Effect of Folicote Antitranspirant and Irrigation Water Regime on Growth Characters of Sweet Potato(*Ipomoea batatas, L.)*Plants Grown In Sandy Soil

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ABSTRACT

Two field experiments were carried out on sweet potato plants (Beauregard cv.) during two successive growing summer seasons of 2008 and 2009 at the newly reclaimed area, at Sadat City, of the Environmental Studies and Research Institute Farm, Minufiya University, Minufiya Governorate, Egypt. The experiments were designed to evaluate the effect of 4 concentrations of the antitranspirant (Folicote), 4 rates of irrigation level and their interaction on some characteristics of sweet potato crop. The rates of irrigation level were 100 % (control), 85%, 70% and 55% of potential evapotranspiration. The concentrations of Folicote were 15%, 10%, 5% and 0% (v/v).

The results obtained showed that tuber root yield/plant and total tuber root yield decreased gradually with decreasing the amount of irrigation rates. The same trend was also recorded regarding tuber root yield with the Folicote concentrations. The interaction between irrigation rates and Folicote concentrations was highly effective on tuber root yield character only in the first season. Water use efficiency exhibited the highest value at 85% and 70% irrigation rates in the first season of the study. Two vegetative characters, i.e. plant length and foliage fresh weight were affected by both irrigation rates and Folicote spraying concentrations. The interaction was significantly effective only in the first season of the study. Non-reducing sugars and starch percentages were positively affected by the interaction between the irrigation rates and Folicote concentrations during the second season of the study.

In this respect, foliar spray with Folicote, at 15% level can be applied as a foliar three times to the growing sweet potato plants in arid or semi-arid areas to save 15% of the recommended irrigation water and to improve the productivity of the growing sweet potato crop.

INTRODUCTION

Sweet potato (*Ipomoea batatas, L.)* is a popular vegetable crop in the developing countries such as Egypt. It is cultivated for both human food consumption and starch production. Moreover, the foliage is used for animal feeding. As a root crop, sandy soil is the most suitable one for its production. (Hassan *et. al. ,2007*).

The policy of Egyptian Ministry of Agriculture directed some of its efforts to improve the production of such a crop, to meet the great demands of the increased population, industrial activities and exportation. Some areas are devoted to such a crop, with a great obstacle that facing any agricultural extension which is the limited water resources.

Nowadays, water, not oil, will be a critical resource in the Middle East. Thus, water deficit in Egypt will be a very complicated problem. In this respect, there is a critical balance between water requirements and water consumption, thus water saving is becoming a decisive factor for agricultural expansion. Therefore, proper understanding of the optional water requirements of various crops is very important for a judicious use of the scare water resources. Antitranspirants are compounds applied to the leaves of plants to reduce transpiration. These antitranspirants protect plants from drying out too quickly. They have also been reportedly used to protect leaves from salt burn and fungal diseases.

The antitranspirants which cause the closing of stomata affect the plant metabolism frequently causing toxic side and reduce proportionally the intensity of transpiration and photosynthesis (Parkinson, 1970; Davenport et. al. 1971; Mishra and Pradhan, 1972 and Kreith et. al., 1975). On the other side, film-forming and reflecting antitranspirants which form a protective layer on the leaf surface have found to be not toxic and have a longer duration of effectiveness than metabolic materials (Davenport *et. al*., 1974; Kreith *et. al*., 1975 and Patil and De, 1976).

Accordingly, the present study was carried out to achieve the following goals (I) Evaluating the effect of Folicote application as an antitranspirant on sweet potato yield and tuber root quality. (ii) Improve the water-use efficiency of sweet potato plants by decreasing the plant irrigation water used due to Folicote application.

MATERIALS AND METHODS

Two field experiments were conducted on sweet potato plants during the summer seasons of the years2008 and 2009 at a newly reclaimed area, of the Environmental Studies and Researches Institute Farm, at Sadat City, Minufiya University, Minufiya Governorate, Egypt; using sweet potato cv. Beauregard. Planting was carried out on the first of June and harvesting was done 120 days later for both years. Stem cuttings of 25 cm

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length were planted in rows 0.75 m apart and at spacing of 0.50 m within rows under a drip irrigation system.

Treatments:

Each experiment contained sixteen treatments, which represented all possible combinations of four irrigation water quantities 55%, 70%, 85% and 100% of the common used of irrigation water with four Folicote (a film-type antitranspirant) spraying concentrations. (0.0, 5%, 10% and 15% v/v.) Tap water was sprayed on the control plants. Folicote was sprayed three times. The first spray was done 40 days after planting, the second was 60 days and the third was 80 days from planting. The irrigation water quantities were randomly distributed in the main plots whereas the Folicote concentrations were randomly assigned in the sub-plots. Each sub-plot consisted of three rows; 10.0 m length and 0.75 m width, with a sub-plot area of 22.5 m^2. The Folicote used in this study is a hydrocarbon paraffin wax emulsion (an emulsion wax polymers). The total amount of drip irrigation at different treatment was calculated and expressed in terms of time based on the rate of water flow through the drippers (2L/ h.) to give such amount of water for each treatment.

All treatments received equal amounts of water at the beginning of transplanting till 40 days.

Agricultural practices were as follows: At soil preparation time, full dose of P_2O_5 (300 Kg/fed), as super phosphate fertilizer (15.5 % P_2O_5), plus 5 tons/fed of compost produced by El-Salam Compost Co., El-Minofiya Governorate, Egypt were added. The nitrogen in the form of ammonium nitrate (33%) and potassium sulphate fertilizers were added to the soil throughout the drip irrigation system in four equal doses, the nitrate fertilizer dose was 150 Kg N/fed, and potassium sulphate fertilizer (48% K_2O) added to 100 kg/fed . All the agricultural practices used for commercial sweet potato production were carried out in both seasons.

Some monthly meteorological data of the experimental location, during the two growing seasons, are listed in Table (1).

Just before planting, representative composite soil samples (0-30 cm) were collected, air dried, pulverized, passed through a 2 mm sieve and analyzed for some selected physico-chemical characteristics according to the methods described by Klute and Dirksen (1986) and the results obtain are shown in Table 2. Field capacity (F.C.) and permanent wilting point (P.W.P.) were determined according to Black (1965) and are shown in Table 2.

Irrigation period, No. of irrigations/ season, irrigation water/day and irrigation water/ season for the four irrigation treatments during the two growth seasons are shown in Table (4). All other agricultural practices were carried out as local recommended, and plants were irrigated daily using drippers of 2L/ hr discharge.

Measurements:

Vegetative growth and yield parameters:

Five whole plant samples per sub-plot were randomly 80 days after planting, for the determination of the vegetative growth characters (plant length (m), Foliage fresh weight (kg) and Foliage dry weight (%). Another five random plants were used for determining plant tuber root yield (kg). Tuber root yield was determined in weight and number of all tuber roots per plant. Total tuber root yield (ton / fed) was determined.

Table 1. Some monthly meteorological data of the experimental location at Sadat City during the two years(2008 and 2009)of the study

Meteorological	June		July		August		September	
	2008	2009	2008	2009	2008	2009	2008	2009
Temperature (°C)	29.0	30.0	29.0	30	30.0	29.0	27	28
Rainfall (mm)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Relative humidity (%)	46.9	45.6	59.2	57.5	60.4	58.0	56.5	56.6
Wind speed (Km/h)	13.0	13.0	12.0	12.0	11.0	11.0	12.0	12.0

Table 2. The main physical and chemical properties of the experimental soil (average of two seasons)

Particle size distribution			Texture	pH*	EC. dS/m**	$CaCO_3$%	O.M.%
Sand%	Silt%	Clay%					
90	5	5	sandy	7.26	6.00	5.5	0.80
Chemical analysis							
Water soluble Cations (meq/L)				Water soluble Anions (meq/L)			
Ca^{++}	Mg^{++}	Na^{+}	K^{+}	HCO_3^{-}		CL^{-}	SO_4^{--}
53.75	23.75	17.1	2.16	8.0		68.0	20.76

*measured in 1: 2.5 soil water suspension.

** measured in soil water Paste extract

Table 3. Field capacity, wilting point and bulk density of the soil in the experimental site (average of the two seasons)

Soil depth (cm)	Moisture content at field capacity (%)	Wilting point (%)	Soil bulk density (g/ cm3)
0 – 30	19.2	10.02	1.45
30 – 60	19.0	9.5	1.50
Average	19.11	9.78	1.48

Table 4. Irrigation period, No. of irrigations/ season, irrigation water/day and irrigation water/ season as affected by irrigation treatments during the two growth seasons

Variables / Treatments	Irrigation period, days		No. of irrigations/season		Irrigation water m^3/ fed. /day		Irrigation water m^3/ fed. /season	
Evapotranspiration	S 1	S 2	S 1	S 2	S 1	S 2	S 1	S 2
100 %	110	110	47.83	47.83	77.16	76.43	3690.75	3655.82
85 %	110	110	47.83	47.83	65.59	64.97	3137.13	3107.45
70 %	110	110	47.83	47.83	54.02	53.50	2583.52	2559.07
55 %	110	110	47.83	47.83	42.47	42.06	2029.90	2010.70

S 1 = 2008 season.
S 2 = 2009 season.

Chlorophyll density: The non-destructive chlorophyll content was determined in plant leaves; using the handheld chlorophyll content meter (CCm-200), produced by Opti-Sicences, Inc. 8 Winn Avenue Hudson, NH 03051, U.S.A.

Water use efficiency (WUE):

Water–use efficiency (WUE) was calculated as kg of sweet potato tuber root yield produced per cubic meter of water consumed (Doorenbos and Kassem, 1979 and Ahmed, 1987).

$$WUE = \frac{\text{Tuber root yield (kg / fed.)}}{\text{Water use } (m^3 / \text{fed.})}$$

Tuber root quality:

1- Tuber root dry matter(%) was determined by weighing a known weight of fresh tubers and then dried in air oven at 70 C until a constant weight was maintained.

2- Determination of reducing and non-reducing sugars content: A known mass (5 g) of fresh tuber root was taken to determine the concentration of reducing and non-reducing sugars, using sulphuric acid and phenol (5%); then colourimetrically determined, according to the method of Dubios *et. al*. (1956).

3- Determination of starch: Starch content in tuber root was determined using a sample of 1 g of fresh tuber, according to the method described in A.O.A.C. (1970**).**

4- Determination of carotene content: Carotene content was determined as β carotene, using the method described by Uniel and. Gabelman (1971). A Milton Roy spectrophotometer-601 at 440 nm, was used.

Experimental design and statistical analysis:

The used experimental layout was arranged as a split-plot in a randomized complete blocks design (R.C.B.D), with three replicates. Irrigation rates were randomly distributed in the main plots, while Folicote concentrations were randomly distributed in the subplots. Collected data of the experiments were statistically analyzed, using the analysis of variance method. Comparisons among the means of different treatments were done, using Duncan's multiple range test procedure at $P \leq 0.05$ level of significance, (Snedecor and Cochran, 1980).

RESULTS AND DISCUSSION

1- Vegetative growth characters of sweet potato:

Table (5) showed that the studied vegetative characters were affected significantly by irrigation rates, exception for chlorophyll content. Generally, vegetative characters increased significantly with increasing irrigation rates from 55% up to 100%.Similar finding was obtained by Smittle *et al*.(1990) due to irrigation regimes on sweet potato. The same trend was noticed with spraying Folicote, where the vegetative traits appeared, generally; to increase significantly with increasing the Folicote concentration from zero to 15%. The interaction between irrigation rates and Folicote concentrations had significant effect to alter the studied vegetative characters, i.e.; plant length and foliage fresh

weight during the first season only while, foliage dry weight was affected with this interaction during the two seasons. Meanwhile, the other studied characters were not affected with the aforementioned interaction.

2- Yield and its component characters of sweet potato:

Table 6 showed that 100% of irrigation water (recommended rate) was the best to obtain the highest production of sweet potato (11.56 ton/fed.) followed by the 85% treatment of recommended irrigation water (10.85 ton/fed.), while the worst productivity (5.90 ton/fed.) resulted with the treatment of 55%irrigation water. Tuber root number per plant trait was only affected by irrigation rates in the second season, while average tuber root weight per plant was significantly affected by irrigation rates only in the first season, where; the rate of 85 % gave the highest value without significant differences with 100 % irrigation rate (Table 6). Similar results were obtained by Smittle *et al*.(1990) to confirm the obtained results. Also, the results obtained by Osman and Hegazi (2001) seemed to confirm these results.

The obtained data revealed that sweet potato yield was found to increase significantly with Folicote applications. Total tuber root yield gradually increased as the Folicote rate increased, especially in the second season, where; the highest sweet potato yield was pronounced when the highest rate of Folicote (15%) was applied. On the other hand, the concentration of 10 % Folicote gave the highest yield per plant followed with the concentration of 15 % Folicote in the first season (Table 6). The characters of tuber root number per plant and tuber root weight was not affected significantly by Folicote concentrations during the two growing seasons years of the study. Most of the studied characters were insignificantly affected with the interaction of the applied factors (irrigation water X Folicote concentration), with the exception of tuber root yield, especially in the first season of the study which possessed significant effect regarding this interaction. In this respect, Table (6) showed that application of 15% Folicote at the rate of 85% of irrigation water produced an approximately production equals to that of supplemented with 100% of the recommended irrigation water rate (10.55 ton / fed.). It means that with applying the Folicote as a foliar spraying to the growing sweet potato plants we can save about 550 m^3 of irrigation water per feddan.

As its shown in Table (6), Water use efficiency WUE (kg/m^3), 85% and 70% irrigation rate did not vary significantly and being higher than 100% irrigation. It is worth to mention that 55% irrigation rate exhibited significantly the least WUE (kg/m^3) in the first season. On the other hand, no significant differences could be traced in WUE (kg/m^3) values at 100%, 85% and 70% irrigation, on contrary to 55% irrigation, being significantly the least WUE (kg/m^3) value in the second season. Simelar results were obtaind by Sayed *et. al.* (2001) on squash seemed to be confirm this finding

It was obvious that 5% Ffolicote in the first season and zero % folicote in the second season gave the highest WUE (kg/m^3) (Table 6).

Regarding irrigation rate x Folicote interaction, 100% irrigation x 10% Folicote and 70% irrigation x 10% Folicote gave significantly the highest WUE (kg/m^3) in the first season. In contrast no significant differences could be figured out in terms of WUE (kg/m^3) in the second season under different irrigation and Folicote percentages investigated in the present study.

3- Tuber root quality characters of sweet potato:

Table (7) showed that tuber root dry matter (%) character was significantly affected with irrigation rates. The results clearly appeared that tuber dry matter, gradually; increased from 26.87% up to 29.58% with increasing irrigation level from 55 % up to 100 % in the first season. The same trend was detected in the second season, where; dry matter percentage increased from 24.17 % to 27.50 %.

Table (7) showed that non-reducing sugars content trait was not affected with the varying in irrigation rates from 55 % up to 100 % of the recommended irrigation water quantity. The other studied quality characters, i.e.; carotene content, reducing sugars and starch percentages responded differently from season to another with respect to irrigation rates as appears from Table (7).

The results of the effect of Folicote percentages on quality characters appeared that none of carotene content and reducing sugars percentages were affected with Folicote spraying through the two seasons of the experiment (Table 7). The results corresponding tuber dry matter percentage clearly appeared that dry matter content gradually increased with increasing Folicote concentration from zero to 15 %. The two characteristics, i.e., non-reducing sugars and starch content was affected with varying the Folicote concentrations only in the second season, where; the concentration of 5 % Folicote gave the highest values with these two traits (Table 7). The interaction between water irrigation rates and Folicote spraying concentrations revealed insignificant effects on most studied quality characters except for both non-reducing sugars and starch contents only in the second season of the study, as appears from the data of Table (7).

Table 5. Effect of irrigation rates and Folicote antitranspirant on vegetative growth characteristics of sweet potato during both summer seasons of 2008 and 2009

seasons		1 st 2008				2 nd 2009			
Treatments		plant length (m)	Foliage fresh weight (Kg)	Foliage dry weight (%)	Leaf chlorophyll content	plant length (m)	Foliage fresh weight (Kg)	Foliage dry weight (%)	Leaf chlorophyll content
Irrigation percentages treatment									
100 % irrigation		3.027 a	0.621 a	21.40 a	11.65 a	3.169 a	0.707 a	26.88 a	13.35 a
85 % irrigation		3.070 a	0.585 b	19.17 b	11.94 a	2.645 b	0.675 a	25.53 a	13.23 a
70 % irrigation		2.538 b	0.480 c	20.03 ab	11.71 a	2.456 c	0.566 b	22.49 b	13.06 a
55 % irrigation		2.270 c	0.406 d	18.81 b	11.88 a	2.174 d	0.413 c	22.82 b	13.57 a
Folicote percentages treatment									
15 % Folicote		2.869 a	0.551 a	20.92 a	13.45 a	2.796 a	0.640 a	23.85 b	15.89 a
10 % Folicote		2.859 a	0.585 a	19.87 ab	12.27 b	2.657 b	0.605 b	24.67 ab	14.38 b
5 % Folicote		2.582 b	0.502 b	19.66 b	11.34 c	2.548 c	0.583 b	25.54 a	12.19 c
0 % Folicote		2.595 b	0.454 c	18.97 b	10.12 d	2.442 d	0.534 c	23.67 b	10.75 d
Irrigation X Folicote Interaction									
100 % irrigation	**15 % Folicote**	3.19 a	0.720 a	22.45 b	12.94 a	3.44 a	0.747 a	23.94 d	16.27 a
	10 % Folicote	3.03 a	0.687 b	20.29 c	11.98 a	3.27 a	0.720 a	26.50 b	14.73 a
	5 % Folicote	2.92 b	0.547 bc	21.36 b	11.49 a	3.07 a	0.713 a	28.87 a	11.37 a
	0 % Folicote	2.97b	0.533 bc	25.87 a	10.18 a	2.90 a	0.650 a	28.09 a	11.03 a
85 % irrigation	**15 % Folicote**	3.33 a	0.637 b	19.97 c	14.50 a	2.83 a	0.733 a	27.09 a	15.80 a
	10 % Folicote	3.43 a	0.667 b	18.54 c	12.82a	2.66 a	0.697 a	23.96 d	14.10 a
	5 % Folicote	2.82bc	0.533 bc	20.87 c	10.84 a	2.55 a	0.673 a	27.77 a	12.40 a
	0 % Folicote	2.70 bc	0.517 bc	17.49cd	9.61 a	2.54 a	0.600 a	23.30 d	10.63 a
70 % irrigation	**15 % Folicote**	2.57 c	0.420 c	20.48 c	12.99 a	2.60 a	0.607 a	21.73 e	15.40 a
	10 % Folicote	2.65 c	0.547 bc	19.93 c	11.99 a	2.45 a	0.573 a	24.39 c	13.90 a
	5 % Folicote	2.35 d	0.520 bc	18.94 c	10.99 a	2.43 a	0.567 a	23.21 d	12.13 a
	0 % Folicote	2.53 c	0.433 c	20.80 c	10.86 a	2.35 a	0.520 a	20.63 f	10.80 a
55 % irrigation	**15 % Folicote**	2.33 de	0.440 c	20.97 c	13.39 a	2.32 a	0.473 a	22.64 d	16.10 a
	10 % Folicote	2.32 de	0.443 c	20.73 c	12.29 a	2.26 a	0.433 a	23.70 d	14.80 a
	5 % Folicote	2.25 e	0.413 c	17.46 d	12.02 a	2.15 a	0.380 a	22.30 e	12.87 a
	0 % Folicote	2.18 e	0.333 d	16.08 e	9.83 a	1.98 a	0.367 a	22.65 d	10.53 a

Means having an alphabetical letter in common, within a comparable group of means, do not significantly differ, using Duncan,s multiple test at $p \leq 0.05$ level of significance

Table 6. Effect of irrigation rates and Folicote antitranspirant concentrations on tuber root yield, yield component and Water Use Efficiency (WUE) of sweet potato during both summer seasons of 2008 and 2009

seasons		1 st 2008					2 nd 2009				
Treatments		Tuber root yield/plant (kg)	No. of tubers root /plant	Tuber root weight (kg)	Total tuber root yield ton/fed	WUE (kg)/m3	Tubers root Yield /plant (kg)	No. of tubers root / plant	Tuber root weight (kg)	Total tuber yield ton/fed	WUE kg/m3
Irrigation percentages treatment											
100 % irrigation		**1.085 a**	5.83 a	0.198 ab	11.56 a	3.20 b	1.030 a	5.88 a	0.183 a	10.96 a	2.99 a
85 % irrigation		**1.018 a**	4.77 a	0.222 a	10.85 a	3.46 a	0.875 b	5.22 ab	0.176 a	9.32 b	2.99 a
70 % irrigation		**0.871 b**	5.50 a	0.174 b	9.28 b	3.59 a	0.746 c	4.44 b	0.170 a	7.95 c	3.11 a
55 % irrigation		**0.554 c**	5.47 a	0.102 c	5.9 c	2.91 c	0.480 d	5.94 a	0.086 a	5.11 d	2.55 b
Folicote percentages treatment											
15 % Folicote		**0.915 b**	5.97 a	0.166 a	9.75 b	2.99 c	0.848 a	5.75 a	0.159 a	9.03 a	2.70 d
10 % Folicote		**1.037 a**	5.66 a	0.189 a	11.05 a	2.94 c	0.797 b	5.16 a	0.155 a	8.49 b	2.84 c
5 % Folicote		**0.778 c**	4.69 a	0.176 a	8.29 c	3.78 a	0.764 b	5.77 a	0.140 a	8.14 b	2.97 b
0 % Folicote		**0.799 c**	5.25 a	0.163 a	8.51 c	3.46 b	0.721 c	4.80 a	0.162 a	7.68 c	3.16 a
Irrigation X Folicote Interaction											
100 % irrigation	**15 % Folicote**	1.025 bc	6.78 a	0.171 a	10.92 bc	2.96 c	1.087 a	6.67 a	0.166 a	11.58 a	3.17 a
	10 % Folicote	1.516 a	6.11 a	0.259 a	16.15 a	4.37 a	1.063 a	6.00 a	0.181 a	11.32 a	3.10 a
	5 % Folicote	0.857 d	5.33 a	0.170 a	9.13 d	2.47 cd	1.017 a	5.66 a	0.205 a	10.84 a	2.96 a
	0 % Folicote	0.941 cd	5.11 a	0.187 a	10.02 cd	2.71 b	0.953 a	5.22 a	0.197 a	10.15 a	2.77 a
85 % irrigation	**15 % Folicote**	1.095 b	5.67 a	0.196 a	11.66 b	3.72 b	0.990 a	4.89 a	0.225 a	10.55 a	3.39 a
	10 % Folicote	1.005 bc	5.44 a	0.196 a	10.71bc	3.41 b	0.870 a	5.00 a	0.176 a	9.13 a	2.98 a
	5 % Folicote	1.046 bc	4.22 a	0.250 a	11.14 bc	3.55 b	0.857 a	5.89 a	0.147 a	9.13 a	2.94 a
	0 % Folicote	0.928 cd	3.78 a	0.246 a	8.83 cd	3.15 c	0.781 a	5.11 a	0.159 a	8.32 a	2.68 a
70 % irrigation	**15 % Folicote**	0.829 de	5.33 a	0.175 a	11.47 de	3.42 b	0.799 a	4.78 a	0.167 a	8.51 a	3.33 a
	10 % Folicote	1.077 b	5.44 a	0.206 a	7.28b	4.44 a	0.763 a	4.67 a	0.164 a	8.13 a	3.18 a
	5 % Folicote	0.683 f	4.00 a	0.184 a	9.56 f	2.82 c	0.726 a	4.66 a	0.158 a	7.73 a	3.02 a
	0 % Folicote	0.897 cd	7.22 a	0.132 a	7.57 cd	3.70 b	0.698 a	3.67 a	0.194 a	7.44 a	2.91 a
55 % irrigation	**15 % Folicote**	0.711 f	6.11 a	0.120 a	5.86 f	3.73 b	0.518 a	6.67 a	0.079 a	5.52 a	2.74 a
	10 % Folicote	0.550 g	5.67 a	0.097 a	5.6 g	2.89 c	0.492 a	5.00 a	0.099 a	5.24 a	2.61 a
	5 % Folicote	0.526 g	5.22 a	0.102 a	5.329 g	2.76 c	0.460 a	6.89 a	0.067 a	4.90 a	2.44 a
	0 % Folicote	0.432 g	4.89 a	0.090 a	4.60 g	2.27 cd	0.452 a	5.22 a	0.101 a	4.82 a	2.40 a

Means having an alphabetical letter in common, within a comparable group of means, do not significantly differ, using Duncan,s multiple test at $p \leq 0.05$ level of significance

Table7. Effect of irrigation rates and Folicote antitranspirant of tuber root quality attributes of sweet potato during both summer seasons of 2008 and 2009

Treatments		Tuber dry matter (%)	Carotene content (mg/100g)	Reducing sugars (%)	Non reducing sugars (%)	Starch (%)	Tuber dry matter (%)	Carotene content (mg/100g)	Reducing sugars (%)	Non reducing sugars (%)	Starch (%)
Irrigation percentages treatment											
100 % irrigation		**29.58 a**	4.08 bc	3.43 a	1.64 a	16.71 b	27.50 a	4.14 ab	3.68 b	1.70 a	14.04 a
85 % irrigation		**28.80 b**	4.43 a	3.45 a	1.75 a	17.80ab	26.43 b	3.83 b	3.83 b	2.01 a	12.78 b
70 % irrigation		**27.97 c**	4.39 ab	3.42 a	1.61 a	18.27 a	24.87 c	3.83 b	4.15 a	2.01 a	13.82 a
55 % irrigation		**26.87 d**	3.87 c	3.47 a	1.63 a	18.47 a	24.17 d	4.45 a	4.20 a	1.87 a	13.18 b
Folicote percentages treatment											
15 % Folicote		**28.61a**	4.14 a	3.47 a	1.46 a	17.72 a	26.25 a	4.18 a	3.97 a	1.80 b	12.82 b
10 % Folicote		**28.48a**	4.17 a	3.47 a	1.78 a	18.21 a	25.94ab	3.99 a	4.09 a	1.97ab	13.16 b
5 % Folicote		**28.22ab**	4.21 a	3.34 a	1.83 a	18.33 a	25.47bc	4.22 a	3.77 a	2.07 a	14.00 a
0 % Folicote		**27.92b**	4.24 a	3.49 a	1.56 a	17.00 a	25.31 c	3.86 a	4.03 a	1.74 b	13.85 a
Irrigation X Folicote Interaction											
100 % irrigation	**15 % Folicote**	**30.00 a**	4.29 a	3.83 a	1.30 a	17.83 a	28.07 a	4.43 a	3.87 a	1.40 f	12.83 cd
	10 % Folicote	**29.83 a**	3.73 a	3.43 a	1.67 a	16.30 a	27.77 a	4.10 a	3.60 a	1.67 e	13.80 c
	5 % Folicote	**29.37 a**	4.24 a	3.10 a	2.17 a	17.23 a	27.10 a	4.26 a	3.57 a	2.27 a	15.50a
	0 % Folicote	**29.13 a**	4.07 a	3.37 a	1.43 a	15.47 a	27.07 a	3.79 a	3.70 a	1.47f	14.03 b
85 % irrigation	**15 % Folicote**	**29.07 a**	4.15 a	3.43 a	1.60 a	17.17 a	26.96 a	3.85 a	3.63 a	2.13 bc	12.37 d
	10 % Folicote	**28.93 a**	4.47 a	3.50 a	1.77 a	18.40 a	26.83 a	3.63 a	3.87 a	1.97 c	12.50 d
	5 % Folicote	**28.50 a**	4.28 a	3.23 a	2.10 a	18.13 a	26.13 a	4.07 a	3.73 a	2.27 a	13.20 c
	0 % Folicote	**28.70 a**	4.80 a	3.63 a	1.53 a	17.50 a	25.50 a	3.80 a	4.10 a	1.67 e	13.07 c
70 % irrigation	**15 % Folicote**	**28.30 a**	4.13 a	3.30 a	1.07 a	16.87 a	25.27 a	4.14 a	4.33 a	1.70 de	13.47 c
	10 % Folicote	**28.17 a**	4.66 a	3.27 a	2.50 a	20.13 a	24.90 a	3.52 a	4.43 a	2.50 a	13.77 c
	5 % Folicote	**28.06 a**	4.42 a	3.67 a	1.27 a	19.50 a	24.60 a	3.96 a	3.80 a	1.90 c	15.10 a
	0 % Folicote	**27.37 a**	4.35 a	3.47 a	1.60 a	16.60 a	24.44 a	3.72 a	4.03 a	1.93 c	12.93 cd
55 % irrigation	**15 % Folicote**	**27.00 a**	4.14 a	3.33 a	1.87 a	18.43 a	24.37 a	4.32 a	4.07 a	1.97 c	12.60 cd
	10 % Folicote	**27.00 a**	3.70 a	3.67 a	1.20 a	18.47 a	24.23 a	4.72 a	4.47 a	1.73 de	12.57 d
	5 % Folicote	**26.97 a**	3.91 a	3.37 a	1.80 a	18.00 a	24.00 a	4.63 a	3.97 a	1.87 d	12.20 d
	0 % Folicote	**26.47 a**	3.75 a	3.50 a	1.67 a	19.00 a	23.00 a	4.13 a	4.30 a	1.90 c	15.37 a

Means having an alphabetical letter in common, within a comparable group of means, do not significantly differ, using Duncan,s multiple test at $p \leq 0.05$ level of significance

Conclusion

The results of the present study have some practical uses in the areas of vegetable production, especially under limited water resources, such as in arid and semi-arid regions, where Folicote plays a fundamental role as: 1- conserving water supplies, hence minimizing the irrigation water requirements, 2- improving plant growth and productivities of the growing crops (Gawish, 1992).and 3- maximizing the water-use efficiency.

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الملخص العربي

تاثير مضاد النتح الفوليكوت ونظام مياه الرى على صفات نمو نباتات البطاطا فى الاراضى الرملية

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أجريت تجربتان حقليتان على نباتات البطاطا بالمزرعة البحثية لمعهد الدراسات والبحوث البيئية بمدينة السادات- جامعة المنوفية- جمهورية مصر العربية.

تمت الزراعة بإستخدام شتلات الصنف بيوريجارد خلال الموسم الصيفى لعامى 2008، 2009 وذلك بغرض دراسة كفاءة إضافة مضاد النتح (الفوليكوت) فى تقليل الفقد المائى من نباتات البطاطا عن طريق الثغور وذلك من خلال التعرف على تأثير كميات الرى المستخدمة فى رى نباتات البطاطا(100%، 85%، 70%، 55% من إحتياجات البطاطا لمياه الرى) ،وأيضا دراسة تأثير تركيزات الفوليكوت المستخدمة رشا على نباتات البطاطا (15%، 10%، 5%، صفر %)، والتداخل بينهما على عدد من الصفات الهامة لمحصول البطاطا. أستخدم في إجراء التجربتين نظام القطع المنشقة فى تصميم القطاعات الكاملة العشوائية، وذلك بثلاث مكررات، حيث وزعت عشوائيا معاملات الرى على القطع الرئيسية ،بينما تم توزيع معاملات تركيزات الفوليكوت على القطع تحت الرئيسية.

تشير النتائج المتحصل عليها إلى الأتي:

- اظهرت النتائج انخفاض محصول الجذور للنبات ومحصول الجذور للفدان مع انخفاض معدلات الرى وتركيزات الفوليكوت على مدار السنتين، وكان هناك تأثير كبير للتداخل بين هذين العاملين فى السنة الأولى فقط من الدراسة على محصول الجذور للنبات والمحصول الكلى للفدان.
- حققت كفاءة استهلاك الماء أعلى القيم عند 85%, 70% معدل رى فى الموسم الأول للدراسة.
- تأثرت الصفات الخضرية لطول النبات، ووزن المجموع الخضرى الطازج للنبات إيجابيا مع كل من معدلات الرى وتركيزات الفوليكوت. وكان هناك تأثير كبير للتداخل بين هذين العاملين فى السنة الأولى فقط من الدراسة على هاتين الصفتين.
- تأثر محتوى كل من السكريات غير المختزلة والنشا بالجذور بالتداخل بين معدلات الرى وتركيزات الفوليكوت خلال الموسم الثانى فقط من الدراسة.
- اتضح من النتائج المتحصل عليها أنه يمكن تقليل كمية مياه الرى المستخدمة فى رى نباتات البطاطا بنسبة 15% من الكمية المقررة للحصول على نفس كمية الإنتاج بإضافة الفوليكوت رشا على نباتات البطاطا بتركيز 15%.