Zagazig J. Agric. Res., Vol. 47 No. (4) 2020 963-974

Soil Science and Agricultural Engineering

Available online at http://zjar.journals.ekb.eg

http:/www.journals.zu.edu.eg/journalDisplay.aspx?Journalld=1&queryType=Master

IMPACT OF IRRIGATION WATER REGIMES AND ANTI-TRANSPIRATIONS WITH HYDRO-GEL ON NUTRITIONAL STATUS OF PEANUT GROWN IN SANDY SOIL

Heba A.A. El Shahawy[1*], A.E. El-Sherbieny[2], A.A. Sheha[2] and N.R. Habashy[1]

1. Soils, Water and Environ. Res. Inst., ARC, Egypt

2. Soil Sci. Dept., Fac. Agric., Zagazig Univ., Egypt

Received: 23/09/2019 ; Accepted: 09/06/2020

ABSTRACT: Two field experiments were carried out on a newly reclaimed sand soil under drip irrigation system at Ismailia Agricultural Research Station, Ismailia Governorate, Egypt located between Latitude 30° 35' 30" N, Longitude 32° 14' 50" E and Elevation 3 meters, and cultivate with peanut plants as summer season (*Arachis hypogaea*, Giza 5 c.v) during the agricultural growing season of 2016 and 2017 at rate of 50 kg fad^{-1}. To evaluate foliar application of some anti-respiration (chitosan at rate of 0.0, 5.0, 10.0) and (abscisic acid at rate of 0.0, 15.0, 20.0 mg l^{-1}), as foliar spray afternoon at three times after three weeks from sowing (30, 60 and 90 days) and applied hydrogel at rate of zero, 2 and 3% as soil application under two irrigation water requirements 100 and 75% (1125 and 884 m^3 fad.$^{-1}$). Results obtained showed that: It was clear that applied irrigation water requirements at rate 100% with foliar spray of 5 mg l^{-1} chitosan and soil application of hydro-gel at rate of 2% on both seed yield of peanut and contents of macro-nutrients (N, P and K) and micro-nutrias (Fe, Mn and Zn) for seeds and high water use efficiency at irrigation water requirements 100% accompanied with foliar application of abscisic acid and hydrogel at rate of 3%.

Key word: Irrigation water, anti-raspirations, drip irrigation system, nutritional status, peanut plants, sandy soils.

INTRODUCTION

Peanut (*Arachis hypogeae* L.) is one of the most important cash crops grown in Egypt (**Shaban *et al.,* 2009**). Increasing planted area of peanut is considered a good way to improve its production (**El-Hameed, 2005**). Nutritional quality of oil is determined by its fatty acid composition. Oleic, a monounsaturated acid, and linoleic, a polyunsaturated fatty acid, account for 75-80% of the total fatty acids in peanut oil. Oleic/linoleic acid ratio and iodine value are both indicators of oil stability and shelf life of peanut products. Peanuts with high oil ratio and low iodine value have long product stability (**Dwivedi *et al.,* 1993**).

Plants under water stress can avoid the harmful of drought throw several ways among them stomatal closure, leaf rolling, osmotic adjustments, reductions and consequently decreases in cellular expansion, and alterations of various essential physiological and biochemical processes that can affect growth, productivity and yield quality (**Hefny, 2011; Farouk and Ramadan, 2012**). In this respect, **Bittelli *et al.* (2001)** reported that occasional or episodic drought events can be counteracted through the use of anti-transpirants, compounds applied to foliage to limit the water loss. These compounds are able to increase leaf resistance to water vapor loss, thus improving plant water use and increasing biomass or yield (**Tambussi and Bort, 2007**).

The hydrogel has the ability to function in absorption-desorption cycles of water and nutrients, releasing them to the plants

***Corresponding author: Tel. :** +201272210042
E-mail address: hebaana277@gmail.com

accordingly with their requirements (**Farrell *et al.,* 2013; Galeş *et al.,* 2016**). Hydrogels also increase the efficiency of water use and reduce the frequency of irrigation (**Sivapalan, 2006**). In addition, they enhance the efficiency of fertilizer use (**El-Hady and Wanas, 2006**).

Water stress impaired the growth of plants and decreased the content of nutrient elements and photosynthetic pigments as well as carbohydrate concentration in shoots. Also water stress affects the yield and its quality represented by nutrient elements, protein and carbohydrate concentrations. Foliar-applied chitosan, in particular 200 mg l^{-1}, increased plant growth, yield and its quality as well as physiological constituents in plant shoot under stressed or non-stressed conditions as compared to chitosan untreated plants. It is suggested that chitosan could be a promising material used to reduce the harmful effect of water stress on the growth and yield of common plant(**Abu-Muriefah, 2013**).

Peanut has the potential to have very high photosynthetic capacity accompanied by low stomatal conductance levels, translating into high WUE without sacrificing carbon assimilation and possibly yield (**Wright *et al.,* 1993**).

The objectives of this study are to evaluate the impact of some anti-respiration and hydro-gel with irrigation water regimes on productivity and nutritional status of both peanut plant grown under sandy soil conditions and to increase water use efficiency.

MATERIALS AND METHODS

A field experiment was conducted on a newly reclaimed sandy texture class under drip irrigation system at Ismailia Agricultural Research Station, Ismailia Governorate, Egypt, and cultivated with peanut plants as summer season (*Arachis hypogaea*, Giza 5) during the agricultural growing season of 2016 and 2017. The current study aims to evaluate foliar application of anti-Transpiration chitosan and abscisic acid at rate of 0.0, 5.0, 10.0 and 0.0, 15.0, 20.0 mg l^{-1}, respectively at different water requirements 100 and 75% (1125 and 884 m^3 $fad.^{-1}$) on nutrient contents in soil, seeds productivity, nutritional status of peanut plants, and water use efficiency. Some physical and chemical properties of studied sandy soil are illustrated in Table 1.

Irrigation water requirement for peanut plant is 1125 m^3 fad^{-1}. The design was split-split plot, two irrigation water regimes are 100 and 75% from water requirement (1125 and 884 m^3 $fad.^{-1}$) as main plots. Two type of anti-transpiration were used as sub plots with three concentration rates as sub-sub plots of chitosan at rate of 0.0, 5.0 and 10.0 g $l^{-1}$and abscisic acid at rate of 0.0, 15.0 and 20.0 g $l^{-1.}$ Two application rates applied of hydro-gel at 0.0, 2.0 and 3.0% as soil application.

All peanut plots received 40 kg $fad.^{-1}$ nitrogen as ammonium sulphate (20.6% N), added as basal doses in two equal ones (one and two months after planting). Phosphorus was (12.0% P_2O_5), while K was added with a rate of 50 kg $fad.^{-1}$ K_2O as potassium sulphate (48% K_2O) during the preparation of soil cultivation.

Physical, chemical and fertility properties of the investigated soil (bulk density, total porosity, hydraulic conductivity, moisture constants and nutrients retained) at elongation stage of vegetative growth were determined according to the standard methods as described by **Piper (1950), Richerds (1954) and Page *et al.* (1982)**. Available N, P and K were extracted by 1.0% K_2SO_4, 0.5 M solution sodium bicarbonate and 1.0 N ammonium acetate, respectively and were determined according to **Jackson (1981)**. Available micronutrients of Fe, Mn and Zn were extracted by DTPA (**Lindsay and Norvell, 1978**) and determined using Atomic Absorption Spectrophotometer.

Yield of peanut and seed nutrient contents of N, P, K, Fe, Mn and Zn were determined.

For each plot, the selected samples for both seeds and foliage were dried; ground and wet digested using mixture of H_2SO_4+$HClO_4$ acid. In the digested products, N was determined with a micro-Kjeldahl (**Chapman and Pratt, 1961**). Phosphorus was determined colourmetrically according to **Watanab and Olsen (1965)**. Water use efficiency (WUE, kg ha^{-1} cm^{-1}) was calculated using the equation of **Vites (1965)** for grain yield, as followed formula: WUE=Seed yield in kg ha^{-1}/actual consumptive used in m^3 ha^{-1}.

Table 1. Some physical and chemical properties of the experimental soil

Soil characteristic	Value	Soil characteristic	Value
Particle size distribution (%)		**Soluble cations (soil paste mmole$_c$ L^{-1})**	
Sand	87.25	Ca^{2+}	0.82
Silt	8.90	Mg^{2+}	0.58
Clay	3.85	Na^{+}	0.95
Textural class	Sand	K^{+}	0.14
Soil chemical properties		**Soluble anions (soil paste mmole$_c$L^{-1})**	
pH (1:2.5 soil water suspension)	7.69	CO_3^{2-}	0.00
$CaCO_3$ (%)	1.33	HCO_3^{-}	1.45
Organic carbon (%)	0.21	Cl^{-}	0.71
ECe (dS m^{-1}, soil paste extract)	0.25	SO_4^{2-}	0.34
Soil physical properties			
Bulk density g cm^{-3}	1.68	Total aggregate (%)	14.79
Hydrulic conductivity (cm hr.$^{-1}$)	5.84	Avail. Water (%)	7.11
Soil moisture at wilting point (%)	4.98	Soil moisture at field capacity (%)	12.09

Available nutrients mg kg^{-1}

N	P	K	S	Fe	Mn	Zn
11.79	5.58	70.01	0.99	6.42	0.88	0.51

Potassium was determined using a Flamephotometer, according to **Jackson (1981)**. Iron, manganese and zinc were determined using an Atomic Absorption Spectrophotometer. All collected data were statistically analyzed according to **Gomez and Gomez (1984)**.

RESULTS AND DISCUSSION

The current work may be helpful for identifying the best soil agro-management practices of some newly reclaimed soils for maximizing their productivity, especially for soils have no partially capable to retain neither water nor nutrients for growing plants. In addition, these soils are poor not only in the nutrient-bearing minerals, but also in organic matter, which are a storehouse for the essential plant nutrients; in turn the productivity of different crops tends to decrease markedly (**Moustafa *et al.* 2005**).

Soil Properties

The experimental soil is mainly developed on the sand deposits as a parent material, and occupying the desert zone adjacent to Ismailia Governorate, Egypt. The prevailing climatic conditions of the studied area are long hot rainless summer and short mild winter with scare amounts of rainfall. The obtained results in Table 2 reveal that, the studied soil is characterized by coarse texture grade of sand and low CEC value as well as poorer in each of organic matter and nutrient bearing minerals, consequently its capacity to retain either plant nutrients or soil moisture is low. Such severe conditions get more attention for soil supplying essential nutrients to plants as well as soil amendments. That is true, since the available macro and micronutrient contents in the experimental sandy soil (Table 2) are lying at the low levels according to the critical levels of

Table 2. Soil limitations and rating indices for the evaluation of the studied soil

Suitability condition	Topography (t)	Wetness (w)	Source				Soil Salinity/ Alkalinity (n)	Rating (Ci)	Class	Sub class
			Soil texture (S1)	Soil depth (S2)	$CaCO_3$ (S3)	Gypsum (S4)				
Current	100	100	30	100	100	90	100	27	S3	S3S1S4
Potential	100	100	30	100	100	90	100	27	S3	S3S1S4

available plant nutrients outlined by **Lindsay and Norvell (1978) and Page *et al.* (1982)**. Such unfavorable conditions are more attributed to the siliceous in nature of soil, which is dominated by sand fraction that is not only poorer in the nutrient bearing minerals but also it is not partially capable to retain nutrients or moisture for grown plants.

According to **USDA (2006)**, data presented in Table 2 indicate that, by applying the parametric system undertaken by **Sys and Verheye (1978)**, the suitability class of studied sandy soil could be evaluated as marginally suitable class of (S3) either in current or potential conditions, besides soil texture (S1) and gypsum (S4) represent the most effective limitations for soil productivity, with intensity degrees of very severe (rating < 40) and slight (rating > 90), respectively.

Effect of Water Regime with Hydro-Gel with Different Anti-transpiration

Peanut seeds yield

Results recorded in Table 3 show that the application of two anti-transpiration (chitosan and abscisic acid) combined with 100 and 75% irrigation water at 2% application rate of hydro-gel resulted in a significant increases in yield of peanut seeds. Further, hydrogel addition improved water storage properties of porous soils and resulted in the delay and onset of permanent wilting percentages under intense evaporation. An increase in water holding capacity due to hydrogel significantly reduced the irrigation requirement of many plants (**Taylor and Halfacre, 1986**).

Results presented in Table 3 reveal that reducing irrigation requirements for 75% and the application of chitosan or abscisic acid at both rate under study gave less seed yield compared to 100% irrigation water applied under same condition. Drought resistance may be enhanced by improving the ability of the crop to extract water from the soil. Deep rooting, root length density and root distribution have been identified as drought adaptive traits (**Songsri *et al.,* 2008**). It is worth to note that 3.0% applied hydro-gel combined with abscisic acid at rate of 20 mg l^{-1} gave the lowest yield compared with the other treatments used.

The available results in Table 3 revealed that the effect of 100% irrigation water on peanut seeds yield was significantly increased with increasing the rate of hydo-gel from 0 to 2% under both foliar spray of anti-transpiration. The application of hydrogels may be is an important practice to assist plant growth by increasing water retention in sandy soils and its availability to grow in dry regions. The soil applied with hydrogel is known to improve seed and increases the quantity of available water and reduces plant stress with influence seed germination, growth, and the yields of plants (**Wallace and Wallace, 1986**).

Results in Table 3 show the effect of the interaction between 100% water requirement and chitosan at rate of 5.0 mg l^{-1} accompanied with 2.0 % soil application of hydro-gel. The interaction was significant and more pronounced on peanut yield. This result may be explained by that hydrogels increased the efficiency of water use and reduce the frequency of irrigation (**Sivapalan, 2006**). In addition, they enhance the efficiency of fertilizer use (**El-Hady and Wanas, 2006**).

Table 3. Effect of water regime with hydro-gel soil application and different anti-transpiration types on yield (kg fad.$^{-1}$) of peanut plants grown in sandy soil

Hydro-gel (%) (H)	Anti-transpiration types (A)						
	Control	Chitozan			Abcissic acid		
		mg l^{-1}					
		5	10	Mean	15	20	Mean
	Seed yield (Kg fad.$^{-1}$)						
	100% from water requirements (R)						
0	976.8	1698.4	1612.3	1429.1	1533.8	1435.9	1331.9
2	979.2	1765.0	1665.1	1469.7	1561.6	1472.6	1484.8
3	910.0	1675.7	1567.9	1384.5	1439.0	1306.8	1223.1
Mean	955.3	1713.0	1615.1	1427.8	1511.4	1405.1	1346.6
	75% from water requirements						
0	943.9	1333.8	1275.1	1304.4	1258.3	1234.7	1146.5
2	961.5	1406.1	1309.0	1225.5	1300.9	1243.2	12168.5
3	923.6	1299.0	1275.3	1165.9	1234.7	1221.0	1126.4
Mean	942.5	1346.3	1286.4	1231.9	1264.6	1232.9	1180.4
LSD at 0.05	H	R	A	H×R	H×A	R×A	H×R×A
	12.3	10.7	6.2	7.8	2.3	4.4	25.3

Nutritional Status of Peanut Plants

Mineral nutrients such as nitrogen, phosphorus, and potassium and calcium ion play multiple essential roles in plant mechanisms (**Junjittakarn *et al.,* 2013**).

Macronutrients content

The results obtained of macro-nutrients (N, P and K) content of peanut plants in Tables 4, 5 and 6 show that irrigation water applied at 100% (1125 m^3 fad.$^{-1}$) was more efficient than that applied at 75%. These results may be due to nutrient transportation to the root and root growth. Drought generally reduces nutrient uptake in crop plants and concentrations of mineral nutrients in plant tissues (**Fageria *et al.,* 2002**). Generally, nutrient uptake by crop plants grown in soil is greatly influenced by several factors including climate and water stress (**Alam, 1999**). Drought stress reduced the uptake of N, P and K in peanut (**Kulkarni *et al.,* 1988**). The reduction in nutrient uptake by plant under drought stress is due to reduced transpiration and impaired active transport and membrane permeability resulting in reduced root absorbing power (**Junjittakarn *et al.,* 3013**). Moreover, water stress at flowering, beginning, pod formation and pod development stages reduced pod yields of peanut and it also reduced the uptake of N, P, K, Ca, magnesium and sulfur (**Kolay, 2008**). Under drought stress conditions, the available soil N (NO^-_3 and NH^+_4) and N_2 fixation is greatly reduced and such reduction leads to low N accumulation and consequently low dry matter production and low crop yield (**Pimratch *et al.,* 2013**).

Concerning the anti-transpiration type and rates, results obtained showed that the same effect on macronutrients content as previously was found at all studies parameters. Chitosan was more effective at rate of 5 mg kg^{-1} at both 100% and 75% irrigation water than data obtained under abscisic acid condition.

Table 4. Effect of water regime with hydro-gel soil application and different anti-transpiration types on nitrogen content (g kg^{-1}) of peanut plants grown in sandy soil

Hydro-gel (%) (H)	Anti-transpiration types (A)						
	Control	Chitozan			Abcissic acid		
		mg l^{-1}					
		5	10	Mean	15	20	Mean
	100% from water requirements requirements (R)						
0	0.169	0.472	0.444	0.361	0.387	0.411	0.322
2	0.191	0.587	0.465	0.414	0.291	0.365	0.282
3	0.150	0.589	0.409	0.382	0.271	0.211	0.210
Mean	0.17	0.549	0.439	0.386	0.316	0.329	0.271
	75% from water requirements requirements						
0	0.155	0.311	0.323	0.277	0.261	0.253	0.227
2	0.143	0.354	0.392	0.282	0.274	0.283	0.229
3	0.131	0.233	0.220	0.194	0.183	0.152	0.155
Mean	0.143	0.998	0.971	0.277	0.239	0.229	0.203
Grand mean	0.156	0.773	0.705	0.331	0.277	0.279	0.237
LSD at 0.05	H	R	A	H×R	H×A	R×A	H×R×A
	0.23	0.12	0.33	0.11	0.21	0.09	0.16

Table 5. Effect of water regime with hydro-gel soil application and different anti-transpiration types on phosphorus content (g kg^{-1}) of peanut plants grown in sandy soil

Hydro-gel (%) (H)	Anti-transpiration types (A)						
	Control	Chitozan			Abcissic acid		
		mg l^{-1}					
		5	10	Mean	15	20	Mean
	100% from water requirements (R)						
0	0.332	0.808	0.734	0.624	0.446	0.563	0.447
2	0.316	0.711	0.645	0.557	0.365	0.479	0.386
3	0.211	0.623	0.563	0.465	0.240	0.274	0.241
Mean	0.286	0.714	0.647	0.549	0.350	0.438	0.358
	75% from water requirements						
0	0.244	0.418	0.301	0.321	0.318	0.2671	0.276
2	0.287	0.444	0.350	0.360	0.344	0.301	0.310
3	0.210	0.390	0.285	0.295	0.290	0.266	0.255
Mean	0.247	0.417	0.312	0.325	0.317	0.278	0.280
Grand mean	0.266	0.565	0.479	0.437	0.333	0.358	0.319
LSD at 0.05	H	R	A	H×R	H×A	R×A	H×R×A
	0.321	0.221	0.111	0.089	0.088	0.108	0.096

Table 6. Effect of water regime with hydro-gel soil application and different anti-transpiration types on potassium content (g kg^{-1}) of peanut plants grown in sandy soil

Hydro-gel (%) (H)	Anti-transpiration types (A)						
	Control	Chitozan			Abcissic acid		
		mg l^{-1}					
		5	10	Mean	15	20	Mean
	100% from water requirements (R)						
0	0.176	0.314	0.267	0.252	0.209	0.201	0.195
2	0.197	0.319	0.299	0.271	0.285	0.229	0.237
3	0.153	0.301	0.263	0.239	0.198	0.174	0.175
Mean	0.175	0.311	0.276	0.254	0.230	0.201	0.202
	75% from water requirements						
0	0.166	0.182	0.175	0.176	0.162	0.150	0.159
2	0.158	0.197	0.190	0.179	0.177	0.168	0.167
3	0.140	0.166	0.186	0.164	0.155	0.146	0.147
Mean	0.154	0.181	0.183	0.173	0.164	0.154	0.158
Grand mean	0.164	0.246	0.229	0.213	0.197	0.177	0.180
LSD at 0.05	H	R	A	H×R	H×A	R×A	H×R×A
	0.012	0.043	0.031	0.110	0.211	0.141	0.10

On the other hand, results also indicated that the hydro-gel at 2% in sandy soil application was more effective on nutrients (N, P, and K) content of peanut plants than 3.0% pronounced.

From the aforementioned results, it could be concluded that peanut plant under different water irrigation application accompanied with 2% soil application of hydro-gel with foliar spray of anti-transpiration chitosan at rates of 5.0 and 15 mg l^{-1} abscisic acid, has higher macronutrients contents under study.

Micronutrients content

The values of the interaction between amount of irrigation water, hydro-gel and anti-transpiration are given in Tables 7, 8 and 9. The results showed that irrigating peanut plants by 1125 m^3 fad.$^{-1}$ and application of hydro-gel at rate of 2.0% with foliar spray of 5.0 mg l^{-1} chitosan and 15 mg l^{-1} abscisic acid resulted in remarkable increases micronutrients (Fe, Mn and Zn) content of peanut. Nerveless, decreasing the amount of irrigation water from 1125 to 884 m^3 fad.$^{-1}$ decreased the micronutrients content.

This behavior may be due to soil moisture that plays an important role in the movement of nutrient to root and consequent absorption and final concentration in the plants. Similar findings were noticed by **Gunes *et al.* (2006)** who stated that decreasing water availability under drought generally results in reduced total nutrient uptake and frequently causes reduced concentrations of mineral nutrients in crop plants. Water deficit had important effect on the nutrient transport. **Ghanbari *et al.* (2011)** noted that yield, plant growth and nutrient uptake were reduced under conditions of drought. Since the reduction in soil water availability affects the rate of diffusion of many plant nutrients, the compositions and concentrations of soil solutions are also affected by drought.

Water Use Efficiency (WUE)

Results in Table 10 show the water use efficiency for peanut plants grown under drip irrigation system and irrigation water regime with different foliar application of anti-transpiration types and rates accompanied with soil application rate of hydro-gel.

Table 7. Effect of water regime with hydro-gel soil application and different anti-transpiration types on iron content (mg kg^{-1}) of peanut plants grown in sandy soil

Hydro-gel (%) (H)	Anti-transpiration types (A)						
	Control	Chitozan			Abcissic acid		
		mg l^{-1}					
		5	10	Mean	15	20	Mean
	100% from water requirements (R)						
0	97.6	287.0	237.3	207.3	151.7	200.9	150.1
2	108.6	333.5	248.0	230.0	171.3	226.4	168.7
3	94.7	273.4	205.2	191.1	144.7	195.5	144.9
Mean	100.3	298.0	230.3	209.4	155.9	207.6	154.6
	75% from water requirements						
0	90.3	166.7	161.0	139.3	157.3	156.1	134.6
2	100.9	170.3	165.8	145.7	164.9	162.7	142.8
3	88.9	162.8	159.8	137.2	152.8	145.7	129.1
Mean	93.4	166.6	162.2	140.7	158.3	154.8	135.5
Grand mean	96.9	232.3	196.3	175.1	157.1	181.2	145.1
LSD at 0.05	H	R	A	H×R	H×A	R×A	H×R×A

Table 8. Effect of water regime with hydro-gel soil application and different anti-transpiration types on manganese content (mg kg^{-1}) of peanut plants grown in sandy soil

Hydro-gel (%) (H)	Anti-transpiration types (A)						
	Control	Chitozan			Abcissic acid		
		mg l^{-1}					
		5	10	Mean	15	20	Mean
	100% from water requirements (R)						
0	127.5	374.5	261.2	254.4	350.2	259.78	245.8
2	128.3	379.0	267.7	258.3	351.6	260.4	246.7
3	125.8	372.9	265.7	254.8	348.6	253.86	242.7
Mean	127.2	375.4	264.8	255.8	350.2	258.0	245.1
	75% from water requirements						
0	129.5	248.1	237.8	205.1	218.9	207.6	185.3
2	121.1	255.0	239.5	205.2	225.7	219.1	188.6
3	118.6	243.3	232.5	198.1	203.5	191.2	171.1
Mean	123.1	248.8	236.6	202.8	216.0	205.9	181.8
Grand mean	125.2	312.1	250.7	229.3	283.1	232.0	213.5
LSD at 0.05	H	R	A	H×R	H×A	R×A	H×R×A

Table 9. Effect of water regime, hydro gel soil application and different anti-transpiration types on zinc content (mg kg^{-1}) of peanut plants grown in sandy soil

Hydro-gel (%) (H)	Anti-transpiration types (A)						
	Control	Chitozan			Abscisic acid		
		mg l^{-1}					
		5	10	Mean	15	20	Mean
				100% water application (R)			
0	31.06	51.45	49.21	43.90	37.00	38.61	35.55
2	42.14	62.36	51.86	52.12	41.75	40.99	41.62
3	30.45	40.00	45.18	38.54	36.52	32.85	33.27
Mean	34.55	51.27	48.75	44.85	38.42	37.48	36.81
				75% from water application			
0	20.42	31.45	30.21	27.35	26.45	24.43	23.76
2	30.91	35.36	32.86	33.04	32.66	31.57	31.71
3	19.80	25.00	23.18	22.66	23.07	22.49	21.78
Mean	23.70	30.60	28.75	27.68	27.39	26.16	25.75
Grand mean	29.125	40.935	38.75	36.265	32.905	31.82	31.28
LSD at 0.05	H	R	A	H×R	H×A	R×A	H×R×A
	2.90	1.60	1.40	2.00	1.90	2.30	2.70

Table 10. Effect of water regime, hydro gel soil application and different anti-transpiration types on water use efficiency (kg fad.$^{-1}$) of peanut plants grown in sandy soil

Hydro-gel (%) (H)	Anti-transpiration types (A)						
	Control	Chitozan			Abscisic acid		
		mg l^{-1}					
		5	10	Mean	15	20	Mean
				100% water application (R)			
0	0.868	1.509	1.443	1.273	1.363	1.276	1.169
2	0.870	1.569	1.480	1.306	1.388	1309	1.189
3	0.809	1.490	1.394	1.231	1.279	1.620	1.236
Mean	0.849	1.523	1.439	1.270	1.343	1.402	1.198
				75% from water application			
0	1.067	1.509	1.442	1.339	1.423	1.397	1.295
2	1.087	1.590	1.488	1.388	1.472	1.406	1.321
3	1.045	1.469	1.455	1.323	1.431	1.381	1.285
Mean	1.066	1.522	1.461	1.350	1.442	1.394	1.301
Grand mean	0.957	1.522	1.450	1.310	1.392	1.398	1.249
LSD at 0.05	H	R	A	H×R	H×A	R×A	H×R×A
	0.957	1.522	1.450	1.310	1.310	1.392	1.249

Results obtained in Table 10 indicate that hydro-gel at 2.0% was more efficient on WUE compared with 3.0% and without application. This may due to the addition of hydrogel at the rate of 2.0% increasing the water holding capacity of coarse sand from 171 to 402% (**Johansen *et al.,* 1984**). Further, hydro-gel addition improved water storage properties of porous soils and resulted in the delay and onset of permanent wilting percentages under intense evaporation. An increase in water holding capacity due to hydrogel significantly reduced the irrigation requirement of many plants (**Taylor and Halfacre, 1986**).

Conclusions

From the abovementioned results it could be concluded that application of irrigation water regime at 100% (1125 m^3 $fad.^{-1}$) accompanied with anti-transpiration chitosan or abscisic acid at low rates and companied with 2.0% hydro-gel were more efficient on yield, nutrients content in soil, and nutritional status in term of water use efficiency of peanut plants grown under sandy soil condition.

REFERENCES

Abu-Muriefah, S.S. (2013). Effect of chitosan on common bean (*Phaseolus vulgaris* L.) plants grown under water stress conditions. Int. Res. J. Agric. Sci. and Soil Sci., 3 (6): 192-199.

Alam, S.M. (1999). Nutrient Uptake by Plants Under Stress Conditions. In: Pessaraki, M. (Ed.), Handbook of Plant and Crop Stress. Marcel Dekker, New York, 285-314.

Bittelli, M., M. Flury, G.S. Campbell and E.J. Nichols (2001). Reduction of transpiration through foliar application of chitosan. Agric. and Forest Meteorol., 107 (3): 167-175.

Chapman, H.D. and P.F. Pratt (1961). Methods of Analysis for Soils, Plants and Waters. Univ. Calif., Riverside, USA.

Dwivedi, S.L., S.N. Nijam, R. Jambunathan, K.L. Sahrawatr, V.S. Nagabhanam and K.R. Haglnmath (1993). Effect of genotypes and environments on oil content and oil quality parameters and their correlation in peanut (*Arachis hypogeal*. L.). Peanut Sci., 5: 84-89.

El-Hady, O.A. and Sh.A. Wanas (2006). Water and fertilizer use efficiency by cucumber grown under stress on sandy soil treated with acrylamide hydrogels. J. Appl. Sci. Res., 2 (12): 1293-1297.

El-Hameed, M.H. (2005). Effect of some cultural treatments on peanut. M. Sc. Thesis, Fac. Agric., Cairo Univ. Egypt, 117.

Fageria, N.K., V.C. Baligar and R.B. Clark (2002). Micronutrient in crop production. Adv. Agron., 77: 185-268.

Farouk, S. and A.A. Ramadan (2012). Improving growth and yield of cowpea by foliar application of chitosan under water stress. Egypt. J. Biol., 14: 14-26.

Farrell, C., X.Q. Ang and J.P. Rayner (2013). Water retention additives increase plant available water in green roof substrates. Ecol. Eng., 52: 112-118.

Galeş, D.C., F. Filipov, R. Donosă, D.C. □opa and G. Jităreanu (2016). The effect of aquasorb on some morpho-physiological parameters of the plants under the pedoclimatical conditions from moldavian plateau. Lucrări Ştiinţifice. Seria Agron., 59 (2): 93-98.

Ghanbari, A., B. Siahsar, A. Tovassoli, Y. Esmaeilian and M. Babaeian (2011). Effect of uniconazole and cycocel on growth, yield and nutrient uptake of pearl millet under drought stress condition. Ame.-Euras J. Agric. Environ. Sci., 10: 857-862.

Gomez, K.A. and A.A. Gomez (1984). Statistical Procedures for Agricultural Research. John Willey and Sons, New York.

Gunes, A., N. Cicek, A. Inal, M. Alpaslan, F. Eraslan, E. Guneri and T. Guzelordu (2006). Genotypic response of chickpea (*Cicer arietinum* L.) cultivars to drought stress implemented at pre and post anthesis stage and its relations with nutrient uptake and efficiency. Plant Soil Environ., 52: 368-376.

Hefny, M.M. (2011). Agronomical and biochemical responses of white lupin *Lupinus albus* L. genotypes to contrasting water regimes and inoculation treatments. J. Ame. Sci., 7 (3): 187-198.

Jackson, M.L. (1981). Soil Chemical Analysis. Prentice-hall, Inc., N: J. USA.

Johansen, C., L. Krishnamurthy, N.P. Saxena and S.C. Sethi (1984). Genotypic variation in moisture response of chickpea grown under line-source in a semi-arid tropical environment. Field Crops Res., 37: 103–112.

Junjittakarn, J., S. Pimratch, S. Jogloy, W. Htoon, N. Singkham, N. Vorasoot, B. Toomsan, C.C. Holbrook and A. Patanotha (2013). Nutrient uptake of peanut genotypes under different water regimes. Int. J. Plant Prod., 7 (4): 677-692.

Kolay, A.K. (2008). Soil moisture stress and plant growth. In: Water and crop growth. Atlantic, Delhi, 45-46.

Kulkarni, J.H., V. Ravindra, V.K. Sojitra and D.M. Bhatt (1988). Growth, nodulation and N uptake of groundnut (*Arachis hypogaea* L.) as influenced by water deficits stress at different phenophase. Oleagineus, 43 (11): 415-419.

Lindsay, W.L. and W.A. Norvell (1978). Development of DTPA soil test for Zn, Mn and Cu. Soil Sci. Soc. Am. J., 24:421- 427.

Moustafa, M.A.A., N.R. Habashy and A.A.W. Anas (2005). Utilization of some organic polymers and humic acids for improving a sandy soil productivity of peanut and their residual effects on the next crop of faba bean. Fayoum J. Agric. Res. and Dev., 9 (2): 42-55.

Page, A.L., R.H. Miller and D.R. Keeney (1982). Methods of Soil Analysis Part 2- Chemical and Microbiological Properties. Part II. ASA-SSSA. Agron., Madison, USA.

Pimratch, S., N. Vorasoot, B. Toomsan, T. Kesmala, A. Patanothai and C.C. Holbrook (2013). Association of nitrogen fixation to water uses efficiency and yield traits of peanut. Int. J. Plant Prod., 7 (2): 225-242.

Piper, C.S. (1950). Soil and Plant Analysis. Inter. Sci. Publishers Inc. NY, USA.

Richards, L.A. (1954). Diagnosis and Improvement of Saline and Alkali Soils. Agric. Handbook No. 60. USD Agric., Washington, USA.

Shaban, Sh.A., N.M. Abu-Hagazy, N.M. Mahrous and M.H. Abd El-Hameed (2009). Effect of planting dates, hill-spacing and harvest dates on yield and quality of the new released peanut cultivar Giza-6. Egypt. J. Agro., 31 (1): 3954.

Sivapalan, S. (2006). Benefits of treating a sandy soil with a crosslinked-type polyacrylamide. Austral. J. Exp. Agric., 46: 579–584.

Songsri, P., S. Jogloy, N. Vorasoot, C. Akkasaeng, A. Patanothai and C.C. Holbrook (2008). Root distribution of drought-resistant peanut genotypes in response to drought. J. Agron. and Crop Sci., 4 (5): 92-103.

Sys, C. and W. Verheye (1978). An attempt to the evaluation of physical land characteristics for irrigation to the FAO framework for land evaluation. Int. 1, Trai. Cent. Post Grad. Soil Sci., Ghent, Belgium.

Tambussi, E.A. and J. Bort (2007). Water use efficiency in C3 cereals under Mediterranean conditions: a review of physiological aspects. Ann. Appl. Biol., 150: 307–321.

Taylor, K.C. and R.G. Halfacre (1986). The effect of hydrophilic polymer on media water retention and nutrient availability to *Ligustrum lucidum*. Hort. Sci., 21: 1159–1161.

USDA (2006). Keys to Soil Taxonomy. 10^{th} Ed., United States Dept. Agric., Nat. Res. Conserv. Service.

Vites, F. Jr. (1965). Increasing water use efficiency by soil management in plant environment and efficient water use. J. Ame. Soc. Agron., 26: 537-546.

Wallace, A. and G.A. Wallace (1986). Effects of polymeric soil conditioners on emergence of tomato seedlings. Soil Sci., 141: 321–323.

Watanab, F.S. and S.R. Olsen (1965). Test of ascorbic and method for determining phosphorous in water and $NaHCO_3$ extract from soil. Soil Sci. Cos. Am. Proc., 29: 677-683.

Wright, G.C., K.T. Hubick, G.D. Farquhar and R.C. Nageswara Rao (1993). Genetic and environmental variation in transpiration efficiency and its correlation with carbon isotope discrimination and specific leaf area in peanut. In Ehleringer JR, Hall AE, Farquhar GD (eds.), Stable Isotopes and Plant Carbon-Water Relations. Acad. Press, Inc., San Diego, CA, USA.

تأثير مياه الري ومضادات النتح مع الهيدرو جل على حالة المغذيات في نباتات الفول السوداني النامية في أرض رملية

هبه عبد الحليم أحمد الشهاوي[1] - أحمد عفت الشربيني[2] - عادل عبد الرحمن شيحه[2] - نادر رمزي حبشي[1]

١- معهد بحوث الأراضي والمياه والبيئة - مركز البحوث الزراعية – مصر

٢- قسم علوم الأراضي - كلية الزراعة - جامعة الزقازيق - مصر

أجريت تجربتان حقليتان على ارض رملية مستصلحة حديثاً تروي بنظام الري بالتنقيط بمحطة الاسماعيلية للبحوث الزراعية، محافظة الإسماعيلية، مصر وهي تقع بين خط العرض ٣٠ ° ٣٥ '٣٠ "N ، خط الطول ٣٢ ° ١٤' ٥٠" E والارتفاع ٣ متر عن سطح البحر و زراعت بنباتات الفول السوداني (*Arachis hypogaea*، cv Giza 5) خلال موسمي الزراعة الصيفي لعامي ٢٠١٦ و ٢٠١٧ بمعدل ٥٠ كجم فدان$^{-١}$. وكان الهدف من اجراء التجربة تقييم الإضافة عن طريق الرش الورقي لبعض مضادات النتح (حمض الشيتوزان بمعدلات صفر و ٥ و ١٠ مليجرام لتر$^{-١}$) و (حمض الأبسيسيك بمعدلات صفر و ١٥ و ٢٠ مليجرام لتر$^{-١}$) رشا علي الاوراق يدويا في فترة بعد الظهيرة علي ثلاثة مرات تبدأ بعد ثلاثة أسابيع من الزراعة (٣٠ و ٦٠ و ٩٠ يوم) وقد تم أضافة الهيدروجل بمعدلات صفر و ٢ و ٣ % كإضافة أرضية وذلك تحت معدلين من الري هما ١٠٠% من الاحتياجات المائية للفول السوداني و ٧٥% منها (١١٢٥ و ٨٨٤م٣ فدان$^{-١}$) وقد اظهرت النتائج الآتي: كان هناك تأثير واضح معنوي لاستخدام ١٠٠% من الاحتياجات المائية للفول السوداني والرش بالشيتوزان بمعدل ٥ مليجرام لتر$^{-١}$ مع اضافة ٢% هيدروجل كإضافة أرضية على محصول البذور للفول السوداني ومحتوى العناصر الكبرى (النيتروجين والفوسفور والبوتاسيوم) وكذلك محتوي العناصر الصغرى (الحديد والمنجنيز والزنك) في البذور وأعلى كفاءة استخدام للمياه كانت مع استخدام ١٠٠% من الاحتياجات المائية عند الرش بحمض الابسيسيك مع اضافة ارضية للهيدروجل بمعدل ٣%.

المحكمـــــون:

١- **د. سامي محمد محمود السعدي** رئيس بحوث بمعهد بحوث الأراضي والمياه والبيئة - مركز البحوث الزراعية بالجيزة.

٢- **د. محمد سعيد دسوقي أبوهاشم** أستاذ الأراضي المساعد – كلية الزراعة – جامعة الزقازيق.