of potato requires knowledge of both amounts of irrigation water and scheduling methods. Improved irrigation methods can save water without compromising potato yield or quality (Zeag, 1991). Potato tuber yield and quality can be reduced by water stress occurring at any time during the growing seasons (Adams and Stevenson, 1990). The least amount of water required to produce high potato yield in the new land was obtained under drip irrigation system. The net profit from crop production with drip irrigation system was 14.8% less than the profit from sprinkler irrigation system (Zeag, 1991). Water use efficiency of a potato variety produced from surface drip irrigation was higher than tha t of sprinkler irrigation system (Badr, 1992). A widely adopted method for estimating crop consumptive water use (CWU) is the evaporation pan method, which relates evaporation from Class A Weather Bureau evaporation pan to CWU. These two quantities are related by what is called crop coefficient (Kc). The crop coefficient represents crop specific water use and is essential for accurate estimation of irrigation requirements of different crops in the irrigated area (CSSRI, 2000). Irrigation scheduling based on the Kc is one of the simplest methods where no sophisticated instrument is required. Based on the US Weather Service Class A pan evaporation, many studies on the irrigation of potato have been completed (Ferreira and Carr, 2002; and Panigrahi *et al.,* 2001). The trends of water use efficiency (WUE) showed that the lower the amount of irrigation water received, the higher the water use efficiency obtained for the drier

plant biomass and the tuber yields (Yuan *et al.,* 2003). On the loamy and sandy loam soils, tuber yields were reduced by deficit irrigation corresponding to 70% and 74% of evapotranspiration in sprinkler and trickle irrigation systems, respectively. Water use of potato crop ranged from 490 to 760 mm for trickle- irrigated plots and from 565 to 830 mm for sprinkler- irrigated treatments (Ŭnlü *et al.,* 2006). Erdem *et al.* (2006) with potato grown under furrow and drip irrigation methods and irrigation regimens 30, 50, or 70% of the available water was consumed, found that seasonal evapotranspiration ranged from 501 to 683 mm in 2003 and from 464 to 647 mm in 2005. In addition, furrow and drip irrigation had no significant effect on tuber yield in both seasons. Irrigation regimens influenced tuber yield, where in 2005 the highest tuber yield was registered for 30% irrigation depletion regimen reaching 35.13 t ha^{-1} in 2003 and 44.56 t ha^{-1} in 2005.Furthermore, water use efficiency values increased from 4.70 to 6.63 kg m^{-3} for furrow-irrigated treatments and from 5.19 to 9.47 kg m^{-3} for drip irrigated ones. Ayes and Korukeu (2010) reported that, the amounts of irrigation water applied to the potato plants were between 399 and 655 mm in the first year, and between 370 and 646 mm in the second year, and plant water consumption varied from 345 to 585 mm. The authors found that the highest yields of 32.3 t ha^{-1} and 35.0 t ha^{-1} were obtained from full irrigation imposed at all growth periods, while the lowest yields of 12.1 t ha^{-1} and 10.9 t ha^{-1} were reported from the 50% water deficiency applied at all growth periods. The highest values of water use efficiency (WUE) and irrigation water use efficiency(IWUE)of 5.23 and 4.35kg m^{-3}, respectively, were reported for applying deficit irrigation only at ripening period and full irrigation at all other stages. Kandil *et al.* (2011) found that, irrigation at 54% moisture from field capacity produced maximum values of potato yield and its components. Eskandaria *et al.* (2012) indicated that, full irrigation regime, which provides 100% of

the water requirement of potato (Agria and Almeria cultivars) had the highest yield and water productivity under drip irrigation system.

The objectives of the present research were to study the effect of the amounts of applied irrigation water under sprinkler and drip systems on potato fresh yield, dry matter yield, tuber starch percentage, water requirements, water consumptive use, and water utilization efficiency, and to develop potato crop coefficient under local conditions.

MATERIALS AND METHODS

A field experiment was conducted at Ali Mubarak agricultural research station (30º 35´ N, 30° 15´ E, and 32 m above sea level), El-Bustan area, El-Behiera Governorate, Egypt during 2008-2009 and 2009-2010 winter growing seasons. The experimental site represents the newly reclaimed sandy soils where modern irrigation systems (drip and sprinkler) are introduced to the region. Particle size distribution, bulk density and some hydro-physical parameters of the experimental soil are shown in Table 1.

A split plot experimental design with four replicates was adopted. The main plots were assigned to two irrigation systems (drip and sprinkler), and four irrigation regimes were represented in the sub-plots. The adopted irrigation regimes were as follows:

I_1= irrigation with amount of water equals 125% of potential evapotranspiration ($ETp_{125\%}$).

I_2= irrigation with amount of water equals 100% of ETp, ($ETp_{100\%}$)

I_3= irrigation with amount of water equals 75% of ETp. ($ETp_{75\%}$)

I_4= irrigation with amount of water equals 50% of ETp. ($ETp_{50\%}$)

Irrigation water was applied in 3 and 6 days- interval under drip and sprinkler systems, respectively, and irrigation water quantities were based ETp value to ensure the proper germination. The adopted irrigation regimes were applied after complete plant's establishment.

Potential evapotranspiration (ETp) values were calculated based on class A pan records as follows:

$ETp = Epan * Kpan,$ Doorenbos and Pruitt, 1984

where:

Epan = measured class A pan evaporation values, (mm d^{-1})

Kpan = pan coefficient that equals 0.75 for the experimental site.

Table 1. Particle size distribution and some hydro-physical parameters of the experimental soil

Soil depth (cm)	Particle size distribution			Textural class	Hydro-physical parameters			Bulk density (g cm^{-3})
	Sand (%)	Silt (%)	Clay (%)		Field capacity (%,w/w)	Wilting point (%,w/w)	Available water (%,w/w)	
00-15	91.5	3.5	5.0	sandy	8.8	4.7	4.1	1.44
15-30	91.9	3.2	4.9	sandy	8.7	4.6	4.1	1.63
30-45	92.0	3.0	5.0	sandy	8.5	4.5	4.0	1.70
45-60	92.5	2.8	4.7	sandy	8.3	4.4	3.9	1.75
Average	92.0	3.1	4.9	sandy	8.6	4.6	4.0	1.63

The amounts of irrigation water were calculated according to the equation given by Vermeiren and Jopling (1984) as follows:

$$AIW = \frac{ETp * Kc * I}{Ea\,(1 - LR)}$$

where:

AIW = depth of applied irrigation water (mm)

ETp = potential evapotranspiration (mm d^{-1})

Kc = calculated crop coefficient values at the experimental site

I = irrigation intervals (days)

Ea = irrigation application efficiency of the drip and sprinkler irrigation systems.

LR = leaching requirements, not considered under the present experiment.

Irrigation time for drip irrigation system was determined before an irrigation event by measuring the actual emitter discharges according the equation given by Ismail (2002) as follows:

$$t = \frac{AIW \times A}{q}$$

where:

t = irrigation time (hour)

A = wetted area (cm^2)

q = emitter discharge (Lh^{-1})

AIW = applied irrigation water (cm)

The irrigation time for sprinkler irrigation system was calculated according to the following equation:

$$Irrigation\,time\,(h) = \frac{AIW}{AR}$$

where:

AR= application rate, (mm h^{-1})

$$AR = \frac{1000 \times Q}{L\,l \times Ls}$$

Q = sprinkler discharge, ($m^3\,h^{-1}$)

L_L = distance between laterals, (m)

Ls = distance between sprinklers, (m)

The drip irrigation system used in the experimental farm included an irrigation pump connected to sand and screen filters and venture fertilizer injector, control values, water flow meters, and pressure gauges. The distribution system consisted of PVC pipes forming the mainline (75mm diameter) and manifolds (63mm diameter) for supplying and discharging irrigation water to each plot. Irrigation laterals (16mm in diameter and 30meters in length) with in - line emitters spaced 0.3m apart with 3.6 L h^{-1} flow rate at pressure of 100 kPa. A sprinkler irrigation system solid-set type was installed in the experimental site, and composed of PVC pipes of 110 and 75mm diameters, which used as main and lateral lines, respectively. The distance between sprinklers was 7m and between lateral was 9m. Fertilizer tanks were placed at the upper end of the main line, which used for nitrogen, phosphorus, and potassium fertilizers application. The actual discharge of sprinkler was 0.5 m^3h^{-1}.

During land preparation, 15m^3/fed of chicken manure was incorporated into the soil surface. N, P and K fertilizers were applied as recommended for potato production in the area, where180 kg/fed N (as ammonium nitrate, 33.5%N), 96 kg/fed K_2O (as potassium sulfate, 48% K_2O) and 45 kg/fed P_2O_5 (as phosphoric acid 85% P_2O_5) were injected through the irrigation water in 10 and 5 doses, respectively, for drip and sprinkler irrigation systems. Potato seeds (Spunta variety) were planted on the 15th and the 3rd of November and the tubers were harvested on the 20th and 3rd of March in the 1st and 2nd seasons, respectively.

Water consumptive use (WCU) values were calculated according to Israelsen and Hansen (1962) using the following equation:

$$WCU = \sum_{i=1}^{i-4} \frac{\theta 2 - \theta 1}{100} \times d \times \rho$$

where:

WCU = water consumptive use or actual evapotranspiration, ETa (cm)

i = number of soil layer

θ2 = soil moisture content 6 hours after irrigation, (%, by weight)

θ1 = soil moisture content just before irrigation, (%, by weight)

d = depth of soil layer, (cm)

ρ = soil bulk density, (g cm^{-3})

Crop coefficient (Kc) values were calculated as:

$$Kc = \frac{ETa}{ETp}$$

where:

ETa = actual evapotranspiration or water consumptive use (cm)

ETp = potential evapotranspiration (cm)

Water utilization Efficiency (WUtE, kgm^{-3}) values were calculated according to Jensen (1983) as follows:

$$WU_tE = \frac{Potato\ tuber\ yield\ (kg/fed)}{Applied\ irrigation\ water\ (m^3/fed)}$$

Starch content of the potato tubers samples under each sub -plot was determined according to Norgia *et al.* (2008).

The obtained data of yields of fresh and dry potato tubers (ton/fed) and starch percentage were statistically analyzed according to technique of analysis of variance (ANOVA) for the split- plot experimental design as described by Steel and Torrie (1960).

RESULTS AND DISCUSSION
Potato fresh and dry matter yields (tonfed^{-1}), and starch percentage:

Effect of irrigation systems and irrigation regimes on potato fresh yield, potato dry matter, and starch percentage in sandy soils during the 2008-2009 and 2009-2010 growing seasons is presented in Table 2. Results showed significant effects of the tested variables on potato fresh yield in the 1st and 2nd seasons and on potato dry yield in the 1st season only. The drip irrigation system recorded significant increase in fresh potato yield by 23.0 and 7.0% in the 1st and 2nd seasons, respectively as compared with sprinkler irrigation system. The ETp$_{125\%}$ irrigation regime gave the highest values of fresh potato yield in the two growing seasons. The results indicated, under the experimental conditions, that

potato fresh yield increases by increasing amount of irrigation water up to ETp$_{125\%}$ in the two growing seasons. The highest yields of potato were 14.325 and 17.902 tonfed^{-1} in the 1st and 2nd seasons, respectively, were obtained from ETp$_{125\%}$ irrigation regime with drip irrigation system. The ETp$_{125\%}$ irrigation regime produced the highest values of potato dry mater and starch% reached (2.358 and 2.975 tonfed^{-1}) and (18.8 and18.5%), respectively, in the 1st and 2nd seasons. Results showed also that, imposing water stress reduced potato fresh yield by 15.4, 29.5, and 38.2% in the 1st season and by 5.1, 17.4, and 36% in the 2nd season for ETp$_{100\%}$, ETp$_{75\%}$ and ETp$_{50\%}$ irrigation regimes, respectively as compared with ETp$_{125\%}$ regime. The obtained results agreed with those reported by Adams and Stevenson (1990); Porter *et al.* (1999); Faberio *et al.* (2001); Yuan *et al.* (2003); Ayas and Korukeu (2010) and Eskandaria *et al.* (2012).

Water requirements (WR):

Data in Table 3 indicated that, the highest monthly values of water requirements e.g.6.6 and 6.0 cm recorded at February in the 1st and 2nd seasons with all adopted irrigation regimes under sprinkler and drip irrigation systems. For sprinkler system, the total amounts of water requirements were 40.2, 37.0, 30.5, and 26.0 cm in the 1st season, and 42.5, 35.5, 29.0, and 22.5 cm in the 2nd season for the ETp$_{125\%}$, ETp$_{100\%}$, ETp$_{75\%}$, and ETp$_{50\%}$ irrigation regimes, respectively. For drip irrigation system, the total amounts of water requirements were 35.0, 31.1, 27.1, and 23.0cm in the 1st season and were 38.6, 32.2, 26.5, and 21.4cm in the 2nd season, for the same respective treatments. Results indicated that average amounts of applied water by drip system were 13 and 8% less than those applied by the sprinkler system. The obtained results agreed with those reported by Brown (1999) and Ayas and Korukeu (2010).

Table 2: Average potato fresh yields (ton/fed), potato dry matter (ton/fed), and starch percentage as affected by Sprinkler and Drip irrigation systems and irrigation regimes and interaction, 2005/2009 and 2009/2010 seasons

Treatment	Potato fresh yield (tonfed^{-1})		Potato dry matter yield (tonfed^{-1})		Starch percentage	
	2008-2009	2009-2010	2008-2009	2009-2010	2008-2009	2009-2010
Irrigation systems						
Sprinkler	9.429	13.965	1.758	2.658	17.7	18.1
Drip	11.600	14.943	2.370	2.726	17.9	18.3
L.S.D at 0.05	0.469	0.924	0.145	N.S.	N.S.	N.S.
Irrigation regimes						
125% ETp (I_1)	13.262	16.928	2.358	2.975	18.8	18.5
100% ETp (I_2)	11.222	16.073	2.103	2.857	17.9	18.2
75% ETp (I_3)	9.350	13.981	1.917	2.697	17.5	18.6
50% ETp (I_4)	8.197	10.836	1.877	2.238	17.0	17.4
L.S.D at 0.05	0.726	0.900	0.130	0.463	0.38	0.71
<u>**Interaction**</u>						
Sprinkler x I_1	12.200	15.955	2.416	3.000	18.2	18.4
Sprinkler x I_2	9.475	14.832	1.876	2.788	18.1	18.2
Sprinkler x I_3	8.475	14.055	1.878	2.642	17.3	18.3
Sprinkler x I_4	7.500	11.020	1.885	2.572	17.2	18.2
Drip x I_1	14.325	17.902	2.836	3.366	19.4	18.4
Drip x I_2	12.975	17.312	2.569	3.255	17.7	18.1
Drip x I_3	10.225	13.907	2.325	2.615	17.8	18.0
Drip x I_4	8.875	10.652	1.957	2.403	16.8	17.8
L.S.D at 0.05	1.024	1.269	N.S.	N.S.	0.54	N.S.

Table 3. Monthly and seasonal potato water requirements (cm) as affected by irrigation regimes and the two irrigation systems in the two growing seasons

Irrigation system		Sprinkler						Drip					
season	Irrigation regime	Nov.	Dec.	Jan.	Feb.	Mar.	**Total**	Nov.	Dec.	Jan.	Feb.	Mar.	**Total**
2008-2009	125% ETp	5.8	9.7	10.0	11.5	3.2	**40.2**	5.1	7.3	7.5	8.6	6.5	**35.0**
	100% ETp	5.8	8.4	9.3	10.7	2.8	**37.0**	5.1	6.4	6.5	7.2	5.9	**31.1**
	75% ETp	5.8	6.1	7.6	8.9	2.1	**30.5**	5.1	5.2	5.3	6.9	4.6	**27.1**
	50% ETp	5.8	5.8	6.0	7.0	1.4	**26.0**	5.1	4.4	4.6	5.5	3.4	**23.0**
2009-2010	125% ETp	7.7	9.3	10.2	12.6	2.7	**42.5**	7.2	8.7	9.1	11.3	2.3	**38.6**
	100% ETp	7.2	7.6	8.2	10.3	2.2	**35.5**	6.8	7.0	7.4	9.1	1.9	**32.2**
	75% ETp	6.8	5.8	6.7	7.9	1.8	**29.0**	6.3	5.6	5.9	7.2	1.5	**26.5**
	50% ETp	6.3	4.1	4.3	6.6	1.2	**22.5**	5.9	4.1	4.3	6.0	1.1	**21.4**

Water consumptive use (CU):

Data in Table 4 indicated that, the highest monthly values of water consumptive use occurred during February in both seasons for all irrigation regimes and the two irrigation systems. For the sprinkler irrigation system, the total water consumptive use values were 29.5, 28.9, 27.2, and 23.9cm in the 1st season and 32.2, 27.2, 22.8, and 17.2 cm in the 2nd season, respectively for the 125, 100, 75, and 50% ETp irrigation regimes. While for the drip irrigation system, the total water consumptive use values for the same respective treatments were 27.8, 26.5, 24.0, and 20.8cm in the first season and were 32.0, 26.8, 22.4, and 17.7cm in the second season. Results indicated that, decreasing the amount of applied irrigation water increased the amounts of consumed water by potato crop. Also, plants under drip irrigation system were more efficient in consuming water as compared with those under sprinkler system. The 2-year average percentage of CU/WR values under sprinkler system were 74.6, 77.4, 83.9, and 84.2% for the $ETp_{125\%}$, $ETp_{100\%}$, $ETp_{75\%}$, and $ETp_{50\%}$ irrigation regimes, respectively. For the drip system, the same respective values were 81.2, 84.2, 86.5, and 86.6%. The obtained results agreed with those reported by CSSRI (2000), and Ayas and KoruKeu (2010).

Water Utilization Efficiency (WUtE):

Results in Table 5 represent the effect of irrigation treatments and the two modern irrigation systems (drip and sprinkler) on water utilization efficiency (WUtE) expressed as kg of potato yield per cubic meter of water requirements. Comparing the values of WUtE under different irrigation regimes and the two irrigation systems reveals that maximum values were obtained from the drip irrigation system in the 1st and 2nd seasons. The highest WUtE average value of 11.37 kg potato yield/m^3 applied water resulted from the interaction between I_2 irrigation treatment and the drip irrigation system. The lowest WUtE average value of 8.03 kg potato yield/m^3 applied water was recorded from $ETp_{100\%}$ irrigation regime under sprinkler irrigation system. These results were in agreement with those reported by Bader (1992); Yuan *et al.* (2003) and Erdem *et al.* (2006).

Potential Evapotranspiration (ETp) and crop coefficient (Kc):

The calculated monthly potential evapotranspiration and crop coefficient values during the two growing seasons are shown in Table 6. The Kc values were calculated based on the monthly actual evapotranspiration (ETa) values measured for $ETp_{125\%}$ irrigation regime under drip irrigation system which produced the highest potato yields. Results showed that, the monthly ETp values were low at the beginning of the growing season and increased gradually to reach its maximum value in February. This trend is due to the increase in evaporation and air temperature at the experimental site. The developed local potato crop coefficient (Kc) values reflect the relation between crop characteristics as well as the percent of crop cover and the local climatic conditions. Crop coefficient (Kc) values were low at early stages of growth, then increased gradually as the percentage of crop cover increased, and decreased again as plants started to mature. The 2- season average Kc value 1.19 reached in January. The average of seasonal local crop coefficient value of the two seasons was 0.81. The obtained results are in agree with those reported by Doorenbos and Pruitt (1984) and CSSRI (2000).

Table 4. Monthly and total water consumptive use (cm) for potato crop as affected by irrigation treatments and the two irrigation systems in the two growing seasons

Irrigation system		Sprinkler						Drip					
season	Irrigation regime	Nov.	Dec.	Jan.	Feb.	Mar.	**Total**	Nov.	Dec.	Jan.	Feb.	Mar.	**Total**
2008 - 2009	$ETp_{125\%}$	3.7	6.4	7.3	8.8	3.3	**29.5**	2.0	5.6	6.7	7.5	6.0	**27.8**
	$ETp_{100\%}$	3.9	6.2	7.1	8.6	3.1	**28.9**	2.3	5.2	6.3	6.9	5.8	**26.5**
	$ETp_{75\%}$	3.7	5.6	6.9	8.2	2.8	**27.2**	2.0	5.0	5.6	6.6	4.8	**24.0**
	$ETp_{50\%}$	3.6	5.4	5.7	7.3	1.9	**23.9**	2.2	4.4	4.8	5.6	3.8	**20.8**
2009 - 2010	$ETp_{125\%}$	4.1	6.0	7.2	12.6	2.3	**32.2**	4.7	5.9	9.3	10.6	1.5	**32.0**
	$ETp_{100\%}$	4.0	5.1	5.3	10.9	1.9	**27.2**	4.0	5.1	7.1	9.0	1.6	**26.8**
	$ETp_{75\%}$	4.1	4.0	4.5	8.5	1.7	**22.8**	3.8	4.0	6.0	7.2	1.4	**22.4**
	$ETp_{50\%}$	3.1	3.3	3.6	6.1	1.1	**17.2**	3.2	3.4	4.7	5.2	1.2	**17.7**

Table 5. Water utilization efficiency (kg potato yield/m^3 water requirements) as affected by irrigation treatments and the two irrigation systems in the two growing seasons.

Irrigation regimes	2008-2009		2009-2010		Average	
	Sprinkler system	Drip system	Sprinkler system	Drip system	Sprinkler system	Drip system
$ETp_{125\%}$	7.23	9.74	8.93	11.03	8.08	10.39
$ETp_{100\%}$	6.10	9.94	9.95	12.80	8.03	11.37
$ETp_{75\%}$	6.62	8.98	11.55	12.48	9.09	10.73
$ETp_{50\%}$	6.87	9.18	11.67	12.44	9.27	10.81

Table 6. Potential evapotranspiration (ETp) and crop coefficient (Kc) for potato crop under drip irrigation in the two growing seasons

Season	2008-2009		2009-2010		Average Kc
	ETp (cm/month)	Kc	ETp (cm/month)	Kc	
November	5.0	0.40	10.2	0.46	0.43
December	6.5	0.86	6.3	0.94	0.90
January	6.0	1.12	7.4	1.26	1.19
February	9.2	0.82	11.5	0.92	0.87
March	9.1	0.66	2.4	0.63	0.65
Average		0.77		0.84	0.81

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تأثير معاملات الري على انتاجية محصول البطاطس فى الاراضي الرملية تحت نظامى الري بالرش والتنقيط

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قسم بحوث المقننات المائية والري الحقلي – معهد بحوث الأراضى والمياه والبيئة – مركز البحوث الزراعية – مصر

الملخص العربى

أجريت تجربة حقلية بالمزرعة البحثية بقرية على مبارك بمنطقة البستان بغرب النوبارية خلال موسمي النمو ٢٠٠٨–٢٠٠٩ و ٢٠٠٩–٢٠١٠ وقد استهدفت التجربة دراسة مدي تأثير معاملات الري على محصول البطاطس صنف سبونتا فى الاراضي الرملية تحت نظامى الري بالرش والتنقيط وكانت معاملات الري كالتالي:-

١. الري بكمية مياه تعادل ١٢٥% من جهد البخر نتح القياسي مقدراً من وعاء البخر القياسى Class A

٢. الري بكمية مياه تعادل ١٠٠% من جهد البخر نتح القياسي

٣. الري بكمية مياه تعادل ٧٥% من جهد البخر نتح القياسي

٤. الري بكمية مياه تعادل ٥٠% من جهد البخر نتح القياسي

وقد اوضحت النتائج المتحصل عليها ما يلي

- كان هناك تأثير معنوى لمعاملات الري ونظامى الري بالرش والتنقيط على محصول البطاطس

- أعلي محصول للبطاطس كان ١٤.٣٢٥ ، ١٧.٩٠٢ طن/فدان من معاملة الري بكمية مياه تعادل ١٢٥% من جهد البخر نتح القياسي تحت نظام الري بالتنقيط لموسمي النمو على الترتيب .

- الاحتياجات المائية المثلي لمحصول البطاطس كانت ٣٥.٠ ، ٣٨.٦ سم تحت نظام الري بالتنقيط خلال موسمي النمو على الترتيب .

- الاستهلاك المائي لمحصول البطاطس كان ٢٧.٨ ، ٣٢.٠ سم تحت نظام الري بالتنقيط خلال موسمي النمو على الترتيب.

- أعلي قيمة للكفاءة الاستعمالية لمياه الري المضافة كانت ٩.٩٤ ، ١٢.٨٠ كجم بطاطس لكل م٣ مياه مضافة خلال موسمي النمو على الترتيب وذلك من معاملة الري بكمية مياه تعادل ١٠٠% من جهد البخر نتح القياسي وتحت نظام الري بالتنقيط.

- متوسط قيمة معامل النبات (Kc) لمحصول البطاطس كان ٠.٨١ وأعلي قيمة لمعامل النبات كانت خلال شهر يناير .